TURKISH JOURNAL OF EMERGENCY MEDICINE

Original Article

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Quick Response Code:

Website: https://turkjemergmed.com/

DOI: 10.4103/tjem.tjem_45_24



# Comparative analysis of Glasgow Coma Scale, quick Sepsis-related Organ Failure Assessment, base excess, and lactate for mortality prediction in critically ill emergency department patients

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**Abstract:**

**OBJECTIVES:** It is crucial to promptly identify high-mortality patients in emergency departments and initiate their treatment as soon as possible. Although many parameters have been studied to select patients with high mortality, no comprehensive evaluation exists in previous literature on these parameters in critically ill patients, regardless of patient groups. The aim of this study is to evaluate the Glasgow Coma Scale (GCS), quick Sepsis-related Organ Failure Assessment (qSOFA), blood gas base excess (BE), and blood gas lactate in predicting mortality in critically ill patients admitted to the emergency department.

**METHODS:** This prospective observational cohort study included adult patients with Emergency Severity Index 1–2 (critically ill) admitted to the emergency department. All patients were evaluated by the physician within 10 min, and blood gas samples were taken. The data collection forms recorded the patients' GCS and qSOFA scores at the time of first evaluation by the physician. The qSOFA score assessment was performed in all patients with ESI levels 1 and 2, regardless of whether infective pathology was suspected. Blood gas BE and lactate values were also from laboratory test results. Patients or their relatives were contacted by phone at the end of the 1st month to obtain information about the clinical condition (survival or mortality).

**RESULTS:** A total of 868 patients were included, with 163 deaths observed within 30 days. GCS score, qSOFA score, and lactate value were significant in predicting mortality within 30 days. While the BE value was significant for predicting 30-day mortality for values equal to or below the lower limit of −1.5 ($P < 0.001$), it was not significant for values equal to or above the upper limit of +3 ($P > 0.05$). The most successful prediction model for predicting 30-day mortality was found to be qSOFA with a cutoff value of ≥1.

**CONCLUSION:** In emergency departments, each of the GCS, qSOFA scores, BE, and lactate values can be used independently as a practical mortality prediction model in critically ill patients. Among these four models, qSOFA is the most successful practical mortality prediction model in critically ill patients.

**Keywords:**

Base excess, Glasgow Coma Scale, lactate, quick Sepsis-related Organ Failure Assessment

**Submitted:** 03-03-2024
**Revised:** 03-07-2024
**Accepted:** 04-07-2024
**Published:** 01-10-2024

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**How to cite this article:** Meral G, Ardıç Ş, Günay S, Güzel K, Köse A, Durmus HG, *et al*. Comparative analysis of Glasgow Coma Scale, quick Sepsis-related Organ Failure Assessment, base excess, and lactate for mortality prediction in critically ill emergency department patients. Turk J Emerg Med 2024;24:231-7.

## Box-ED section

**What is already known about the study topic?**

- Previous research has extensively explored the predictive value of the Glasgow Coma Scale (GCS) and quick Sepsis-related Organ Failure Assessment (qSOFA) score in mortality outcomes among critically ill patients. Studies have also identified lactate levels and base excess (BE) as significant biomarkers for mortality prediction across various clinical contexts, including emergency departments. The Emergency Severity Index (ESI) is widely acknowledged for its effectiveness in triaging critically ill patients, particularly in promptly identifying individuals at the highest risk of mortality.

**What is the conflict on the issue? Is it important for readers?**

- Within the scope of this research, we evaluated the GCS score, qSOFA score, BE, and lactate value in predicting mortality in critically ill patients admitted to the emergency department. The endpoint was determined as mortality or survival at the completion of the 30-day follow-up period. No comprehensive evaluation of these parameters exists in the previous literature.

**How is this study structured?**

- This prospective observational cohort study included adult patients ($n$ = 868) with ESI 1–2 (critically ill) admitted to the emergency department. Patients or their relatives were contacted by phone at the end of the 1st month to obtain information about the clinical condition (survival or mortality).

**What does the study tell us?**

- The qSOFA score was superior to all other models in predicting 30-day mortality. Among GCS, qSOFA, BE, and lactate, qSOFA is the best practical mortality prediction model.

## Introduction

The Emergency Severity Index (ESI) is a commonly used triage system.[1] Categories 1 and 2 in the ESI triage system include the highest mortality, comprising critically ill patients.[2] It is crucial to promptly identify high-mortality patients in this group and initiate their treatment as soon as possible.[3] The increasing number of patients and the shortage of physicians in emergency departments further emphasize the importance of this selection.[4] Therefore, prediction models that practically select patients with high mortality will be useful in chaotic situations.[5]

Glasgow Coma Scale (GCS) evaluation is one of the first evaluations made by the physician after triage by nurses in many emergency departments.[6] Quick Sepsis-related Organ Failure Assessment (qSOFA) is a simple assessment that consists of mental status, respiratory rate, and systolic blood pressure parameters.[7] In addition, blood gases are among the examinations that provide the fastest results in emergency departments.[8] With their easy accessibility and applicability features, GCS, qSOFA, and blood gas parameters seem to be practical models that can be evaluated for use in predicting the mortality of critically ill patients in emergency departments. GCS, qSOFA, and base excess (BE) and lactate, which are blood gas parameters, have previously been used as mortality prediction models in many studies in limited patient populations.[6,9-11] However, no comprehensive evaluation exists in previous literature on these parameters in critically ill patients, regardless of patient groups.

Within the scope of this research, our aim is to make a comparative analysis of GCS, qSOFA, BE, and lactate models in predicting mortality in critically ill patients admitted to the emergency department without limiting the patient group.

## Methods

This study was conducted in a third-level hospital emergency department between May 10, 2018, and December 12, 2019. Ethics committee approval was granted on May 9, 2018, with protocol number 2018/18 (Clinical Research Ethics Committee of Health Sciences University Trabzon Kanuni Training and Research Hospital). ESI 1 or 2 category patients who were 18 years of age or older, who were not pregnant, and who had not received cardiopulmonary resuscitation were

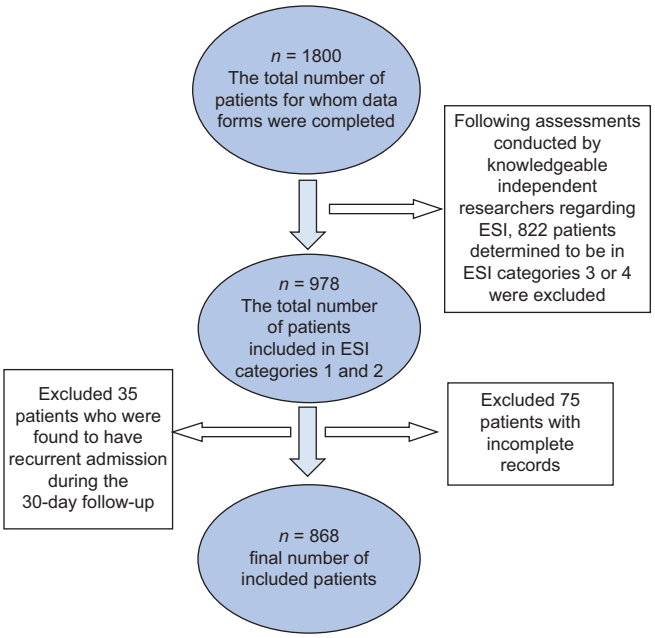


**Figure 1:** Flowchart. ESI: Emergency Severity Index

included in the study [Figure 1]. The hospital emergency department where the study was conducted did not actively utilize the ESI triage system. Triage for outpatient cases was conducted by experienced triage nurses using a 3-category (red, yellow, and green) triage system. Critically ill patients brought in by ambulance teams (such as unconscious patients, trauma patients with altered consciousness, and unstable chest pain patients) were directly taken to the resuscitation room and triaged by the emergency department physician. After providing a brief training session on the ESI triage system to emergency department physicians, the study commenced. During the period of the study, there were physicians available in sufficient numbers and qualifications to evaluate patients categorized as yellow zone and red zone within 10 min. Upon presentation, vital signs were recorded by nurses. GCS and qSOFA assessments were conducted by physicians and, along with preliminary diagnoses, documented in the data collection forms. All patients taken to the resuscitation room and those categorized as yellow zone in triage were swiftly re-evaluated by resident physicians, and all patients deemed to be ESI 1 or 2 were included in the study. To ensure that no eligible patients were missed during the study period, blood gas sampling was performed on all patients in the yellow and red zones on the decision of the emergency department attending physician. For patients presenting with clinical conditions such as respiratory distress that may require arterial blood gas sampling, blood gas samples were obtained by the emergency department physician evaluating the patient at that time. Venous sampling was performed for patients who did not require arterial blood gas sampling.

The blood gas analyses were performed using the Radiometer ABL90 FLEX blood gas analyzer, situated in a room integrated with the emergency department and easily accessible, with a technician available 24 h a day and regular maintenance performed. The device provided results within a short timeframe, typically within 5 min. The reference ranges for BE on the device were −1.5 mmol/L to +3 mmol/L and for blood gas lactate were 0.5–1.6 mmol/L. The blood gas data obtained following patients' emergency department examinations, along with their admission or discharge diagnoses, were also recorded on the data forms.

Patients or their legal guardians were contacted by phone at the end of the 30-day follow-up to obtain information about their clinical condition, and the acquired data were recorded. The patients were categorized as infective and noninfective based on clinical and laboratory findings, along with the final diagnoses before hospitalization or discharge, as determined by an infectious disease specialist. In addition, the patients included in the study were categorized as traumatic or nontraumatic based on the initial assessment by the emergency department physician. Those without signs of trauma sufficient to categorize them as critically ill were not classified as traumatic patients. After all registration procedures and follow-up periods, GCS, qSOFA, BE, and lactate, which we determined as the mortality prediction model, were statistically evaluated. Written consent was obtained from all patients or their legal guardians who agreed to participate in the study. All reporting has been prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology and Transparent Reporting of a Multivariable Prediction Model for Individual Prognosis Or Diagnosis guidelines.[12,13]

### Statistical analyses

The data were analyzed using IBM SPSS V23 (SPSS Inc., Chicago, IL, USA). The normality of distribution was assessed using the Kolmogorov–Smirnov Test. The Mann–Whitney *U* test compared nonnormally distributed data in binary groups. The Pearson Chi-Square test was used to compare categorical data. Binary logistic regression analysis was used to examine mortality risk factors within 30 days for the measured parameters. We wanted to investigate which parameters are superior in predicting 30-day mortality. For this purpose, we used Jamovi Desktop 2.5.3. current version program. Areas under the curve (AUC) were calculated with receiver operating characteristic (ROC) analysis, and cutoff values were determined with the Youden Index. By comparing the AUC with the DeLong method, it was tried to determine which of the mortality prediction models was superior in 30-day follow-up. Afterward, the DeLong test was studied separately in infective and noninfective patient groups, and a superior prediction model, if any, was tried to be determined in these groups. Analysis results were presented as frequencies (percentages) for categorical variables, mean ± standard deviation, and median (minimum–maximum) for quantitative variables. The results were considered statistically significant when $P < 0.05$.

## Results

A total of 868 patients with ESI categories 1 and 2 were included in the study. Among these patients, 107 patients were traumatic, and 237 patients were infective. Of the participants, 54.3% were male ($n = 471$), and 45.7% were female ($n = 397$). The mean age of the participants was 69.0 ± 19.0 years. There were no patients or relatives who could not be reached when contacted to obtain information about their clinical condition after the 1-month follow-up. The mortality rate in the 30-day follow-up was 18.8% ($n = 163$). Other demographic parameters and final diagnosis groups in the emergency department are denoted in Table 1a and b.

The analysis of the mortality prediction models within 30 days using a univariate model found that the median

**Table 1a: The frequency distributions and descriptive statistics of the variables**

| | ESI 1 and 2 (*n*=868) |
|---|---|
| Age | 69.0±19.0 |
| Gender | |
| Male | 471 (54.3) |
| Female | 397 (45.7) |
| Noninfective | 631 (72.7) |
| Infective | 237 (27.3) |
| Nontraumatic | 761 (87.7) |
| Traumatic | 107 (12.3) |
| GCS score | 15.0 (13.0–15.0) |
| qSOFA score | 1.0 (0.0–1.0) |
| Hospitalization | |
| Yes | 833 (96) |
| No | 31 (3.6) |
| Exitus in ED | 4 (0.4) |
| 30-day mortality | |
| Yes | 163 (18.8) |
| No | 705 (81.2) |
| Exitus day | 7.0 (2.0–15.0) |
| Intubation | 48 (5.5) |
| BE (mmol/L) | 0.7 (−2.7–3.5) |
| Lactate (mmol/L) | 1.7 (1.2–2.5) |
| Temperature (°C) | 36.4 (36.0–36.8) |
| Heart rate/min | 88.0 (76.0–105.0) |
| Systolic blood pressure (mmHg) | 130.0 (102.8–150.0) |
| $SaO_2$ | 94.0 (90.0–97.0) |
| Respiratory rate/min | 18.0 (16.0–24.0) |

Descriptive statistics were presented as counts and percentages (%) for categorical variables, and as mean ± SD or median [IQR] for numerical variables depending on the distribution. GCS: Glasgow Coma Scale, qSOFA: Quick Sepsis-related Organ Failure Assessment, ED: Emergency department, BE: Blood gas base excess, Lactate: Blood gas lactate, $SaO_2$: Oxygen saturation, SD: Standard deviation, IQR: Interquartile range, ESI: Emergency Severity Index

values of GCS, qSOFA, and lactate were significantly higher in patients with mortality compared to those without mortality. According to this result, as the median values of GCS, qSOFA, and lactate increase, mortality significantly increases within 30 days. BE median values of patients with 30-day mortality were significantly lower than those without. According to this result, mortality increases significantly as BE decreases to lower values than the lower limit value [Table 2, for each $P < 0.001$]. When patients were divided into four groups as infective-noninfective and traumatic-nontraumatic, and mortality prediction models were re-evaluated, significant results were obtained again for mortality prediction in all four groups [Table 3, for each $P < 0.05$]. According to these results, prediction models are successful in predicting 30-day mortality regardless of patient groups.

The DeLong test was performed to examine the superiority of parameters for prediction in the 30-day follow-up. The results showed that GCS and lactate provided similar predictions, while the qSOFA score achieved superior outcomes compared to other models, with a cutoff value of ≥1 [Table 4].

**Table 1b: The diagnostic groups and their percentages among included patients**

| Final diagnosis group in ED | *n* (%) |
|---|---|
| Cerebrovascular event | 253 (29.1) |
| Pneumonia | 132 (15.2) |
| Multiple trauma | 105 (12.1) |
| AMI | 72 (8.3) |
| Intoxication | 29 (3.3) |
| Sepsis | 27 (3.1) |
| Spontaneous pneumothorax | 26 (3.0) |
| Acute renal failure | 20 (2.3) |
| Pulmonary edema | 20 (2.3) |
| Acute abdomen | 19 (2.2) |
| Gastrointestinal perforation | 16 (1.8) |
| COPD exacerbation | 15 (1.7) |
| Diabetic ketoacidosis | 14 (1.6) |
| Gastrointestinal bleeding | 14 (1.6) |
| Arrhythmia | 13 (1.5) |
| Pulmonary embolism | 12 (1.4) |
| Acute pulmonary edema | 9 (1.0) |
| CO intoxication | 9 (1.0) |
| Arterial occlusion | 8 (0.9) |
| Aortic dissection | 6 (0.7) |
| Dehydration | 6 (0.7) |
| Hyperglycemic hyperosmolar state | 6 (0.7) |
| Status epilepticus | 6 (0.7) |
| Epileptic seizures | 4 (0.5) |
| Anaphylaxis | 3 (0.3) |
| Aortic rupture | 3 (0.3) |
| Neutropenic fever | 3 (0.3) |
| Asphyxia | 2 (0.2) |
| Hypoglycemia | 2 (0.2) |
| Acute pancreatitis | 1 (0.1) |
| Cellulitis | 1 (0.1) |
| Crimean–Congo hemorrhagic fever | 1 (0.1) |
| Encephalitis | 1 (0.1) |
| Food poisoning | 1 (0.1) |
| Hepatic encephalopathy | 1 (0.1) |
| Hypertensive emergency | 1 (0.1) |
| Increased intracranial pressure | 1 (0.1) |
| Necrotizing fasciitis | 1 (0.1) |
| Ovarian torsion | 1 (0.1) |
| Pancytopenia | 1 (0.1) |
| Peripheral arterial dissection | 1 (0.1) |
| Peripheral arterial rupture | 1 (0.1) |
| Urinary tract infection | 1 (0.1) |

ED: Emergency department, AMI: Acute myocardial infarction, COPD: Chronic obstructive pulmonary disease, CO: Carbon monoxide

The prediction models were compared using the DeLong method in the infective patient group. According to the results, in the infective patient group, qSOFA is more successful than GCS and BE [Table 5, $P < 0.05$ for each comparison]. No significant results were obtained in other comparisons [Table 5, $P > 0.05$ for each]. When the DeLong test was applied to the noninfective patient group, it was concluded that qSOFA was more successful than BE [Table 5, $P > 0.0408$]. No significant

**Table 2: 30-day mortality in Emergency Severity Index 1 and 2**

| 30-day mortality | Mortality (*n*=163) | Survive (*n*=705) | *P* |
|---|---|---|---|
| GCS | 13.0 (9.0–15.0) | 15.0 (14.0–15.0) | <0.001* |
| qSOFA | 2.0 (1.0–2.0) | 0.0 (0.0–1.0) | <0.001* |
| BE | −0.6 (−6.3–2.5) | 1.0 (−1.9–3.6) | <0.001* |
| Lactate | 2.2 (1.4–4.3) | 1.6 (1.1–2.3) | <0.001* |

*Mann–Whitney *U*-test was used. Variables were presented as median (IQR). GCS: Glasgow come scale, qSOFA: Quick-sepsis related organ failure assessment score, BE: Blood gas base excess (mmol/L), Lactate: Blood gas lactate (mmol/L), IQR: Interquartile range

**Table 3: 30-day mortality evaluations of predictive models in various patient groups**

| | 30-day mortality | | *P* |
|---|---|---|---|
| | Mortality | Survive | |
| Infective | *n*=66 | *n*=171 | |
| GCS | 12.0 (9.0–14.2) | 14.0 (12.0–15.0) | <0.001* |
| qSOFA | 2.0 (1.0–2.8) | 1.0 (1.0–2.0) | <0.001* |
| BE | −0.9 (−6.9–3.0) | 1.1 (−2.6–4.0) | 0.034* |
| Lactate | 2.3 (1.5–5.8) | 1.7 (1.2–2.5) | <0.001* |
| Noninfective | *n*=97 | *n*=534 | |
| GCS | 15.0 (12.0–15.0) | 15.0 (15.0–15.0) | <0.001* |
| qSOFA | 1.0 (1.0–2.0) | 0.0 (0.0–1.0) | <0.001* |
| BE | −0.6 (−6.1–2.0) | 0.9 (−1.5–3.5) | <0.001* |
| Lactate | 2.1 (1.4–3.4) | 1.6 (1.1–2.3) | <0.001* |
| Traumatic | *n*=11 | *n*=96 | |
| GCS | 10.0 (5.8–15.0) | 15.0 (15.0–15.0) | <0.001* |
| qSOFA | 1.0 (1.0–2.5) | 0.0 (0.0–1.0) | <0.001* |
| BE | −4.1 (−6.5–−2.6) | 0.6 (−3.2–2.8) | 0.002* |
| Lactate | 3.6 (2.3–4.7) | 1.6 (1.2–2.6) | 0.008* |
| Nontraumatic | *n*=152 | *n*=609 | |
| GCS | 13.0 (9.0–15.0) | 15.0 (14.0–15.0) | <0.001* |
| qSOFA | 2.0 (1.0–2.0) | 1.0 (0.0–1.0) | <0.001* |
| BE | −0.6 (−6.2–2.8) | 1.0 (−1.8–3.8) | <0.001* |
| Lactate | 2.2 (1.4–3.8) | 1.6 (1.1–2.3) | <0.001* |

*Mann–Whitney *U*-test was used. Variables were presented as median (IQR). GCS: Glasgow Coma Scale, qSOFA: Quick-sepsis related organ failure assessment score, BE: Blood gas base excess (mmol/L), Lactate: Blood gas lactate (mmol/L), IQR: Interquartile range

**Table 4: 30-day mortality comparative receiver operating characteristic curve analysis in Emergency Severity Index 1 and 2**

| | Cutoff | AUC | SE | 95% CI | qSOFA | BE | Lactate |
|---|---|---|---|---|---|---|---|
| GCS | <15 | 0.685 | 0.0245 | 0.652–0.717 | 0.019* | 0.027* | 0.371 |
| qSOFA | ≥1 | 0.737 | 0.0227 | 0.705–0.767 | - | 0.001* | 0.010* |
| BE | ≤−1.7 | 0.604 | 0.0291 | 0.569–0.638 | - | - | 0.123 |
| Lactate | ≥2.2 | 0.652 | 0.0263 | 0.618–0.684 | - | - | - |

*DeLong test was used, *P*<0.05 was considered significant. GCS: Glasgow Coma Scale, qSOFA: Quick Sepsis-related Organ Failure Assessment score, BE: Blood gas base excess (mmol/L), Lactate: Blood gas lactate (mmol/L), AUC: Area under the curve, SE: Standard error, CI: Confidence interval

differences were found in other comparisons [Table 5, $P > 0.05$ for each].

## Discussion

In previous studies, GCS, qSOFA, BE, and lactate parameters have often been studied in limited patient groups and have not been extensively tested as mortality prediction models in general patient populations.[6,9-11] Our study reveals that GCS, qSOFA, BE, and lactate are successful alone in predicting 30-day mortality without limiting the patient group. Moreover, qSOFA is the most superior among them with the cutoff ≥1. The practical utility of GCS, qSOFA, BE, and lactate may be sufficient to address the requirements in emergency service conditions. This study indicated a significant relationship between low GCS scores and increased mortality, and Ramazani and Hosseini supported these findings.[14] Hao *et al.* reported that qSOFA effectively predicted 28-day mortality in elderly patients in the emergency service.[9] Our study found similar results in all patients, regardless of whether they had infective pathology or not. It is worth noting that at this stage, unlike other studies, we included all adult patients with ESI 1–2 regardless of their age. Boonmee *et al.* compared the predictivity of GCS and qSOFA in mortality in sepsis patients and determined that qSOFA was superior.[10] We considered all critically ill patients, regardless of being in the infective or the noninfective group, and found that qSOFA was successful in predicting mortality regardless of etiology. In addition, when we compared the AUC with the DeLong method, our results showed that qSOFA was more successful than GCS in predicting 30-day mortality. The qSOFA score includes altered mental status, respiratory rate ≥22/min, and systolic blood pressure ≤90 mmHg.[7] A qSOFA score of ≥1, indicating the presence of at least one of these three parameters in a critically ill patient, is closely associated with significantly higher mortality. In a chaotic situation, these patients should be given priority, and treatment should be started immediately.

Erdur *et al*. conducted research on critically ill cancer patients and demonstrated that venous BE and lactate successfully predicted mortality.[11] Our study observed that BE values −1.7 and below successfully predicted mortality; values above +3 did not align. Qi *et al.* stated that arterial BE and lactate successfully predicted 72-h mortality in multiple trauma patients, with lactate being a better predictor than BE.[15] In contrast, our study did not limit the participant group to trauma patients. In addition, we did not require arterial blood gas sampling based on previous studies supporting that venous values instead of arterial BE and lactate can be used as mortality predictors.[11] We leave it to the doctor's decision depending on the patient. We concluded that these two parameters did not demonstrate superiority over each other in 30-day follow-ups.

In addition, in our study, we evaluated BE and lactate, as well as GCS and qSOFA, in infective, noninfective, traumatic, and nontraumatic patient groups. In our study, we concluded that BE and lactate alone can be used to predict mortality in critically ill patients, whether

**Table 5: 30-day mortality comparative analysis in infective and noninfective patient groups**

| | AUC | SE | 95% CI | qSOFA | BE | Lactate |
|---|---|---|---|---|---|---|
| Infective | | | | | | |
| GCS | 0.654 | 0.0313 | 0.615–0.692 | 0.037* | 0.505 | 0.872 |
| qSOFA | 0.719 | 0.0305 | 0.681–0.754 | - | 0.036* | 0.093 |
| BE | 0.624 | 0.0379 | 0.584–0.663 | - | - | 0.596 |
| Lactate | 0.646 | 0.0344 | 0.606–0.684 | - | - | - |
| Noninfective | | | | | | |
| GCS | 0.678 | 0.0413 | 0.612–0.740 | 0.649 | 0.095 | 0.541 |
| qSOFA | 0.695 | 0.0377 | 0.630–0.756 | - | 0.048* | 0.357 |
| BE | 0.575 | 0.046 | 0.506–0.641 | - | - | 0.160 |
| Lactate | 0.643 | 0.0434 | 0.576–0.707 | - | - | - |

*DeLong test was used, $P<0.05$ was considered significant. GCS: Glasgow Coma Scale, qSOFA: Quick Sepsis-related Organ Failure Assessment score, BE: Blood gas base excess (mmol/L), Lactate: Blood gas lactate (mmol/L), AUC: Area under the curve, SE: Standard error, CI: Confidence interval

infective or not, traumatic or not. In this study, we could not detect any superiority between BE and lactate.

In a study conducted by Sohn *et al*. in emergency room patients with suspected infection, qSOFA predicted mortality better than lactate.[16] Similarly, in our study, we reached results indicating that qSOFA is superior to lactate in predicting 30-day mortality. When we divided the patients into infective-noninfective patient groups, qSOFA was again superior to BE in both groups. It was observed that GCS was superior to GCS only in the infective patient group, but it appeared to have similar predictive power as lactate in both groups.

## Limitations

This study had some limitations. One limitation was the clinician's discretion in arterial blood gas sampling without considering the arterial to venous blood gas ratio. This was based on our aim to develop a practical mortality prediction model, considering that arterial blood gas sampling may lead to more complications than venous sampling and is generally a more time-consuming procedure.[17,18] Another limitation was that 48 patients were intubated, but it was unknown how many were intubated in the emergency department versus the pre-hospital setting, and whether they had received sedation (e.g., midazolam). No tally was kept regarding this, and since GCS evaluation could not be made clearly in these patients, they were recorded as "intubated." This was also included in the statistical analysis in this way. With these aspects, the inclusion of these 48 patients may be thought-provoking regarding the mortality reliability of GCS. Another limitation is that 30-day follow-up information about the clinical situation was obtained by calling the patient or his/her guardian by phone. Considering elderly patients and their relatives, the clinical information they provide regarding the cause of death may not be completely reliable. While the models were compared with each other, AUC was compared using ROC analysis and then the DeLong method. Considering that qSOFA consists of 4 units and GCS consists of 12 units, the high single ratio values of the qSOFA score may have caused qSOFA to appear superior. However, these limitations will not change the conclusion that qSOFA is successful in predicting mortality in all critically ill patients without specializing in the patient group, such as infective patients.

## Conclusion

In emergency department conditions, GCS score, qSOFA score, BE, and lactate can be used as standalone practical mortality prediction models in critically ill patients. qSOFA score was superior to all others for predicting 30-day mortality. When compared with GCS, BE, and lactate, qSOFA is the best practical mortality prediction model in critically ill patients and it can be used in mortality assessment regardless of the presence of infectious pathology.

### Author contributions statement

Authorship provides credit for a researcher's contributions to a study and carries accountability. Authors are expected to fulfill the criteria below:

GM: Conceptualization (equal); Data Curation (lead); Formal Analysis (lead); Investigation (equal); Methodology (equal); Project Administration (lead); Resources (lead); Supervision (lead); Validation (lead); Visualization (lead); Writing – Original Draft (lead); Writing – Review and Editing (lead). ŞA: Conceptualization (equal); Investigation (equal); Methodology (equal); Project Administration (lead); Supervision (supporting); Visualization (supporting); Writing – Review and Editing (equal). SG: Conceptualization (equal); Data Curation (supporting); Formal Analysis (supporting); Resources (supporting); Software (lead); Supervision (equal); Visualization (supporting); Writing – Original Draft (supporting); Writing – Review and Editing (equal). KG: Data Curation (supporting); Formal Analysis (supporting); Supervision (equal); Writing – Original Draft (supporting); Writing – Review and Editing (equal). AK: Data Curation (supporting) (supporting); Formal Analysis (supporting); Validation (equal); Writing – Original Draft (equal); Writing – Review and Editing (equal). HGD: Data Curation (supporting); Formal Analysis (supporting); Writing – Original Draft (equal); Writing – Review and Editing (equal). SU: Data Curation (supporting); Formal Analysis (supporting); Writing – Original Draft (equal); Writing – Review and Editing (equal). AC: Data Curation (supporting); Formal Analysis (equal); Writing – Original Draft (equal); Writing – Review and Editing (equal).

### Conflicts of interest

None declared.

### Ethical approval

Our study was produced from a medical specialization thesis that was approved by the Clinical Research Ethics Committee of Health Sciences University Trabzon Kanuni Training and Research Hospital on May 9, 2018, with the decision number 2018/18.

### Funding

None.

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