



Comparative Evaluation of NEWS2 and qSOFA Scores in Assessing the Severity of Sepsis: A Prospective Observational Study.

Dr. Fouzia Almas¹, Dr. Mohammed Manzoor Patel^{2*}, Ahemer Siddiqui³.

¹Senior Resident, Department of General Medicine, Gulbarga Institute of Medical Sciences, Gulbarga, India.

²Senior Resident, Department of Anaesthesiology, Gulbarga Institute of Medical Sciences, Gulbarga, India.

³Senior Resident, Department of General Medicine, Yadgir Institute of Medical Sciences, Mudhal, Yadgir, India.



Correspondence:

Mohammed Manzoor Patel.

Senior Resident, Department of Anaesthesiology, Gulbarga Institute of Medical Sciences, Gulbarga, India.

Email: mmpatel3166@gmail.com

Received: 21-09-2025

Revised: 19-10-2025

Accepted: 18-12-2025

Published: 06-01-2026

Abstract

Background: Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection and is associated with considerable morbidity and mortality. Early recognition of clinical deterioration is essential for timely treatment and escalation of care. NEWS2 and qSOFA are commonly used bedside scoring systems, but their relative performance in assessing sepsis severity remains uncertain. **Aim:** To compare the effectiveness of NEWS2 and qSOFA scores in assessing the severity of sepsis among adult patients admitted with suspected or confirmed sepsis. **Materials and Methods:** A hospital-based prospective observational study was conducted among 100 adults with suspected or confirmed sepsis. NEWS2 and qSOFA scores were calculated at admission. Patients were categorized according to sepsis severity and followed until discharge or in-hospital death. The associations of both scores with ICU admission, septic shock, mechanical ventilation, vasopressor requirement, length of hospital stay, and mortality were evaluated. Sensitivity, specificity, predictive values, diagnostic accuracy, likelihood ratios, and area under the receiver operating characteristic curve were calculated. A p-value <0.05 was considered statistically significant. **Results:** Of the 100 patients, 58 had severe sepsis and 42 had non-severe sepsis. The mean NEWS2 score was significantly higher in severe than non-severe sepsis patients (9.1 ± 2.6 versus 5.4 ± 2.1 ; $p < 0.001$). The mean qSOFA score was also significantly higher in severe cases (2.12 ± 0.70 versus 1.07 ± 0.71 ; $p < 0.001$). NEWS2 ≥ 7 was present in 84.5% of severe cases compared with 33.3% of non-severe cases, while qSOFA ≥ 2 was present in 74.1% and 26.2%, respectively. NEWS2 ≥ 7 showed a sensitivity of 84.5%, specificity of 66.7%, and diagnostic accuracy of 77.0% for severe sepsis. qSOFA ≥ 2 showed a sensitivity of 74.1%, specificity of 73.8%, and accuracy of 74.0%. NEWS2 demonstrated a significantly higher AUC than qSOFA for identifying severe sepsis (0.84 versus 0.76; $p = 0.039$) and predicting in-hospital mortality (0.85 versus 0.77; $p = 0.044$). High NEWS2 and qSOFA scores were significantly associated with ICU admission, septic shock, mechanical ventilation, vasopressor use, longer hospitalization, and mortality. **Conclusion:** Both NEWS2 and qSOFA were useful for assessing sepsis severity and predicting adverse outcomes. NEWS2 demonstrated higher sensitivity and significantly better overall discriminatory performance, making it more suitable for early screening and triage. qSOFA showed slightly higher specificity and remained useful for identifying patients with established high-risk clinical deterioration. Both scores should be used alongside comprehensive clinical and laboratory assessment.

Keywords: NEWS2; qSOFA; Sepsis.



This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection and remains one of the leading causes of mortality among critically ill patients worldwide. Despite advances in antimicrobial therapy, intensive care management, and organ support, sepsis continues to impose a major burden on healthcare systems due to its high incidence, prolonged hospital stay, and substantial mortality. Early recognition of patients at risk of clinical deterioration is essential because prompt diagnosis and timely initiation of appropriate therapy significantly improve patient outcomes. Delayed identification of sepsis is associated with progression to septic shock, multiple organ dysfunction syndrome (MODS), and increased mortality. Therefore, reliable bedside clinical scoring systems have become indispensable tools for early risk stratification and prognostication in patients presenting with suspected infection.[1]

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) redefined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection and recommended the Sequential Organ Failure

Assessment (SOFA) score for diagnosis of organ dysfunction. However, because SOFA requires laboratory investigations that may not be immediately available in emergency settings, the quick Sequential Organ Failure Assessment (qSOFA) score was introduced as a simplified bedside screening tool. The qSOFA score comprises three easily measurable clinical parameters: respiratory rate $\geq 22/\text{min}$, systolic blood pressure ≤ 100 mmHg, and altered mental status. A score of two or more indicates a higher risk of poor clinical outcomes and mortality.[2]

Although qSOFA is simple and rapid, several studies have questioned its sensitivity for early detection of sepsis, particularly in patients presenting before significant organ dysfunction develops. Consequently, the National Early Warning Score 2 (NEWS2), originally developed by the Royal College of Physicians for identifying acutely ill patients, has gained increasing attention as an alternative screening tool. NEWS2 incorporates respiratory rate, oxygen saturation, supplemental oxygen requirement, systolic blood pressure, heart rate, body temperature, and level of consciousness. Because it evaluates a broader range of physiological abnormalities, NEWS2 may identify patient deterioration earlier than qSOFA and provide superior prognostic accuracy.

Numerous international studies have compared NEWS2 and qSOFA in emergency departments and intensive care units. Most investigations have demonstrated higher sensitivity of NEWS2 for identifying patients requiring intensive care admission, vasopressor support, or mechanical ventilation, whereas qSOFA generally exhibits higher specificity but lower sensitivity. Consequently, there remains uncertainty regarding which scoring system offers better clinical utility in routine practice, particularly in resource-limited settings where rapid bedside assessment is essential.[3]

In India, sepsis continues to be associated with significant morbidity and mortality owing to delayed presentation, limited critical care resources, and diverse infectious etiologies. Comparative data evaluating NEWS2 and qSOFA among Indian patients remain limited. Establishing the relative diagnostic and prognostic performance of these scoring systems may facilitate early recognition of high-risk patients, appropriate triage, timely intensive care referral, and improved clinical outcomes. Therefore, the present prospective observational study was undertaken to compare NEWS2 and qSOFA scores in assessing the severity of sepsis and predicting adverse clinical outcomes among adult patients admitted with suspected or confirmed sepsis.[4]

AIM

To compare the effectiveness of NEWS2 and qSOFA scores in assessing the severity of sepsis among adult patients admitted with suspected or confirmed sepsis.

OBJECTIVES

1. To calculate NEWS2 and qSOFA scores at admission in patients with suspected or confirmed sepsis.
2. To compare the diagnostic performance of NEWS2 and qSOFA scores in identifying severe sepsis and predicting adverse clinical outcomes.
3. To evaluate the association of NEWS2 and qSOFA scores with ICU admission, septic shock, length of hospital stay, and in-hospital mortality.

MATERIALS AND METHODS

Source of Data

The study data were collected from adult patients admitted with suspected or confirmed sepsis in the Department of General Medicine and Medical Intensive Care Unit of the tertiary care teaching hospital. Clinical information, laboratory investigations, physiological parameters, treatment details, and patient outcomes were recorded using a predesigned case record form.

Study Design

A hospital-based prospective observational study was conducted.

Study Location

The study was conducted in the Department of General Medicine and Medical Intensive Care Unit of a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of 24 months, including patient recruitment, follow-up, data collection, statistical analysis, and interpretation.

Sample Size

A total of 100 consecutive eligible patients fulfilling the inclusion criteria were enrolled during the study period.

Inclusion Criteria

- Adult patients aged 18 years and above.
- Patients with suspected or confirmed infection fulfilling Sepsis-3 criteria.
- Patients admitted to the emergency department, medical wards, or ICU.
- Patients who provided written informed consent or whose legally authorized representative provided consent.

Exclusion Criteria

- Patients younger than 18 years.
- Pregnant women.
- Trauma patients.
- Patients with burns.
- Patients transferred after more than 24 hours of hospitalization elsewhere.
- Patients discharged against medical advice before completion of evaluation.
- Patients or relatives unwilling to provide consent.

Procedure and Methodology

Following Institutional Ethics Committee approval, all eligible patients admitted with suspected or confirmed sepsis were screened for enrolment. Written informed consent was obtained before inclusion.

A detailed history regarding demographic characteristics, presenting complaints, comorbid illnesses, source of infection, and duration of symptoms was recorded. A complete clinical examination was performed.

At admission, physiological parameters including respiratory rate, heart rate, systolic blood pressure, temperature, oxygen saturation, oxygen supplementation, and level of consciousness (AVPU/GCS) were recorded.

NEWS2 score was calculated using:

- Respiratory rate
- Oxygen saturation
- Supplemental oxygen requirement
- Temperature
- Systolic blood pressure
- Heart rate
- Level of consciousness

Simultaneously, qSOFA score was calculated using:

- Respiratory rate $\geq 22/\text{min}$
- Systolic blood pressure ≤ 100 mmHg
- Altered mental status

Routine laboratory investigations including complete blood count, renal function tests, liver function tests, serum electrolytes, arterial blood gas (where indicated), serum lactate, blood culture, urine culture, and other investigations relevant to the source of infection were performed.

Patients were managed according to institutional protocols and Surviving Sepsis Campaign guidelines. They were followed throughout hospitalization for clinical outcomes including:

- ICU admission
- Requirement of vasopressors
- Mechanical ventilation
- Septic shock
- Length of hospital stay
- In-hospital mortality

All observations were documented in a standardized case record form.

Sample Processing

Approximately 5–10 mL of venous blood was collected under aseptic precautions at admission. Samples were processed immediately in the central clinical laboratory according to standard operating procedures.

Routine hematological investigations were performed using automated hematology analyzers. Biochemical parameters including serum creatinine, bilirubin, electrolytes, liver function tests, and serum lactate were analyzed using automated biochemistry analyzers. Blood cultures were processed using automated culture systems following microbiological laboratory protocols.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0.

Citation: Almas F, Patel MM, Siddiqui A. Comparative evaluation of NEWS2 and qSOFA scores in assessing the severity of sepsis: a prospective observational study. *Int. J. Med.*, 2026;8(1):248-258.

Continuous variables were expressed as Mean $\pm$ Standard Deviation (SD) or Median (Interquartile Range) depending on data distribution.

Categorical variables were expressed as frequency and percentage.

Comparison between groups was performed using:

- Student's independent t-test
- Mann–Whitney U test
- Chi-square test
- Fisher's exact test

Diagnostic performance of NEWS2 and qSOFA was evaluated using:

- Sensitivity
- Specificity
- Positive Predictive Value (PPV)
- Negative Predictive Value (NPV)
- Diagnostic accuracy
- Positive and negative likelihood ratios

Receiver Operating Characteristic (ROC) curves were constructed for both scoring systems, and the Area Under the Curve (AUC) was calculated.

Logistic regression analysis was performed to determine independent predictors of severe sepsis and mortality.

A p-value <0.05 was considered statistically significant.

Data Collection

Data were collected prospectively using a structured case record form. Demographic characteristics, clinical presentation, physiological variables required for NEWS2 and qSOFA scoring, laboratory investigations, microbiological findings, treatment received, ICU admission, need for organ support, duration of hospitalization, and final outcome (discharge or death) were documented. Patients were followed until discharge or in-hospital death. All collected data were verified for completeness and confidentiality was maintained throughout the study.

RESULTS

Table 1. Comparative effectiveness of NEWS2 and qSOFA scores in assessing sepsis severity (N=100)

Parameter	Severe sepsis (n=58)	Non-severe sepsis (n=42)	Test of significance	95 % CI	p-value
NEWS2 score, Mean $\pm$ SD	9.1 $\pm$ 2.6	5.4 $\pm$ 2.1	t=7.86	2.77 to 4.63	<0.001*
qSOFA score, Mean $\pm$ SD	2.12 $\pm$ 0.70	1.07 $\pm$ 0.71	t=7.34	0.77 to 1.33	<0.001*
NEWS2 ≥ 7	49 (84.5%)	14 (33.3%)	$\chi^2=27.34$	OR=10.89 (4.18–28.37)	<0.001*
qSOFA ≥ 2	43 (74.1%)	11 (26.2%)	$\chi^2=22.55$	OR=8.08 (3.27–19.97)	<0.001*
ICU admission	45 (77.6%)	6 (14.3%)	$\chi^2=38.51$	OR=20.77 (7.34–58.76)	<0.001*
Septic shock	31 (53.4%)	0 (0.0%)	Fisher's exact	Risk difference: 53.4% (40.6%–66.3%)	<0.001*
Length of hospital stay, days, Mean $\pm$ SD	11.8 $\pm$ 4.7	6.8 $\pm$ 2.9	t=6.60	3.49 to 6.51	<0.001*
In-hospital mortality	23 (39.7%)	1 (2.4%)	$\chi^2=18.34$	OR=26.81 (3.45–208.20)	<0.001*

Among the 100 patients, 58 had severe sepsis and 42 had non-severe sepsis. The mean NEWS2 score was significantly higher in patients with severe sepsis than in those with non-severe sepsis (9.1 $\pm$ 2.6 versus 5.4 $\pm$ 2.1), with a mean difference of 3.7 points (95% CI: 2.77–4.63; t=7.86; p<0.001). Similarly, the mean qSOFA score was significantly higher in the severe sepsis group (2.12 $\pm$ 0.70) than in the non-severe sepsis group (1.07 $\pm$ 0.71), with a mean difference of 1.05 points (95% CI: 0.77–1.33; t=7.34; p<0.001). A NEWS2 score of ≥ 7 was observed in 84.5% of severe sepsis patients compared with 33.3% of non-severe cases, indicating that patients with NEWS2 ≥ 7 had approximately 10.9 times higher odds of severe sepsis (OR=10.89; 95% CI: 4.18–28.37; p<0.001). Likewise, qSOFA ≥ 2 was present in 74.1% of severe sepsis patients and 26.2% of non-severe sepsis patients, with an odds ratio of 8.08 (95% CI: 3.27–19.97; p<0.001). ICU admission was required in 77.6% of severe sepsis cases compared with 14.3% of non-severe cases, representing markedly higher odds of ICU admission in severe sepsis (OR=20.77; 95% CI: 7.34–58.76; p<0.001). Septic shock occurred in 53.4% of severe sepsis patients and in none of the non-severe patients, with a risk difference of 53.4% (95% CI: 40.6%–66.3%; p<0.001). The

mean duration of hospital stay was also significantly longer in severe sepsis patients (11.8±4.7 days) than in non-severe patients (6.8±2.9 days), with a mean difference of 5.0 days (95% CI: 3.49–6.51; $p<0.001$). In-hospital mortality was substantially higher in the severe sepsis group (39.7%) than in the non-severe group (2.4%), with an odds ratio of 26.81 (95% CI: 3.45–208.20; $p<0.001$).

Table 2. NEWS2 and qSOFA scores calculated at admission among patients with sepsis (N=100)

Admission score parameter	n (%) or Mean±SD	Test of significance	95 % CI	p-value
NEWS2 score, Mean±SD	7.55±3.01	$t=25.08^\dagger$	6.95–8.15	<0.001*
NEWS2 0–4, low risk	18 (18.0%)		11.1%–26.9%	
NEWS2 5–6, medium risk	19 (19.0%)	$\chi^2=49.76^\ddagger$	11.8%–28.1%	<0.001*
NEWS2 ≥ 7 , high risk	63 (63.0%)		52.8%–72.4%	
qSOFA score, Mean±SD	1.68±0.87	$t=19.31^\dagger$	1.51–1.85	<0.001*
qSOFA score 0	9 (9.0%)		4.2%–16.4%	
qSOFA score 1	37 (37.0%)		27.6%–47.2%	
qSOFA score 2	37 (37.0%)	$\chi^2=20.64^\ddagger$	27.6%–47.2%	<0.001*
qSOFA score 3	17 (17.0%)		10.2%–25.8%	
qSOFA ≥ 2	54 (54.0%)	$\chi^2=0.64^\S$	43.7%–64.0%	0.424
Respiratory rate $\geq 22/\text{min}$	68 (68.0%)	$\chi^2=12.96^\S$	58.0%–77.0%	<0.001*
Systolic blood pressure ≤ 100 mmHg	56 (56.0%)	$\chi^2=1.44^\S$	45.7%–65.9%	0.230
Altered mental status/GCS <15	44 (44.0%)	$\chi^2=1.44^\S$	34.1%–54.3%	0.230
Supplemental oxygen required	61 (61.0%)	$\chi^2=4.84^\S$	50.7%–70.6%	0.028*
Oxygen saturation $<94\%$	65 (65.0%)	$\chi^2=9.00^\S$	54.8%–74.3%	0.003*

† One-sample t-test against a score of zero.

‡ Chi-square goodness-of-fit test across score categories.

§ Chi-square goodness-of-fit test against equal proportions.

The mean NEWS2 score at admission was 7.55±3.01, with a 95% confidence interval of 6.95–8.15, and was statistically significant on one-sample testing ($t=25.08$; $p<0.001$). According to NEWS2 risk categories, 18% of patients were classified as low risk with scores of 0–4, 19% as medium risk with scores of 5–6, and 63% as high risk with scores ≥ 7 . The distribution across NEWS2 categories was statistically significant ($\chi^2=49.76$; $p<0.001$), showing that the majority of patients presented in the high-risk category. The mean qSOFA score was 1.68±0.87, with a 95% confidence interval of 1.51–1.85 ($t=19.31$; $p<0.001$). Nine percent of patients had a qSOFA score of 0, 37% had a score of 1, 37% had a score of 2, and 17% had the maximum score of 3. The distribution of qSOFA scores was statistically significant ($\chi^2=20.64$; $p<0.001$). Overall, 54% of patients had qSOFA ≥ 2 , although this proportion was not significantly different from an equal distribution ($\chi^2=0.64$; $p=0.424$). Among individual qSOFA components, respiratory rate $\geq 22/\text{min}$ was the most frequent abnormality, observed in 68% of patients, and was statistically significant ($\chi^2=12.96$; $p<0.001$). Systolic blood pressure ≤ 100 mmHg was present in 56% and altered mental status or GCS <15 in 44%; neither proportion differed significantly from 50% ($p=0.230$ for both). Supplemental oxygen was required in 61% of patients ($\chi^2=4.84$; $p=0.028$), while oxygen saturation below 94% was recorded in 65% ($\chi^2=9.00$; $p=0.003$).

Table 3. Diagnostic performance of NEWS2 and qSOFA for severe sepsis and adverse outcomes

A. Diagnostic performance for identifying severe sepsis

Diagnostic parameter	NEWS2 ≥ 7	qSOFA ≥ 2	Test of significance	95 % CI	p-value
Sensitivity	84.5%	74.1%	$Z=1.37$	Difference: –4.6% to 25.3%	0.171
Specificity	66.7%	73.8%	$Z=0.72$	Difference: –26.3% to 12.0%	0.474
Positive predictive value	77.8%	79.6%	$Z=0.23$	Difference: –17.1% to 13.5%	0.819
Negative predictive value	75.7%	67.4%	$Z=0.86$	Difference: –10.7% to 27.3%	0.390
Diagnostic accuracy	77.0%	74.0%	$Z=0.49$	Difference: –9.0% to 15.0%	0.625
Positive likelihood ratio	2.53	2.83	—	—	—
Negative likelihood ratio	0.23	0.35	—	—	—
Area under ROC curve	0.84	0.76	$Z=2.06$	Difference in AUC: 0.004–0.156	0.039*

B. Performance for predicting in-hospital mortality

Diagnostic parameter	NEWS2 ≥ 7	qSOFA ≥ 2	Test of significance	95% CI	p-value
Sensitivity	91.7%	83.3%	Z=0.88	Difference: -10.3% to 27.0%	0.378
Specificity	46.1%	55.3%	Z=1.14	Difference: -25.1% to 6.7%	0.255
Positive predictive value	34.9%	37.0%	Z=0.24	Difference: -19.4% to 15.2%	0.811
Negative predictive value	94.6%	91.3%	Fisher's exact	Difference: -5.5% to 12.1%	0.681
Diagnostic accuracy	57.0%	62.0%	Z=0.72	Difference: -18.6% to 8.6%	0.471
Area under ROC curve	0.85	0.77	Z=2.01	Difference in AUC: 0.002–0.158	0.044*

For identifying severe sepsis, NEWS2 ≥ 7 demonstrated a sensitivity of 84.5%, which was higher than the 74.1% sensitivity of qSOFA ≥ 2 ; however, the difference was not statistically significant (Z=1.37; 95% CI for difference: -4.6% to 25.3%; p=0.171). qSOFA showed higher specificity than NEWS2 (73.8% versus 66.7%), although this difference was also not significant (Z=0.72; p=0.474). The positive predictive values were similar for NEWS2 and qSOFA at 77.8% and 79.6%, respectively (p=0.819), while NEWS2 had a higher negative predictive value than qSOFA (75.7% versus 67.4%; p=0.390). Overall diagnostic accuracy was 77.0% for NEWS2 and 74.0% for qSOFA, without a statistically significant difference (p=0.625). The positive likelihood ratios were 2.53 for NEWS2 and 2.83 for qSOFA, while the negative likelihood ratios were 0.23 and 0.35, respectively. The area under the ROC curve was significantly greater for NEWS2 than for qSOFA (0.84 versus 0.76), with an AUC difference of 0.08 (95% CI: 0.004–0.156; Z=2.06; p=0.039), indicating superior overall discrimination by NEWS2 for severe sepsis.

For predicting in-hospital mortality, NEWS2 ≥ 7 had a sensitivity of 91.7%, compared with 83.3% for qSOFA ≥ 2 , although the difference was not statistically significant (p=0.378). qSOFA had slightly higher specificity than NEWS2 (55.3% versus 46.1%; p=0.255). The positive predictive values were relatively low for both scores, at 34.9% for NEWS2 and 37.0% for qSOFA, whereas the negative predictive values were high, at 94.6% and 91.3%, respectively. This suggests that both scores were more useful for ruling out mortality risk than for confirming it. Diagnostic accuracy was 57.0% for NEWS2 and 62.0% for qSOFA, with no significant difference (p=0.471). Nevertheless, NEWS2 had a significantly higher AUC than qSOFA for mortality prediction (0.85 versus 0.77; difference in AUC: 0.002–0.158; Z=2.01; p=0.044).

Table 4. Association of NEWS2 and qSOFA risk categories with clinical outcomes (N=100)

A. Association of NEWS2 with clinical outcomes

Clinical outcome	NEWS2 <7 (n=37)	NEWS2 ≥ 7 (n=63)	Test of significance	95% CI	p-value
ICU admission	12 (32.4%)	39 (61.9%)	$\chi^2=8.10$	OR=3.39 (1.44–7.97)	0.004*
Septic shock	4 (10.8%)	27 (42.9%)	$\chi^2=11.19$	OR=6.19 (1.96–19.57)	0.001*
Length of hospital stay, days, Mean $\pm$ SD	7.1 $\pm$ 3.2	11.6 $\pm$ 4.8	t=5.61	Mean difference: 2.91–6.09	<0.001*
Mechanical ventilation	5 (13.5%)	25 (39.7%)	$\chi^2=7.52$	OR=4.21 (1.45–12.25)	0.006*
Vasopressor requirement	6 (16.2%)	29 (46.0%)	$\chi^2=9.16$	OR=4.41 (1.62–12.02)	0.002*
In-hospital mortality	2 (5.4%)	22 (34.9%)	$\chi^2=11.13$	OR=9.39 (2.06–42.77)	0.001*

B. Association of qSOFA with clinical outcomes

Clinical outcome	qSOFA <2 (n=46)	qSOFA ≥ 2 (n=54)	Test of significance	95% CI	p-value
ICU admission	14 (30.4%)	37 (68.5%)	$\chi^2=14.42$	OR=4.97 (2.12–11.65)	<0.001*
Septic shock	7 (15.2%)	24 (44.4%)	$\chi^2=9.92$	OR=4.46 (1.69–11.72)	0.002*
Length of hospital stay, days, Mean $\pm$ SD	7.8 $\pm$ 3.6	11.8 $\pm$ 4.9	t=4.69	Mean difference: 2.31–5.69	<0.001*
Mechanical ventilation	8 (17.4%)	22 (40.7%)	$\chi^2=6.43$	OR=3.26 (1.29–8.25)	0.011*
Vasopressor requirement	9 (19.6%)	26 (48.1%)	$\chi^2=8.90$	OR=3.81 (1.53–9.47)	0.003*
In-hospital mortality	4 (8.7%)	20 (37.0%)	$\chi^2=10.94$	OR=6.18 (1.93–19.80)	0.001*

*Statistically significant at p<0.05.

Patients with NEWS2 ≥ 7 experienced significantly worse clinical outcomes than those with NEWS2 <7. ICU admission was required in 61.9% of patients with NEWS2 ≥ 7 compared with 32.4% of those with lower scores, corresponding to 3.39 times higher odds of ICU admission (95% CI: 1.44–7.97; p=0.004). Septic shock occurred in 42.9% of the high-NEWS2 group compared with 10.8% of the lower-score group, with an odds ratio of 6.19 (95% CI: 1.96–19.57; p=0.001). The

mean hospital stay was significantly longer among patients with NEWS2 ≥ 7 (11.6 ± 4.8 days) than among those with NEWS2 < 7 (7.1 ± 3.2 days), with a mean difference ranging from 2.91 to 6.09 days ($t=5.61$; $p<0.001$). Mechanical ventilation was required in 39.7% of patients with NEWS2 ≥ 7 compared with 13.5% of those with lower scores (OR=4.21; 95% CI: 1.45–12.25; $p=0.006$). Similarly, vasopressor requirement was significantly higher in the high-score group (46.0% versus 16.2%; OR=4.41; 95% CI: 1.62–12.02; $p=0.002$). In-hospital mortality was 34.9% among patients with NEWS2 ≥ 7 compared with 5.4% among those with NEWS2 < 7 , indicating 9.39 times higher odds of death (95% CI: 2.06–42.77; $p=0.001$).

A similar pattern was observed for qSOFA. ICU admission was needed in 68.5% of patients with qSOFA ≥ 2 compared with 30.4% of those with qSOFA < 2 , with an odds ratio of 4.97 (95% CI: 2.12–11.65; $p<0.001$). Septic shock was present in 44.4% of patients with qSOFA ≥ 2 and 15.2% of those with lower scores (OR=4.46; 95% CI: 1.69–11.72; $p=0.002$). Patients with qSOFA ≥ 2 had a significantly longer mean hospital stay than those with qSOFA < 2 (11.8 ± 4.9 versus 7.8 ± 3.6 days; $p<0.001$). Mechanical ventilation was required in 40.7% of patients with qSOFA ≥ 2 compared with 17.4% of those with lower scores (OR=3.26; 95% CI: 1.29–8.25; $p=0.011$), while vasopressor support was required in 48.1% and 19.6%, respectively (OR=3.81; 95% CI: 1.53–9.47; $p=0.003$). In-hospital mortality was significantly higher in the qSOFA ≥ 2 group than in the qSOFA < 2 group (37.0% versus 8.7%), with an odds ratio of 6.18 (95% CI: 1.93–19.80; $p=0.001$).

DISCUSSION

The present prospective observational study compared NEWS2 and qSOFA for assessing sepsis severity and predicting adverse clinical outcomes among 100 adults with suspected or confirmed sepsis. Both scores increased significantly with disease severity; however, NEWS2 demonstrated greater sensitivity and significantly better overall discrimination than qSOFA. Elevated scores on either system were associated with ICU admission, septic shock, mechanical ventilation, vasopressor requirement, prolonged hospitalization, and in-hospital mortality. These findings support the use of NEWS2 as a sensitive early screening and risk-stratification tool while recognizing that qSOFA may provide comparatively greater specificity for identifying patients at high risk of poor outcomes.

Comparative effectiveness of NEWS2 and qSOFA in assessing sepsis severity

In the present study, the mean NEWS2 score was significantly higher among patients with severe sepsis than among those with non-severe sepsis (9.1 ± 2.6 versus 5.4 ± 2.1 ; $p<0.001$). The mean qSOFA score was similarly higher in severe cases (2.12 ± 0.70 versus 1.07 ± 0.71 ; $p<0.001$). NEWS2 ≥ 7 was present in 84.5% of severe cases compared with 33.3% of non-severe cases, whereas qSOFA ≥ 2 was identified in 74.1% and 26.2%, respectively. Thus, both scores distinguished between levels of clinical severity, although NEWS2 identified a larger proportion of severe cases.

These findings agree with Mellhammar et al. (2019)^[1], who reported that NEWS2 was superior to qSOFA for detecting sepsis with organ dysfunction, infection-related mortality, or infection-related ICU admission among emergency department patients. NEWS2 assesses a broader range of physiological abnormalities, including heart rate, temperature, oxygen saturation, supplemental oxygen requirement, respiratory rate, blood pressure, and consciousness. In contrast, qSOFA incorporates only three variables and may become positive only after clinically significant hypotension, tachypnoea, or neurological dysfunction has developed.

Verma et al. (2023)^[2] also found NEWS2 to be superior to qSOFA for predicting in-hospital mortality among Indian patients with sepsis presenting to the emergency department. Their findings are particularly relevant to the present study because both investigations were performed in Indian clinical settings, where delayed presentation, heterogeneous infections, and limitations in critical care resources may affect score performance.

Oduncu et al. (2021)^[3] prospectively evaluated 463 emergency department patients and observed that NEWS had greater sensitivity than qSOFA for diagnosing sepsis, whereas qSOFA showed very high specificity. For mortality, the sensitivity was 77% for NEWS and 39% for qSOFA, while specificity was 64% and 91%, respectively. The mortality AUROCs were 0.772 for NEWS and 0.758 for qSOFA. Their findings support the present observation that NEWS2 is more sensitive, while qSOFA tends to be more specific.

Usman et al. (2019)^[4] compared SIRS, qSOFA, and NEWS for early identification of sepsis and reported that NEWS was more sensitive than qSOFA for detecting sepsis and adverse clinical deterioration. Similarly, Wattanasit and Khwannimit (2021)^[5] reported that NEWS showed better performance for Sepsis-3-defined sepsis, hospital admission, and mortality than qSOFA and several other early warning scores. In their study, NEWS ≥ 7 demonstrated a specificity of 80.9% for Sepsis-3-defined sepsis, while qSOFA provided the highest positive likelihood ratio for hospital mortality.

The severe sepsis group in the present study also had markedly higher rates of ICU admission, septic shock, prolonged hospitalization, and death. ICU admission occurred in 77.6% of severe cases compared with 14.3% of non-severe cases,

while septic shock developed in 53.4% of severe cases and none of the non-severe cases. Mean hospital stay was approximately five days longer among severe cases, and mortality was 39.7% compared with 2.4%. These results demonstrate that the score-defined physiological deterioration was accompanied by clinically meaningful organ support requirements and adverse outcomes.

Singer et al. (2016)^[6] defined sepsis as life-threatening organ dysfunction resulting from a dysregulated host response to infection and emphasized that qSOFA should function as a prompt for further clinical assessment rather than as an independent diagnostic definition. The marked increase in ICU admission, septic shock, and mortality observed among patients with higher scores in the present study is consistent with the fundamental Sepsis-3 concept that increasing organ dysfunction is associated with increasing mortality.

Seymour et al. (2016)^[7] demonstrated that patients with two or three qSOFA points accounted for approximately 70% of deaths or prolonged ICU admissions in their derivation cohort. Outside the ICU, qSOFA ≥ 2 was associated with a three- to fourteen-fold increase in hospital mortality across baseline-risk categories. These findings support the strong association between qSOFA ≥ 2 and severe outcomes observed in the present study.

Admission distribution of NEWS2 and qSOFA scores

The mean admission NEWS2 score in the present study was 7.55 ± 3.01 , and 63% of participants belonged to the high-risk NEWS2 category of ≥ 7 . By comparison, the mean qSOFA score was 1.68 ± 0.87 , and 54% had qSOFA ≥ 2 . The larger proportion categorized as high risk by NEWS2 indicates that it may detect physiological deterioration among patients who have not yet fulfilled two qSOFA criteria.

The current NEWS2 classification was consistent with the thresholds proposed by the Royal College of Physicians, in which a score of 0–4 generally represents low risk, 5–6 medium risk, and ≥ 7 high clinical risk requiring urgent assessment and possible escalation of care.^[8] Inada-Kim et al. (2022)^[9] explained that the physiological components of qSOFA—respiratory rate, systolic blood pressure, and consciousness—are contained within NEWS2, but NEWS2 additionally evaluates hypoxaemia, oxygen supplementation, pulse rate, and temperature. This expanded physiological coverage may explain why 63% of patients in the present study were classified as high risk by NEWS2 compared with 54% by qSOFA. Respiratory rate $\geq 22/\text{min}$ was the most frequent qSOFA abnormality in the present study, affecting 68% of participants. Oxygen saturation below 94% was present in 65%, while 61% required supplemental oxygen. These observations suggest that respiratory dysfunction was a dominant early manifestation of illness. NEWS2 may consequently have performed better because it separately weights respiratory rate, oxygen saturation, and oxygen supplementation, thereby capturing the severity of pulmonary involvement more comprehensively than qSOFA.

Mellhammar et al. (2019)^[11] similarly attributed the superior screening performance of NEWS2 partly to its inclusion of additional respiratory and cardiovascular variables. Melero-Guijarro et al. (2023)^[10], in a prehospital evaluation of NEWS2, qSOFA, and modified SOFA, found that NEWS2 offered better sensitivity and discrimination for critical illness than qSOFA. Their results indicate that a broader physiological score can identify high-risk patients before advanced organ failure becomes apparent.

Nevertheless, the proportion with qSOFA ≥ 2 was not statistically different from an equal distribution in the present study. This does not indicate that qSOFA lacked prognostic relevance; rather, it shows that the threshold divided the cohort into nearly equal groups. The high proportion with qSOFA ≥ 2 may reflect the recruitment of hospitalized patients with established sepsis rather than an undifferentiated emergency population.

Diagnostic performance for identifying severe sepsis

NEWS2 ≥ 7 showed a sensitivity of 84.5%, specificity of 66.7%, PPV of 77.8%, NPV of 75.7%, and diagnostic accuracy of 77.0% for identifying severe sepsis. qSOFA ≥ 2 demonstrated lower sensitivity at 74.1% but higher specificity at 73.8%, with a diagnostic accuracy of 74.0%. Although individual differences in sensitivity, specificity, and predictive values were not statistically significant, NEWS2 had a significantly larger AUC than qSOFA (0.84 versus 0.76; $p=0.039$).

The AUC of 0.84 for NEWS2 indicates good discrimination between severe and non-severe sepsis, whereas the qSOFA AUC of 0.76 represents acceptable discrimination. These findings closely correspond with Mellhammar et al. (2019)^[11], who showed superior discrimination by NEWS2 for sepsis with organ dysfunction and infection-related adverse outcomes. Wang et al. (2022)^[11], in a meta-analysis of 26 studies involving more than 62,000 patients with suspected sepsis, concluded that NEWS generally had higher sensitivity for mortality prediction, while qSOFA had higher specificity. No single score combined both optimal sensitivity and specificity. This pattern is directly reflected in the present study, in which NEWS2 was more sensitive and qSOFA more specific.

Jaruwatthanasunthon et al. (2022)^[12] reported that qSOFA had comparatively high diagnostic accuracy but the lowest sensitivity among the evaluated scoring systems. The authors considered this reduced sensitivity unsuitable for triage, where failure to identify an at-risk patient may delay escalation of treatment, and preferred NEWS because of its more acceptable sensitivity.

Wattanasit and Khwannimit (2021)^[5] found that NEWS had an AUC of 0.722 for Sepsis-3-defined sepsis, compared with 0.657 for qSOFA in their cohort. Although their AUC values were lower than those in the present study, the relative superiority of NEWS was similar. Variations in AUC may be explained by differences in patient selection, prevalence of organ dysfunction, score timing, reference standards, and the proportion of patients already receiving treatment before assessment.

Oduncu et al. (2021)^[3], however, observed similar prognostic performance between NEWS and qSOFA, with AUROCs of 0.772 and 0.758 for mortality. This difference from the present study may be related to their use of the original NEWS rather than NEWS2, a larger heterogeneous emergency cohort, and different outcome definitions. Their results nevertheless confirmed the expected trade-off: NEWS had higher sensitivity, while qSOFA had higher specificity.

Brunetti et al. (2022)^[13] evaluated older inpatients with suspected infection and reported an AUROC of 0.76 for qSOFA and 0.74 for NEWS, without a statistically significant difference. Repeated qSOFA measurements showed high sensitivity and NPV in their geriatric population. This contrasts with the present results but highlights that score performance is influenced by age, comorbidities, clinical setting, and whether scores are measured once at admission or repeatedly throughout hospitalization.

Prediction of in-hospital mortality

For predicting in-hospital mortality, NEWS2 ≥ 7 demonstrated a sensitivity of 91.7%, compared with 83.3% for qSOFA ≥ 2 . NEWS2 also had a higher NPV of 94.6%, compared with 91.3% for qSOFA. Both scores had comparatively low PPVs, reflecting the fact that many high-score patients survived after receiving timely intensive care. The high NPVs indicate that low scores were more useful for excluding mortality risk than high scores were for confirming death.

NEWS2 had a significantly greater AUC for mortality prediction than qSOFA (0.85 versus 0.77; $p=0.044$). This result agrees with Verma et al. (2023)^[2], who reported higher sensitivity and diagnostic efficiency for NEWS2 than qSOFA in predicting in-hospital mortality among Indian emergency department patients with sepsis.

The mortality AUC of 0.85 in the present study was also higher than the NEWS AUC of 0.772 reported by Oduncu et al. (2021)^[3]. The difference may reflect the use of NEWS2, the higher prevalence of advanced sepsis, and the inclusion of patients from medical wards and intensive care areas in the present cohort. However, the direction of the finding was consistent, with NEWS/NEWS2 outperforming qSOFA numerically.

Hamilton et al. (2018)^[14] concluded in a systematic review that early warning scores showed variable mortality prediction across sepsis populations and should not be used in isolation. Likewise, the present PPVs of 34.9% for NEWS2 and 37.0% for qSOFA demonstrate that neither score should independently determine prognosis or limitations of treatment. Scores should instead prompt reassessment, laboratory evaluation, source control, antimicrobial therapy, and escalation of monitoring.

The comparatively higher specificity and PPV of qSOFA in the present study may be explained by the clinical severity represented by its components. Hypotension, altered mentation, and marked tachypnoea are often manifestations of established organ dysfunction. Consequently, qSOFA may miss earlier deterioration but, when positive, may indicate a more advanced disease state. Conversely, NEWS2 identifies a wider range of physiological abnormalities and is therefore more suitable for sensitive screening.

Association of NEWS2 with clinical outcomes

Patients with NEWS2 ≥ 7 had significantly higher rates of ICU admission, septic shock, mechanical ventilation, vasopressor use, prolonged hospital stay, and mortality. The odds of ICU admission were 3.39 times greater, the odds of septic shock were 6.19 times greater, and the odds of in-hospital mortality were 9.39 times greater among patients with NEWS2 ≥ 7 . The mean duration of hospitalization was also 4.5 days longer in this group.

Mellhammar et al. (2019)^[1] similarly demonstrated that NEWS2 effectively identified patients requiring intensive care because of infection. Wattanasit and Khwannimit (2021)^[5] found that NEWS outperformed qSOFA and other early warning scores for predicting hospital admission and mortality. These observations support the use of NEWS2 not merely as a mortality score but as an indicator of resource requirements and clinical deterioration.

Alam et al. (2015)^[15] evaluated NEWS in a European emergency department and showed that increasing scores were associated with greater risks of ICU admission and short-term mortality. The present findings extend this association specifically to septic shock, mechanical ventilation, and vasopressor support.

A high NEWS2 score reflects abnormalities across several organ systems. Respiratory compromise contributes through tachypnoea, hypoxaemia, and oxygen dependence; cardiovascular dysfunction contributes through hypotension and tachycardia; and neurological deterioration contributes through altered consciousness. The strong relationship with mechanical ventilation and vasopressor support in the present study therefore has clear clinical plausibility.

Association of qSOFA with clinical outcomes

qSOFA ≥ 2 was also significantly associated with all adverse outcomes. Patients with qSOFA ≥ 2 had 4.97 times higher odds of ICU admission, 4.46 times higher odds of septic shock, 3.26 times higher odds of mechanical ventilation, 3.81 times higher odds of vasopressor requirement, and 6.18 times higher odds of death. Their mean hospital stay was four days longer than that of patients with qSOFA < 2 .

These findings correspond with Seymour et al. (2016)^[7], who established that qSOFA ≥ 2 was associated with mortality and prolonged ICU stay outside intensive care settings. Rudd et al. (2018)^[16] evaluated qSOFA in adults with suspected infection across low- and middle-income countries and demonstrated an association between increasing qSOFA and excess hospital mortality. This supports its usefulness in resource-limited settings because it requires no laboratory tests.

Giamarellos-Bourboulis et al. (2017)^[17] validated Sepsis-3 criteria and found that qSOFA could identify patients with infection who had an increased risk of death, although its sensitivity was insufficient to exclude sepsis reliably. Their conclusion is consistent with the present finding that qSOFA was strongly associated with adverse outcomes but was less sensitive than NEWS2 for detecting severe disease.

CONCLUSION

The present prospective observational study demonstrated that both NEWS2 and qSOFA were useful bedside scoring systems for assessing disease severity and predicting adverse outcomes among adults with suspected or confirmed sepsis. Patients with severe sepsis had significantly higher mean NEWS2 and qSOFA scores than those with non-severe sepsis. Elevated scores were strongly associated with ICU admission, septic shock, mechanical ventilation, vasopressor requirement, prolonged hospitalization, and in-hospital mortality.

NEWS2 ≥ 7 identified a greater proportion of patients with severe sepsis than qSOFA ≥ 2 and showed higher sensitivity and negative predictive value. NEWS2 also demonstrated significantly better overall discriminatory performance for identifying severe sepsis and predicting in-hospital mortality, as reflected by its higher area under the ROC curve. In contrast, qSOFA showed slightly higher specificity and positive predictive value, indicating that a positive qSOFA score may identify patients with more established physiological deterioration.

These findings suggest that NEWS2 is more suitable as an early screening and triage tool because it detects a broader range of physiological abnormalities and is less likely to miss high-risk patients. qSOFA remains a simple and useful bedside score for recognizing patients at increased risk of organ dysfunction and poor outcomes, particularly where rapid assessment without laboratory investigations is required. However, neither score should be used in isolation. Both should be interpreted alongside clinical examination, laboratory findings, SOFA assessment, serum lactate, and serial monitoring. Overall, NEWS2 appeared superior to qSOFA for early recognition and risk stratification of severe sepsis, while qSOFA retained value as a specific indicator of adverse clinical outcomes.

LIMITATIONS OF THE STUDY

- 1) The study was conducted at a single tertiary care centre; therefore, the findings may not be generalizable to other hospitals, primary care settings, or different patient populations.
- 2) The sample size was limited to 100 patients, which reduced the precision of subgroup analyses and resulted in wide confidence intervals for some outcome estimates.
- 3) Consecutive sampling was used, which may have introduced selection bias and may not fully represent the entire spectrum of patients with sepsis.
- 4) NEWS2 and qSOFA were primarily calculated at admission. Serial changes in scores during treatment were not evaluated, although repeated measurements may provide better prognostic information.
- 5) The study included hospitalized patients with suspected or confirmed sepsis and may therefore have contained a relatively high proportion of patients with advanced disease, affecting score sensitivity and specificity.
- 6) Clinical management, including antibiotics, fluid resuscitation, vasopressors, and organ support, may have influenced outcomes and altered the association between admission scores and mortality.

Citation: Almas F, Patel MM, Siddiqui A. Comparative evaluation of NEWS2 and qSOFA scores in assessing the severity of sepsis: a prospective observational study. *Int. J. Med.*, 2026;8(1):248-258.

- 7) The study did not compare NEWS2 and qSOFA with other prognostic systems such as full SOFA, APACHE II, SAPS II, MEWS, or SIRS criteria.
- 8) Differences in the source of infection, causative organisms, comorbidities, age, and baseline organ function were not fully adjusted for in all analyses.
- 9) Long-term outcomes, including 28-day mortality, 90-day mortality, readmission, functional recovery, and quality of life after discharge, were not assessed.
- 10) The definitions of severity and adverse outcomes were based on clinical and institutional criteria, which may differ from those used in other studies.
- 11) Interobserver variation may have occurred while recording respiratory rate, Glasgow Coma Scale, oxygen requirement, and other physiological variables.
- 12) Predictive values were influenced by the prevalence of severe sepsis and mortality in the study population and may differ in settings with lower or higher disease prevalence.

REFERENCES

1. 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.
2. Verma A, Shukla U, Chauhan S, Kiran S, Dey S, Singh A. National Early Warning Score 2 is superior to quick Sequential Organ Failure Assessment in predicting mortality in sepsis patients presenting to the emergency department. *J Emerg Trauma Shock*. 2023;16(1):20-6.
3. 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;48:54-9.
4. 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):1490-7.
5. Wattanasit P, Khwannimit B. Comparison the accuracy of early warning scores with qSOFA and SIRS for predicting sepsis in the emergency department. *Am J Emerg Med*. 2021;46:284-8.
6. 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):801-10.
7. 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):762-74.
8. Royal College of Physicians. National Early Warning Score (NEWS) 2: standardising the assessment of acute-illness severity in the NHS. London: Royal College of Physicians; 2017.
9. Inada-Kim M, Nsutebu E. NEWS2 and improving outcomes from sepsis. *Clin Med (Lond)*. 2022;22(6):514-7.
10. Melero-Guijarro L, Sanz-García A, Martín-Rodríguez F, López-Izquierdo R, Del Pozo Vegas C, Castro Villamor MA, et al. Prehospital qSOFA, mSOFA, and NEWS2 performance for sepsis prediction: a prospective, multicenter cohort study. *Front Med (Lausanne)*. 2023;10:1098909.
11. 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.
12. Jaruwatthanasunthon J, Chaisomboonpan S, Tanachotwutthikul W, Pattrapornpisut P. Comparison accuracy in mSIRS, NEWS and qSOFA score for sepsis screening in the emergency department. *J Health Sci Med Res*. 2022;40(5):527-36.
13. Brunetti E, Isaia G, Rinaldi G, Brambati T, De Vito D, Ronco G, et al. Comparison of diagnostic accuracies of qSOFA, NEWS, and MEWS to identify sepsis in older inpatients with suspected infection. *J Am Med Dir Assoc*. 2022;23(5):865-71.e2.
14. Hamilton F, Arnold D, Baird A, Albur M, Whiting P. Early warning scores do not accurately predict mortality in sepsis: a meta-analysis and systematic review of the literature. *J Infect*. 2018;76(3):241-8.
15. Alam N, Vegting IL, Houben E, van Berkel B, Vaughan L, Kramer MHH, et al. Exploring the performance of the National Early Warning Score in a European emergency department. *Resuscitation*. 2015;90:111-5.
16. Rudd KE, Seymour CW, Aluisio AR, Augustin ME, Bagenda DS, Beane A, et al. Association of the quick Sequential Organ Failure Assessment score with excess hospital mortality in adults with suspected infection in low- and middle-income countries. *JAMA*. 2018;319(21):2202-11.
17. Giamarellos-Bourboulis EJ, Tsaganos T, Tsangaris I, Lada M, Routsis C, Sinapidis D, et al. Validation of the new Sepsis-3 definitions: proposal for improvement in early risk identification. *Clin Microbiol Infect*. 2017;23(2):104-9.