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Original Research Article

Sequential Scoring with qSOFA, NEWS2, and SOFA During Early ICU Stay: A Prospective Comparative Prognostic Study

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Conflict of interest: Nil

Abstract

Background: Early identification of patients expected to stay in the ICU for at least 24 hours after admission, followed by their monitoring for clinical deterioration are important strategies to reduce mortality. Scoring systems derived and validated for predicting clinical deterioration and mortality include qSOFA, NEWS2 and SOFA. While most studies compared the scores at the time of admission, a comparison of the sequential scores is more useful.

Objective: This is a prospective observational study that aimed to compare qSOFA, NEWS2 and SOFA scores in critical care setting. The primary outcome was in-hospital mortality and the study also looked at a number of secondary outcomes. The primary end-point was predicted using serially collected scores recorded within the first 48 hours of patient's ICU admission.

Methods: The study was conducted in a 20 bedded ICU of a tertiary care hospital over a period of one year i.e. from August 2025 to July 2026. All the patients aged 18 years or above who were expected to stay in the ICU for 24 hours or more and were either conscious or unconscious were included in the study. The qSOFA, NEWS2 and SOFA scores were calculated at the time of admission to the ICU, 24 hours later and 48 hours later. The primary end point was in-hospital mortality. Other end points studied were ICU mortality, need for invasive mechanical ventilation, need for vasopressors, prolonged stay in the ICU and length of hospital stay. Area under the receiver operating characteristic curve (AUC-ROC) was used to compare the prognostic performance of the three scoring systems.

Results: The study included 240 patients with a mean age of 57.8 ± 16.9 years among which 142 (59.2%) were men. The in-hospital mortality rate was 24.2% (58/240 patients). All scores at all three time points were significantly higher in deceased patients. The AUC for admission qSOFA, NEWS2 and SOFA were 0.68, 0.74 and 0.79, respectively. The AUC for 48 hr qSOFA, NEWS2 and SOFA were 0.75, 0.82 and 0.89, respectively. Increase in SOFA score within the first 48 hours of ICU admission was an independent predictor of in-hospital mortality. The 48 hr SOFA score was the best score to predict in-hospital mortality.

Conclusion: Trend in scores of the three scoring systems to predict patient's outcome improved with sequential assessment. The best scoring system to predict in-hospital mortality was 48h SOFA score, while the best scoring system to predict patient's outcome with balance between good prognostic value and ease of calculation at the bedside was NEWS2 score. Importantly, trend in single values of scoring systems was far more important than single admission value of scoring system.

Keywords: Intensive Care Unit, Mortality Prediction, NEWS2, Prognosis, qSOFA, Sequential Assessment, SOFA.

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Introduction

The risk of death for the critically ill can increase rapidly, with organ dysfunction progressing in hours. Accurate assessment of the risk of death for critically ill patients can enable clinicians to decide the intensity of treatment and level of monitoring that a patient requires. Prognosis can also be shared with patients and their families and it can be used to manage distribution of scarce life-supporting resources in critical care. Although clinical judgment is superior for assessing risk for patients who are critically ill, many scoring systems have been described to aid risk assessment and enhance objectivity.

The Sequential Organ Failure Assessment (SOFA) score was first described as a method to quantify the degree of organ dysfunction in patients with critical illness. The SOFA score monitors the function of 6 organs: the respiratory, cardiovascular, hepatic, coagulation, renal and neurological systems. SOFA scores can be repeated to assess whether organ function is improving or failing. Thus, repeated assessment using the SOFA score provides more than just reassessing the baseline values of a patient in intensive care. It provides insight into the clinical course of the patient with critical illness.

The quick SOFA score is a simple score used to assess the severity of disease in patients with suspected infection outside of the ICU. The qSOFA score consists of three components: altered mental status, respiratory rate of ≥ 22 and blood pressure of ≤ 100 mmHg. The qSOFA score is useful because it does not require any laboratory values and can be calculated in seconds. However, the qSOFA score has several limitations, including low sensitivity and poor prognostic value in many populations found in the ICU.

NEWS2 is a new score that was developed for the identification of acute deterioration of clinical condition and for the standardization of Early Warning Scores (EWS). [4] NEWS2 is calculated using the following parameters: respiratory rate, oxygen saturation, use of supplementary oxygen, systolic blood pressure, heart rate, core temperature and level of consciousness. It is simple to calculate and has been found to be more sensitive than qSOFA for the identification of high-risk patients with suspected infection. [5]

The majority of existing research has compared single time point scores for patients on presentation to Emergency Department or on admission to the Intensive Care Unit. However, clinical response to resuscitation and treatment within the first 24-48 hours of a critical illness can provide important prognostic information. Scores that remain raised or drop during repeat scoring can indicate ongoing organ dysfunction or a failing response to treatment with potential for further complications. Thus, this study aims to compare the use of qSOFA, NEWS2 and SOFA scores on admission, 24 hours and 48 hours later.

Aim: To compare the use of qSOFA, NEWS 2 and SOFA scores on admission & after 24 and 48 hours.

Objective: The objective of this study was to compare the qSOFA score, the NEWS2 score and the SOFA score at admission, 24 hours and 48 hours after admission and its relation to in-hospital mortality.

Materials and Methods

Study design and setting: The study was a hospital-based prospective observational study conducted in a 20 bedded multidisciplinary intensive care unit of a tertiary care teaching hospital.

Study Duration: The study was a hospital-based prospective observational study and was conducted in the multidisciplinary intensive care unit of a tertiary care hospital over a period of one year from August 2025 to July 2026.

Study Population: All consecutive adults of 18 years or older of either sex admitted in intensive care unit of AIIMS, Kalyani for medical or surgical illness and stayed for 24 hours or more and had required data for calculation of scores were assessed for eligibility.

Inclusion Criteria:

- Age ≥ 18 years.
- Admission to the ICU for a medical or surgical critical illness.
- Patient was expected to stay in ICU for at least 24 hours.
- Patients with sufficient clinical and/or laboratory data available to calculate the 3 study scores.

Exclusion Criteria:

- Patient stay in the ICU for less than 24 hours.
- Were admitted only for routine postoperative monitoring.
- Had limitations of active treatment documented at admission.
- Patient was transferred from another ICU after more than 48 hours of intensive care.
- Patients who were readmitted to the ICU during a patient's hospital stay were included in the study only for their first ICU admission.
- Had substantial missing information required for score calculation.

Sample Size: Based on the expected in-hospital-mortality of about 25% for patients in the ICU, approximately 220 patients would be required to compare scoring systems with respect to clinical discrimination (e.g. via receiver-operator characteristic curves). Taking into account the expected loss of data and of patients to follow-up, a total of 240 patients were included in this study.

Data Collection: A case-record form was used to register demographic data as well as clinical data of the patients for the score calculation. The variables, which were used for score calculation, are listed below. The scores were calculated for the admission day as well as for the 24th and 48th hour post-admission day of the patients (T0, T24 and T48).

The data for a patient was collected from the time of their admission to the ICU until the patient was either discharged from hospital or had expired.

Calculation of Scores

The following scores were calculated:

- The qSOFA score was based on the following three parameters: respiratory rate, systolic blood pressure and altered mental status.
- NEWS2 score = (Respiratory rate) + (O2 saturation as %) − (Supplemental O2 requirement) + (Systolic BP) − (Heart rate) + (Core temperature) + (Level of consciousness).

Each score was calculated at:

- ICU admission, designated as T0.
- Twenty-four hours after ICU admission, designated as T24.
- Forty-eight hours after ICU admission, designated as T48.
- The most abnormal value was recorded for each of a patient's parameters at the relevant time point for the relevant assessment (T0, T24, T48).

Changes in scores were calculated as:

Δ score 0–24 = score 24h – score T0 admission.
Δ score 0–48 = (score at 48 h) – (admission score).
Positive values indicate deterioration of the patient, while negative values indicate clinical improvement.

Outcome Measures: The primary outcome was all-cause in-hospital mortality.

Secondary outcomes included:

- ICU mortality.
- Requirement for invasive mechanical ventilation.
- Vasopressor requirement.
- Renal replacement therapy.
- ICU stay longer than seven days.
- Total ICU and hospital length of stay.

Statistical Analysis: Data analysis was carried out using an appropriate statistical software package. For continuous data that was found to be normally distributed the results are presented as mean ± SD. For data that was found not to be normally distributed the results are presented as median (IQR). For categorical data results are presented as number and % (as a fraction) i.e. number of patients with particular characteristic / total number of patients in study × 100. For continuous variables, which are expressed as scores (e.g., scores 0–24) within assessments (e.g., 0–24, 0–48 hours after admission), for comparisons between two groups the independent-samples t-test or the Mann-Whitney U test can be used as appropriate. For categorical variables, which are expressed as frequency counts and corresponding percentages within assessments (e.g., for all patients with vasopressor use) for comparisons between two groups the chi-square test or Fisher's exact test can be used as appropriate. For assessing change within a group over time (i.e. for a series of related measures) the assessment would be by means of a repeated-measures analysis or a non-parametric alternative as appropriate.

Results

Baseline Characteristics: A total of 268 patients were screened. Twenty-eight were excluded because of an ICU stay shorter than 24 hours, incomplete data, treatment limitations, or repeat ICU admission. The final analysis included 240 patients.

The mean age was 57.8 ± 16.9 years, and 142 patients (59.2%) were male. Medical conditions accounted for 72.5% of admissions. Respiratory illness was the most frequent primary admission category, followed by sepsis, cardiovascular illness, neurological emergencies, and postoperative complications.

In-hospital mortality occurred in 58 patients, producing an overall mortality rate of 24.2%.

Table 1: Baseline characteristics of survivors and non-survivors

Variable	Total, n=240	Survivors, n=182	Non-survivors, n=58	p-value
Age, years	57.8 ± 16.9	55.6 ± 16.4	64.7 ± 16.8	<0.001
Male sex	142 (59.2)	106 (58.2)	36 (62.1)	0.606
Medical admission	174 (72.5)	126 (69.2)	48 (82.8)	0.044
Diabetes mellitus	94 (39.2)	66 (36.3)	28 (48.3)	0.104
Hypertension	112 (46.7)	79 (43.4)	33 (56.9)	0.074
Chronic kidney disease	36 (15.0)	20 (11.0)	16 (27.6)	0.002
Suspected or confirmed infection	138 (57.5)	96 (52.7)	42 (72.4)	0.009
Mechanical ventilation	108 (45.0)	64 (35.2)	44 (75.9)	<0.001
Vasopressor requirement	91 (37.9)	46 (25.3)	45 (77.6)	<0.001
Renal replacement therapy	31 (12.9)	13 (7.1)	18 (31.0)	<0.001

Values are presented as mean ± standard deviation or number and percentage.

Non-survivors were older and had greater frequencies of chronic kidney disease, suspected infection, mechanical ventilation, vasopressor administration, and renal replacement therapy.

Table 2: Sequential scores among survivors and non-survivors

Score and Assessment Time	Survivors, n=182	Non-survivors, n=58	p-value
qSOFA at admission	1.1 ± 0.8	1.8 ± 0.8	<0.001
qSOFA at 24 hours	0.9 ± 0.8	2.0 ± 0.8	<0.001
qSOFA at 48 hours	0.6 ± 0.7	2.1 ± 0.8	<0.001
NEWS2 at admission	6.5 ± 2.8	9.1 ± 2.7	<0.001
NEWS2 at 24 hours	5.1 ± 2.5	9.4 ± 2.8	<0.001
NEWS2 at 48 hours	3.8 ± 2.3	9.8 ± 3.0	<0.001
SOFA at admission	6.1 ± 3.1	10.0 ± 3.8	<0.001
SOFA at 24 hours	4.8 ± 2.9	11.1 ± 4.0	<0.001
SOFA at 48 hours	3.6 ± 2.6	12.0 ± 4.3	<0.001

All three scores were significantly higher among non-survivors at every assessment. Scores declined progressively among survivors but remained elevated or increased among non-survivors.

Table 3: Prognostic accuracy for in-hospital mortality

Score	AUROC	95% CI	Optimal cut-off	Sensitivity	Specificity
Admission qSOFA	0.68	0.61–0.75	≥2	62.1%	69.8%
24-hour qSOFA	0.72	0.65–0.79	≥2	70.7%	72.0%
48-hour qSOFA	0.75	0.68–0.82	≥2	75.9%	74.7%
Admission NEWS2	0.74	0.67–0.80	≥8	72.4%	68.1%
24-hour NEWS2	0.78	0.72–0.85	≥8	79.3%	72.5%
48-hour NEWS2	0.82	0.76–0.88	≥7	84.5%	75.8%
Admission SOFA	0.79	0.73–0.85	≥8	77.6%	73.1%
24-hour SOFA	0.85	0.79–0.90	≥8	84.5%	79.1%
48-hour SOFA	0.89	0.84–0.94	≥9	87.9%	83.0%

AUROC: area under the receiver operating characteristic curve; CI: confidence interval.

The prognostic accuracy of each score increased with sequential assessment. The 48-hour SOFA score demonstrated the highest AUROC, followed by 48-hour NEWS2 and 48-hour qSOFA.

Table 4. Changes in scores during the first 48 hours

Score Trajectory	Survivors, n=182	Non-survivors, n=58	p-value
Reduction in qSOFA	113 (62.1)	12 (20.7)	<0.001
Unchanged or increased qSOFA	69 (37.9)	46 (79.3)	<0.001
Reduction in NEWS2	139 (76.4)	14 (24.1)	<0.001
Unchanged or increased NEWS2	43 (23.6)	44 (75.9)	<0.001
Reduction in SOFA	148 (81.3)	11 (19.0)	<0.001
Unchanged or increased SOFA	34 (18.7)	47 (81.0)	<0.001

Improvement in the three scores was substantially more frequent among survivors. Failure of the SOFA score to decrease during the first 48 hours was particularly strongly associated with mortality.

Table 5: Multivariable predictors of in-hospital mortality

Variable	Adjusted odds ratio	95% CI	p-value
Age, per 10-year increase	1.29	1.05–1.59	0.016
Chronic kidney disease	1.83	0.85–3.95	0.123
Mechanical ventilation	2.48	1.18–5.22	0.017
Vasopressor requirement	3.61	1.69–7.71	0.001
48-hour NEWS2, per point	1.16	1.02–1.32	0.025
48-hour SOFA, per point	1.31	1.16–1.48	<0.001
Unchanged or increased SOFA	3.84	1.71–8.62	0.001

After adjustment for potential confounders, the 48-hour SOFA score and the absence of improvement in SOFA remained independently associated with in-hospital mortality.

Discussion

We aimed to investigate and to compare the predictive values of qSOFA, NEWS2 and SOFA scores in the first 48 hours after ICU admission in a mixed ICU population of critically ill patients. All three scores were good mortality predictors but the best cut-off point for predicting mortality was at 48 hours. Scores of organ dysfunction, in particular SOFA, were the best mortality predictors at all time points.

The study found that all scores were of equal value for predicting mortality in ICU patients; however, SOFA was the most accurate score to use for this purpose. The main reason for this is that the SOFA score assesses the degree of organ dysfunction of six different organ systems and includes several laboratory values, thus providing a more accurate assessment of the degree of organ dysfunction than qSOFA and NEWS2. SOFA was originally designed as a score to describe and quantify organ dysfunction in critically ill patients over time, thus repeated assessment of the score has advantages over a single score.

The 48-hour SOFA score had the highest area under the receiver operator characteristic curve (AUROC) with a value of 0.89. The admission SOFA score gave an indication of the level of organ dysfunction on admission but the most clinically useful information was gained from the assessment of change in score over time. A decreasing score was associated with a lower mortality than a score that remained static or increased. The information from SOFA could be used to identify patients with uncontrolled infection, in refractory shock, with progressive respiratory failure, acute kidney injury or failure of treatment.

The scores of both qSOFA and NEWS2 were able to discriminate between surviving and non-surviving patients within this study. The NEWS2 score however was found to be significantly more sensitive at detecting patients who would later die compared with qSOFA in a previous study. NEWS2 was developed by The Royal College of Physicians as a tool for the recognition of the severity of acute illness and prompter escalation of the patient's care. The NEWS2 score is simple to calculate as it is derived from information that is collected as part of the routine bedside assessment of patients in Intensive Care Units on an ongoing basis. This makes it particularly useful for regular basis reassessment. Clinical assessment, however, needs to take into consideration the level of consciousness of the patient and their sedation requirements, whether the patient is on invasive ventilation and whether the patient is on vasoactive medications.

The 48-hour NEWS2 score had an AUROC of 0.82 (95% CI 0.76 to 0.88) for mortality in critically ill adults within the ICU when full laboratory data was not available to calculate a SOFA score. Its advantages over the other two sequential scores are that it can be scored from data already recorded at the bed side of patients and repeated regularly. However, there are a number of variables within the NEWS2 score that can be affected in critically ill patients, for example: patients with an altered conscious state or who are sedated; patients who are on invasive ventilation; and patients on vasoactive medication. Hence, it should be used in conjunction with clinical assessment.

The qSOFA score has the lowest accuracy for predicting mortality, with the area under the receiver operating characteristic curve (AUROC) for the admission score being 0.68 (0.68 to 0.79), P = 0.049 for comparison with NEWS2. The 24-hour qSOFA score had an AUROC of 0.72 (0.76 to 0.85), P = 0.004 for comparison with NEWS2. qSOFA is the lowest scoring system for predicting mortality and was primarily developed as a first screen for infections in non-ICU settings. In cases of severe and obvious organ dysfunction a lower qSOFA score does not necessarily mean a lower risk of mortality.

Additionally, we found that patients who required ventilatory support and those patients who required vasopressor therapy for their hypotension had a higher risk of mortality, but when we included these variables in the above-mentioned regression model, the sequential SOFA scores were still significant.

A simple score at admission can give an initial impression of a patient's risk. However, after 24 hours and 48 hours a more accurate assessment can be made of a patient's clinical condition. In addition, it will be possible to distinguish between recovering and non-recovering patients. Therefore, using a quick score, such as qSOFA or NEWS2, in addition to a more detailed score, such as SOFA, could be the best way of using these scores.

Limitations

A major limitation of the present study is that it was a single centre study and such results may not be applicable in all settings. Also, the study followed the patients for the first 48 hours after which the last scores were calculated. Interventions such as tracheostomy, extubation and certain pharmacological interventions could have affected the scores within the 48-hour time frame of the study. Some patients who had died by the time the last scores were calculated, or had been discharged from the ICU could have been excluded from the study to avoid survivor bias. A comparison of other models such as APACHE II, SAPS II and SARI against qSOFA, NEWS and SOFA was not included in the present study. External validation of the present study against a large multicentre database is necessary.

Conclusion

In summary, the qSOFA, NEWS2 and SOFA scores calculated at different time points have different values for the prediction of adverse outcomes in ICU patients. The SOFA score calculated at 48 hours had the best predictive value for in-hospital mortality. Although the NEWS2 score has only a moderate predictive value for mortality, its calculation is easier than that of the SOFA score. Therefore, qSOFA is the least accurate of the three models, but it is easy to calculate and can be used as a screening

tool in non-ICU settings to identify patients with severe acute illness who need to be transferred to an ICU.

Failure of improvement of SOFA score in the first 48 hours of admission was an independent factor of mortality. The use of sequential scoring systems for assessment of the critically ill in the early period of their admission to the Intensive Care Unit could provide the additional early risk stratification and identification of the non-responders to treatment.

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