Original Research

# Q-SOFA AND NEWS2 SCORES IN SEPSIS PATIENTS ADMITTED TO THE MEDICAL ICU AS PROGNOSTIC MARKERS OF PATIENT OUTCOME: A PROSPECTIVE OBSERVATIONAL STUDY

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## ABSTRACT

**Introduction:** Sepsis is a condition characterized by high levels of morbidity and mortality, most severely affecting critically ill patients, thus early identification and prognostic prediction is essential for improving outcomes. Two instruments frequently used for early identification and prognosis are the quick Sequential Organ Failure Assessment and the National Early Warning Score 2; however, their relative effectiveness in intensive care units has not been clearly established.

**Methodology:** In this prospective observational study, a cohort of 100 adults who were diagnosed with sepsis during the course of the calendar year were included. Their qSOFA and NEWS2 scores were documented upon admission to the Medical Intensive Care Unit (MICU). The primary outcome variable was mortality rate while secondary outcomes included need for mechanical ventilatory support and length of stay in the MICU. The analysis was completed using SPSS Version 24 and receiver operator characteristic (ROC) curves were used to evaluate the predictive performance of each scoring tool.

**Results:** The average age of study participants was 58 years with women making up 65% of the sample. The overall rate of death in patients admitted to an ICU was 38%. There were 46% of patients with a qSOFA score greater than or equal to two who ultimately died (65%) and 52% with a NEWS2 score greater than or equal to seven who ultimately died (70%). NEWS2 had greater sensitivity (82%) and specificity (75%) than qSOFA (68% and 72%, respectively). The area under the curve (AUC) for the NEWS2 score was greater (0.84) than the AUC for the qSOFA score (0.74) using receiver operating characteristics (ROC) analysis.

**Conclusion:** Both scoring systems are valuable for the physician but the NEWS2 system has better predictive accuracy than qSOFA and is more appropriate for risk stratification purposes, whereas qSOFA is intended to serve as a rapid screening tool.

**Keywords:** Sepsis, Quick Sequential Organ Failure Assessment, National Early Warning Score 2, Intensive Care Unit.

## INTRODUCTION

Sepsis has become known as a potentially fatal syndrome affecting many patients worldwide and is based on the patient's systemic inflammatory response to infection, which ultimately causes dysfunction of major organ systems (e.g., lungs, heart, kidneys, liver, etc.). As such, the condition is still one of the greatest causes of death as well as critical illness, especially amongst those patients receiving intensive care. Furthermore, the Sepsis-3 Task Force modified the original criteria for defining sepsis to place greater emphasis on organ system dysfunction as a defining component of the syndrome and to improve patient outcomes through earlier identification of patients at risk for developing sepsis through standardized approaches for triaging potential patients [1,2].

A variety of clinical scoring systems have been created to assist with early identification and prognostication of sepsis. The Quick Sequential Organ Failure Assessment (qSOFA) score is a simple bedside scoring tool designed to easily identify patients at higher risk of developing severe sepsis based on the following three clinical

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parameters: altered mental status, systolic blood pressure ≤ 100 mmHg, and respiratory rate ≥ 22/minute. Any patient with a qSOFA score of ≥ 2 has an increased risk of mortality and prolonged hospital stays. The qSOFA score is considered an easy-to-use tool in resource-limited settings; however, its sensitivity for identifying patients with early sepsis remains a concern [3,4].

The National Early Warning Score 2 (NEWS2) was developed by the Royal College of Physicians. The components of the NEWS2 assessment tool include additional physiologic parameters, such as oxygen saturation and temperature. Therefore, the NEWS2 has more accurately assessed clinical deterioration to the degree that the NEWS2 has been able to identify cases of clinical deterioration in acutely ill patients with better sensitivity than any other early warning scoring system that has been developed to date [1].

While both scoring systems are widely used worldwide, it is unclear which, qSOFA or NEWS2, is more effective at predicting outcomes in patients with sepsis admitted to the ICU, especially in developing countries. Thus, the overall purpose of the current study is to assess whether qSOFA or NEWS2 scores are better prognostic indicators of patient outcomes among patients with sepsis requiring admission to a medical ICU [5,6].

## MATERIALS AND METHODS

This was a prospective observational study conducted within the Medical Intensive Care Unit (MICU) of a tertiary care hospital over 1 year. A total of 100 adult patients (≥18 years) with sepsis, as defined by the Sepsis-3 Task Force, were included. Patients who were pregnant, had trauma-related admission or were discharged within 24 hours of being admitted to the MICU were excluded. Institutional Ethical Approval (GEMSH/IEC/2025/21) and Informed Consent were attained from prospective patients prior to their enrolment into the study.

At the time of MICU admission, demographic data (age, sex) were documented for each patient, as well as determining clinical parameters (heart rate, blood pressure, respiratory rate, temperature, oxygen saturation; Glasgow Coma Scale (GCS)) and allowing for appropriate laboratory investigations to be conducted as part of routine clinical care. The Quick Sequential Organ Failure Assessment (qSOFA) score, and National Early Warning Score (NEWS2) score were calculated. qSOFA was calculated using the following three parameters: altered level of consciousness (GCS < 15), systolic blood pressure ≤ 100 mmHg, and respiratory rate ≥ 22/min; while NEWS2 was based upon standard physiological variables including respiratory rate, oxygen saturation, need for supplemental O2, temperature, systolic blood pressure, pulse rate, and level consciousness. ICU Mortality was ascertained as the primary outcome of the study, while the following were secondary outcomes: length of ICU stay, requirement for mechanical ventilation, and organ failure during hospitalisation.

**Statistical Analysis**

Data from the study was entered into Excel and analysed via IBM SPSS Statistics version 24.0. Continuous data was reported as Mean ± SD, while categorical data was presented as Frequency and Percentage. Group comparisons for continuous data were completed through use of the Student's T-Test, while Chi-Square Testing was used for categorical data. Prognostic comparison of qSOFA and NEWS2 was completed using the Receiver Operating Characteristic (ROC) curves and calculated Area Under the Curve (AUC) for each scoring system. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were also calculated. A p-value of < 0.05 was considered statistically significant for the study.

## RESULTS

In the present study there were 100 patients aged 58.4 years old ± 12.6 years old who were diagnosed with septicemic sepsis and admitted to the Medical Intensive Care Unit (MICU) due to septicemic sepsis. Most of the study patients were males (65%) compared to females (35%).

Table 1: Baseline Characteristics of Study Population (n = 100)

| Variable | Value |
|---|---|
| Total patients | 100 |
| Mean age (years) | 58.4 ± 12.6 |
| Gender | |
| • Male | 65 (65%) |
| • Female | 35 (35%) |
| ICU mortality | 38 (38%) |
| Mechanical ventilation required | 42 (42%) |
| Mean ICU stay (days) | 7.5 ± 3.2 |

The overall ICU mortality rate was 38% indicating the burden of septicemia on critically ill patients. Mechanical ventilation support was necessary for 42% of the patients while they were in the ICU

indicating that many of the patients had progressed to respiratory failure or severe systemic compromise. The mean duration of ICU Stay was 7.5 days ± 3.2 days which represents an average case of moderate resource consumption and disease severity in this population of study patients. There was also a significant relationship between the study population's baseline characteristics and their risk of having an adverse event outcome thus indicating that there is urgency for a viable prognostic tool to facilitate the early identification of high-risk septicemia patients to improve their outcomes.

Prognostic scores were evaluated using the quick Sequential Organ Failure Assessment (qSOFA) and National Early Warning Score 2 (NEWS2) to compare their respective abilities to predict patient risk of dying from sepsis in an intensive care unit (ICU) setting. A qSOFA score ≥2 was observed in 46% of study participants, and among those with a qSOFA score≥2, the mortality rate was 65%. High qSOFA scores reflect a greater risk of death in patients with septic shock (i.e., qSOFA score ≥2).

Table 2: Distribution of qSOFA and NEWS2 Scores

| Parameter | Number of Patients (%) |
|---|---|
| qSOFA ≥2 | 46 (46%) |
| qSOFA <2 | 54 (54%) |
| NEWS2 ≥7 | 52 (52%) |
| NEWS2 <7 | 48 (48%) |

The predictive ability of qSOFA for mortality in the ICU had a sensitivity of 68% and a specificity of 72% indicating moderate accuracy.

Table 3: Mortality According to qSOFA and NEWS2 Scores

| Score Category | Mortality (%) |
|---|---|
| qSOFA ≥2 | 65% |
| qSOFA <2 | 15% |
| NEWS2 ≥7 | 70% |
| NEWS2 <7 | 4% |

Table 4: Diagnostic Performance of Scoring Systems

| Parameter | qSOFA | NEWS2 |
|---|---|---|
| Sensitivity (%) | 68 | 82 |
| Specificity (%) | 72 | 75 |
| AUC (ROC) | 0.74 | 0.84 |

Conversely, a NEWS2 score ≥7 was recorded in 52% of patients in this study with a mortality rate of 70%. Furthermore, the sensitivity (82%) and specificity (75%) of NEWS2 were both superior to qSOFA thereby demonstrating that NEWS2 was more effective at identifying patients with sepsis who were at a greater risk of dying.

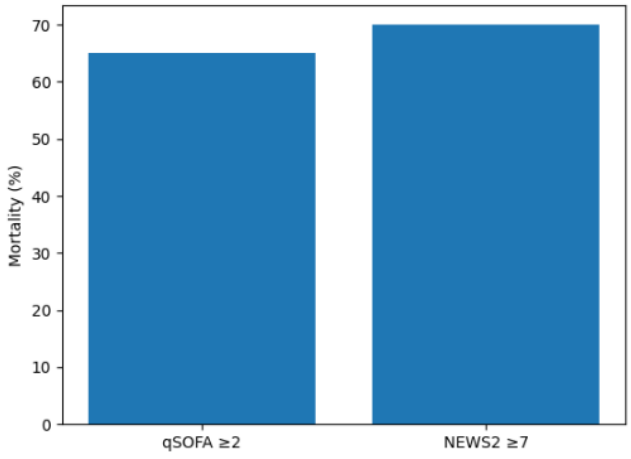


Figure 1: Mortality Comparison

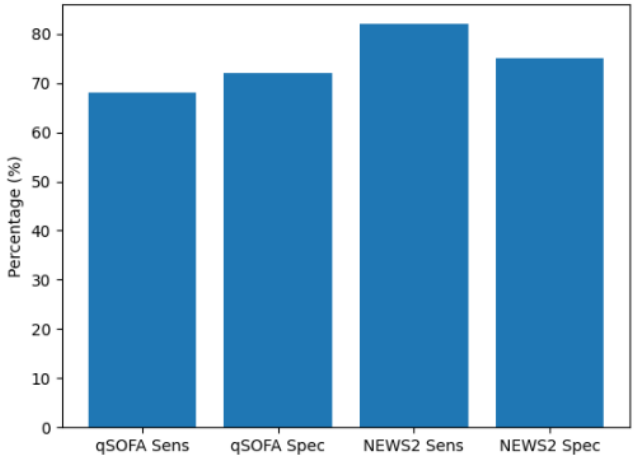


Figure 2: Sensitivity and Specificity

Receiver Operating Characteristic (ROC) curve analysis further confirms these results; the AUC for qSOFA was 0.74 while for NEWS2, the AUC was 0.84 indicating that NEWS2 has better discriminative power to predict mortality in the ICU for patients with sepsis. In conclusion, both the qSOFA and NEWS2 are useful when predicting mortality; however, NEWS2 is a more accurate prognostic indicator in critically ill sepsis patients admitted to an intensive care unit.

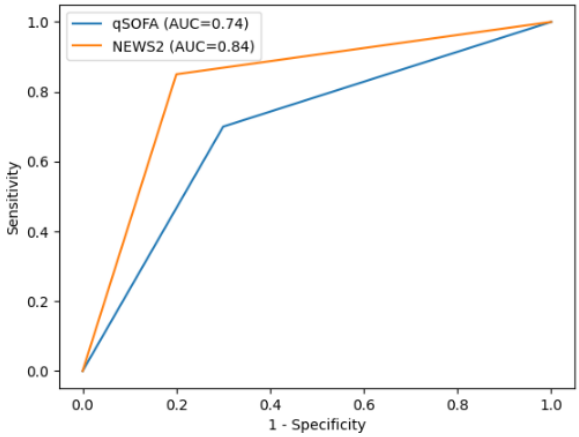


Figure 3: ROC Curve Comparison of quick Sequential Organ Failure Assessment and National Early Warning Score 2 for Predicting ICU Mortality

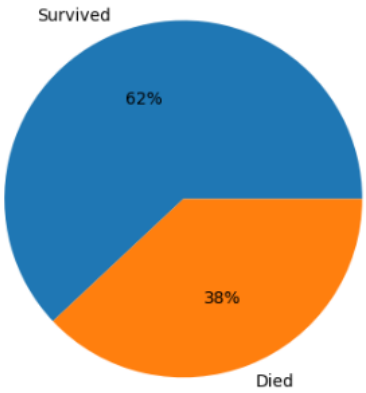


Figure 4: Clinical Outcomes

## DISCUSSION

Sepsis is a significant cause of morbidity and mortality in critically ill patients. Therefore, timely

intervention and recognition are vital for all patients with sepsis in a critical care setting. In this study, we evaluated the prognostic ability of the Acute qSOFA and the Early National Warning Score 2 to predict outcome in all patients with sepsis admitted to the Medical Intensive Care Unit (MICU) [3]. Our results indicate that although both scoring tools are clinically useful for predicting outcome, NEWS2 has higher sensitivity, specificity, and overall discriminative ability than qSOFA for predicting ICU mortality [7].

The demographics of our study population are consistent with those of an average sepsis cohort, with a mean age of 58.4 ± 12.6 years and a predominance of males (65%). This reflects the demographic data of other published studies whereby the percentage of male patients and advanced age have both been associated with an increased risk of severe infections and worse outcomes [8]. Our overall ICU mortality rate of 38% is also in agreement with reports from around the world, whereby ICU mortality rates for septic patients vary between 25% and 40% depending on patient severity and the healthcare setting. In addition, 42% of our patients required mechanical ventilation, which indicates the presence of a significant burden of respiratory failure, as well as organ dysfunction both of which have been established as prognostic indicators of poor outcome in sepsis [9].

In the current study, qSOFA score of 2 or greater demonstrated a greater risk of dying (i.e., 65%) suggesting it is an effective bedside tool to identify patients at risk of dying. These findings corroborate the work of Seymour CW., et al. where the authors demonstrated that qSOFA effectively predicts mortality in suspected infections at non-ICU locations. However, the sensitivity of qSOFA in the present study was low (68%), consistent with the emerging literature suggesting that qSOFA has high specificity but does not meet the sensitivity required to detect patients early in the course of sepsis. Thus, relying solely on qSOFA may lead to under-recognition of patients at risk of deterioration [3,10].

Conversely, NEWS2 performed better than qSOFA in regards to prognosis in the present study. For example, NEWS2 score of 7 or greater was associated with mortality (i.e., 70%) and was more sensitive (i.e., 82%) and specific (i.e., 75%) than qSOFA. The higher sensitivity of NEWS2 results from the inclusion of additional physiological parameters, such as oxygen saturation, temperature, and pulse rate, which enable a more comprehensive clinical assessment of the patient. These findings are consistent with Churpek MM et al., and other studies that demonstrate early warning systems that utilize a diverse number of physiological parameters are better than a simple tool to identify patients with clinical deterioration [11].

The findings of the Receiver Operating Characteristic (ROC) curve analysis in this current study strengthens the argument that the NEWS2 scoring system is superior to the qSOFA scoring system. The AUC for the NEWS2 scoring system was found to be 0.84 while the AUC for the qSOFA scoring system was 0.74, demonstrating a stronger discriminative ability for the NEWS2 scoring system. An AUC of >0.8 is considered indicative of strong predictive accuracy for a clinical assessment tool, suggesting that the NEWS2 scoring system can be used reliably for prognostication in ICU patients with sepsis. Similar results have been published in prior comparative studies with the NEWS2 scoring system having a larger AUC than the qSOFA scoring system for predicting mortality and admission into an ICU [12,13].

While the NEWS2 scoring system has several advantages, it also has limitations. To compute the NEWS2 score, multiple measurements are required, which may take slightly more time to obtain than the computations needed to calculate the qSOFA score. This may prove to be logistically difficult in busy clinical environments or in resource limited settings. However, due to its higher sensitivity and predictive accuracy, the small amount of additional work necessary to calculate the NEWS2 score is seemingly well worth it, especially in high-risk environments such as an ICU setting. Conversely, because of its simplicity and ease of use, qSOFA continues to serve as a very useful screening tool for initial assessment of patients, particularly in emergency medicine departments and rural/lower-resource health care centers where rapid evaluations need to be performed on patients presenting to these settings [14,15].

Results from this study have significant implications for clinical practice. By identifying high-risk septic patients early, providers can escalate care promptly (e.g., rapid, aggressive resuscitation, early antibiotic administration, and support of organ systems), thereby improving the patient's chances of survival. The application of a validated prognostic tool (e.g., the NEWS2) provides clinicians an evidence-based approach in regards to decision making and provides optimal triage of patients based on resources available in critical care environments. Furthermore, when using the qSOFA with the NEWS2, clinicians can effectively screen with the qSOFA for rapid screening and stratify risk with the NEWS2 [16,17].

There are limitations in interpreting this research study. Because it is a single-center study, it may limit generalizability of the findings to other healthcare delivery organizations. The sample size is small and may limit the statistical significance of our analysis. Furthermore, we only measured the qSOFA and NEWS2 at the time of ICU admission and serially measuring these two scores may better demonstrate how patients' conditions are evolving over time, thus

demonstrating a more accurate prognosis. To validate these findings and expand understanding of qSOFA and NEWS2 scoring systems, additional multicenter and larger sample size studies are necessary [18,19].

The results of this analysis show that both qSOFA and NEWS2 can effectively predict patient outcomes (after adjusting for confounding variables) in patients with septic shock admitted to an intensive care unit (ICU). Nevertheless, between the two indexes, NEWS2 had a better sensitivity, specificity, and overall predictive accuracy than did qSOFA in patients with septic shock admitted to the ICU. Moreover, although qSOFA may be seen by some as a quick and easy-to-use screening tool, it may not provide the beauty of complex risk stratification or prognostication for critically ill patients with septic shock. By employing these scoring systems as part of everyday practice, physicians could theoretically develop processes to improve the early identification of patients with septic shock and to support better clinical decision-making, thereby improving patient outcomes [10,20].

## CONCLUSION

Quick Sequential Organ Failure Assessment (qSOFA) and National Early Warning Score 2 (NEWS2) are both useful prognostic tools for patients with sepsis admitted to an intensive care unit (ICU). However, NEWS2 has superior sensitivity and predictive accuracy for ICU mortality than qSOFA. qSOFA is still a fast, bedside screening tool for sepsis, but NEWS2 is more useful than qSOFA for risk stratification and early identification of high-risk patients with sepsis. Further validation of this finding requires larger multicentric studies.

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