Original Article

Comparison of qSOFA and SOFA score for predicting mortality in severe sepsis and septic shock patients in the emergency department of a low middle income country

Muhammad Akbar Baig*, Sadaf Sheikh, Erfaan Hussain, Samina Bakhtawar, Muhammad Subhan Khan, Syed Mujtaba, Shahan Waheed

A Department of Emergency Medicine, Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi, 74800, Pakistan
b Department of Emergency Medicine, Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi, 74800, Pakistan
c Section of Pulmonary and Critical Care Medicine, Department of Medicine, Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi, 74800, Pakistan
d People’s Primary Healthcare Initiative (PPHI)- Sindh, C-27/1, Block-2, Umer Sharif Park, Block-2 Clifton, Karachi, Pakistan
e Department of Emergency Medicine, Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi, 74800, Pakistan
f Department of Emergency Medicine, Aga Khan University Hospital, Stadium Road, P.O. Box 3500, Karachi, 74800, Pakistan

ARTICLE INFO

Keywords:
qSOFA
SOFA
Sepsis

ABSTRACT

Objective: We aimed to determine a comparison between the Quick Sequential Organ Failure Assessment (qSOFA) score and existing Sequential Organ Failure Assessment (SOFA) score when applied to severe sepsis & septic shock patients in the Emergency Department (ED) for prediction of in-hospital mortality in the setting of a tertiary care hospital ED in a low-middle income country.

Method: We conducted a prospective observational cohort study on 760 subjects. The qSOFA, SOFA score and in-hospital mortality were assessed by area under the receiver operating curve (AUROC). We calculated sensitivity and specificity for each score for outcomes at cut-offs of 0.92 and 0.63 for qSOFA and SOFA in Severe Sepsis respectively and 0.89 and 0.63 for qSOFA and SOFA in Septic shock respectively.

Results: In patients with severe sepsis, the AUROC of qSOFA for predicting mortality in subjects was 0.92 (95% CI; 0.89–0.94) with 96% sensitivity and 87% specificity in comparison to the AUROC of SOFA score which was 0.63 (95% CI; 0.55–0.70 with 71% sensitivity and 57% specificity. In patients with septic shock, the AUROC of qSOFA for predicting mortality in subjects was 0.89 (95% CI; 0.85–0.92) with 92% sensitivity and 85% specificity in comparison to the AUROC of SOFA score which was 0.63 (95% CI; 0.55–0.70 with 70% sensitivity and 59% specificity.

Conclusion: Our study concludes that qSOFA score is an effective tool at predicting in hospital mortality in comparison to SOFA score when applied to severe sepsis and septic shock patients in the setting of a tertiary care hospital ED of a low-middle income country however, further studies are needed before application for this purpose.

1. Introduction

Sepsis is a fatal syndrome with dire consequences. It progresses rapidly and delays in its identification and treatment can cause a higher mortality. Presently, there are many clinical scoring systems that measure the disease severity in septic population. Many of these scores are time consuming and require information that is not readily available.

With the introduction of the Severe Inflammatory Response Syndrome (SIRS) criteria in 1991 for rapid bedside identification of sepsis to current era where various complex clinical outcome prediction model snow exist, a few of which that are notable to mention such as the Acute Physiology and Chronic Health Evaluation Score, the Simplified Acute Physiology Score III, the Logistic Organ Dysfunction...
applied to ED patients.\textsuperscript{11} The one ED-based scoring system, the Mort-
investigations have demonstrated these scores to be inadequate when
and validated in the intensive care unit (ICU) setting. Previous in-
gic).\textsuperscript{16} The Sepsis III de-
number and severity of dysfunction in six organ systems (Pulmonary,
and neurolo-
sepsis is yet to be seen.\textsuperscript{20} Further implementation of this within existing guidelines for
ED septic patients\textsuperscript{12,13} however, it is said to be inaccurate in severely ill
patients.\textsuperscript{14} Previous investigators have determined an association be-
tween the organ dysfunction and mortality in ED septic patients.\textsuperscript{15} The
scores need further assessment by the SOFA score.\textsuperscript{17} The surviving
sepsis campaign has suggested qSOFA to be used for prognostication only. Further implementation of this within existing guidelines for
sepsis is yet to be seen.\textsuperscript{20}

Our study aims to compare the qSOFA score and existing SOFA
score when applied to severe sepsis & septic shock patients in the ED for
prediction of in-hospital mortality in the setting of a tertiary care hos-
ital ED in a low-middle income country.

2. Methods

We conducted a prospective observational cohort study in the ED
from October to March 2017. The study was approved by the Ethical
Review Committee (ERC) of (4328-EM-ERC-16) and informed consent
was exempted. We recruited adult patients presenting to the ED, equal
to or above 18 years of age and examined by an ED physician for as-
essment & fulfillment of the clinical criteria of severe sepsis or septic
shock as per the guidelines of the Surviving Sepsis Campaign and were
subsequently admitted to the hospital. Patients were considered as
having severe sepsis when they fulfilled criteria for sepsis along with
signs of acute organ dysfunction or hypoperfusion as defined either by
sepsis-induced hypotension (systolic blood pressure (SBP) < 90 mm
Hg or mean arterial pressure (MAP) < 70 mm Hg or a SBP de-
crease > 40 mm Hg or less than two standard deviations below normal
for age in the absence of other causes of hypotension), serum lactate
above upper limits normal, urine output < 0.5 mL/kg/h for more than
2 h despite adequate fluid resuscitation, acute lung injury (ALI) with
PaO2/FIO2 < 250 in the absence of pneumonia as infection source, ALI with PaO2/FIO2 < 200 in the presence of pneumonia as infection source, serum creatinine > 2.0 mg/dL (176.8 \textmu mol/L), total bilir-
ubin > 2 mg/dL (34.2 \textmu mol/L), platelet count < 100,000 \textmu L or coa-
gulopathy (international normalized ratio > 1.5). Patients were con-
sidered having septic shock when they fulfilled criteria for severe sepsis
with the presence of hypotension (systolic blood pressure < 90 mm Hg)
despite adequate fluid resuscitation.\textsuperscript{21}

Patients who were below 18 years of age, pregnant, dead on arrival
to the ED, suffered multiple trauma injuries, underwent major surgery
in previous 30 days before ED arrival or had preexisting do-not-
resuscitate orders were excluded. A sample size of 1267 subjects was
calculated after achieving 80% power to detect a difference of \textasciitilde 0.130
between two diagnostic tests whose sensitivities are 0.550 and 0.680.
This procedure used a two-sided McNemar test with a signifi-
cance level of 0.05. The prevalence of disease in the population is 0.090. The
proportion of discordant pairs is 0.230. Eligible patients were be-
identified by daily review of ED census sheets and data collection was
performed by trained research assistants. We recorded the date of visit,
demographic data, vital sign parameters, severity of sepsis, diagnosis and
focus of infection, comorbidity, lactate results, items of the qSOFA
and SOFA score. The diagnosis of severe sepsis and septic shock was
made by the treating ED physician when the patient was seen in the ED.
Investigators calculated the qSOFA and the SOFA score of patients on

| Variables | Severe sepsis n = 421 (53.9%) | Septic Shock n = 339 (46.1%) |
|-----------|-------------------------------|-----------------------------|
| Socio-demographics: | | |
| Age (Mean ± SD in years) | 59.6 ± 17.2 | 60.2 ± 17.9 |
| Gender [N[%]] | | |
| Male | 242 (57.5) | 196 (57.7) |
| Female | 179 (42.4) | 143 (42.2) |
| Comorbidities: | | |
| Malignancy [N[%]] | | |
| No | 386 (91.7) | 296 (87.4) |
| Yes | 35 (8.2) | 43 (12.6) |
| Cardiovascular [N[%]] | | |
| No | 202 (48.7) | 173 (51.1) |
| Yes | 219 (51.2) | 166 (48.9) |
| Diabetes [N[%]] | | |
| No | 185 (44.0) | 172 (50.7) |
| Yes | 236 (56.0) | 167 (49.2) |
| Neurological [N[%]] | | |
| No | 366 (87.0) | 298 (88) |
| Yes | 55 (12.2) | 41 (12.0) |
| Congestive heart failure [N[%]] | | |
| No | 17 (3.9) | 404 (11.6) |
| Yes | 404 (96.1) | 391 (88.4) |
| Psychiatric illness [N[%]] | | |
| No | 367 (99.5) | 337 (99.4) |
| Yes | 2 (0.5) | 2 (0.6) |
| Others comorbidities [N[%]] | | |
| No | 396 (94) | 292 (86) |
| Yes | 25 (5.9) | 47 (13.8) |
| Lower Respiratory tract infection [N [%]] | | |
| No | 234 (56) | 128 (37.7) |
| Yes | 187 (44) | 211 (62.2) |
| Urinary tract infection [N[%]] | | |
| No | 158 (77.0) | 271 (80.0) |
| Yes | 47 (22.9) | 68 (20.0) |
| Gastrointestinal infection [N] | | |
| No | 320 (76.1) | 283 (83.4) |
| Yes | 101 (23.9) | 56 (16.5) |
| Skin/Joint infection [N[%]] | | |
| No | 365 (86.9) | 315 (91.1) |
| Yes | 56 (13.1) | 24 (7.0) |
| Hepatobiliary infection [N[%]] | | |
| No | 412 (97.9) | 329 (97.1) |
| Yes | 9 (2.11) | 10 (2.86) |
| Other sources [N[%]] | | |
| No | 382 (90.7) | 325 (95.8) |
| Yes | 39 (9.27) | 14 (4.0) |
| Unit of admission [N[%]] | | |
| Special care unit | 370 (88.8) | 136 (40.5) |
| Intensive care unit | 51 (12.1) | 203 (60.0) |
| SOFA parameters: | | |
| Lactate (Mean ± SD in mmol/L) | 2.9 ± 2.79 | 4.2 ± 3.7 |
| PaO2/FIO2 ratio in mmHg [N[%]] | | |
| 0 | 49 (11.6) | 20 (5.8) |
| < 400 = +1 | 215 (51.0) | 114 (33.6) |
| < 300 = +2 | 104 (24.7) | 84 (24.7) |
| < 200 = +3 | 49 (11.6) | 90 (26.6) |
| < 100 & mechanically ventilated = +4 | 4 (0.95) | 31 (9.2) |
| Platelet (< 10^12/\textmu L)[N[%]] | | |
| 0 | 310 (73.6) | 190 (56.0) |
| < 150 = +1 | 55 (13.0) | 81 (24.0) |
| < 100 = +2 | 33 (7.8) | 31 (9.1) |
| = +3 | 18 (4.39) | 27 (8.0) |
| = +4 | 5 (1.18) | 10 (2.9) |
| GCS[N[%]] | | |
| 0 | 111 (26.3) | 42 (12.3) |
| +1 | 238 (56.5) | 193 (57.1) |
| +2 | 47 (11.2) | 66 (19.4) |
| +3 | 20 (4.8) | 29 (8.5) |
| +4 | 4 (0.98) | 9 (2.8) |
| Total bilirubin in mg/dL [N] | | |
| 0 | 304 (72.2) | 201 (59.4) |
| 1.2-1.9 = +1 | 55 (13.0) | 66 (19.4) |
| 2.5-9.9 = +2 | 31 (7.3) | 42 (12.5) |

(continued on next page)
arrival in ED. The patients were subsequently followed for their in hospital stay for all-cause mortality. Collected data was analyzed in SPSS version 19. Descriptive data was reported as mean and median for quantitative and proportions for qualitative data. The qSOFA, SOFA score in septic ED patients from a low to middle income country applied and has adequate discriminative ability indicating its clinical applicability.

### Table 1 (continued)

| Variables                                      | Severe sepsis n = 421 (53.9%) | Septic Shock n = 339 (46.1%) |
|------------------------------------------------|-------------------------------|-------------------------------|
| 6–11.9 = +3                                    | 18 (4.2)                      | 12 (3.5)                      |
| > 12 = + 4                                     | 13 (3.0)                      | 18 (5.3)                      |
| **MAP or administration of vasopressin mics/kg/min [N%]** |                               |                               |
| No hypotension = 0                             | 170 (40.4)                    | 33 (9.7)                      |
| MAP < 70 mmHg = +1                            | 127 (30.2)                    | 58 (17.1)                     |
| Dopamine ≤ 5 or dobutamine (any dose) = +2    | 16 (3.9)                      | 7 (2.2)                       |
| Dopamine > 5 OR epinephrine ≤ 0.1 OR norepinephrine ≤ 0.1 = +3 | 99 (23.5)                    | 163 (48)                      |
| Dopamine > 15 OR epinephrine > 0.1 OR norepinephrine > 0.1 = +4 | 9 (1.9)                      | 78 (22)                       |
| **Creatinine in mg/dl [N%]**                   |                               |                               |
| < 1.2 = 0                                      | 100 (23.9)                    | 66 (19.4)                     |
| 1.2–1.9 = +1                                   | 85 (20.9)                     | 81 (24.0)                     |
| 2.0–3.4 = +2                                   | 57 (29.2)                     | 101 (29.7)                    |
| 3.5–4.9 = +3                                   | 124 (12.2)                    | 46 (13.7)                     |
| > 5.0 = + 4                                    | 55 (13.6)                     | 45 (13.1)                     |
| **SOFA score [N%]**                            |                               |                               |
| 0 to 6 = < 10% mortality                       | 240 (57.0)                    | 70 (20.5)                     |
| 7 to 9 = 15–20% mortality                     | 125 (29.7)                    | 130 (38.2)                    |
| 10 to 12 = 40–50% mortality                   | 46 (10.7)                     | 83 (24.5)                     |
| 13 to 14 = 50–60% mortality                   | 6 (1.46)                      | 34 (10.2)                     |
| > 15 = > 80% mortality                         | 2 (0.5)                       | 2 (0.57)                      |
| 15 to 24 = > 90% mortality                    | 2 (0.5)                       | 20 (5.7)                      |

4. Discussion

Our study evaluated and compared performance of the qSOFA score and SOFA in septic ED patients from a low to middle income country with a high reported severity of illness and mortality than quoted locally as well as those from high income nations. The utility of qSOFA has been established in numerous instances within and outside the intensive care unit setting. Through our comparison, we have found that the qSOFA score appears well calibrated and has adequate discriminative ability indicating its clinical applicability.

In patients with severe sepsis, the AUROC cutoff of qSOFA for predicting mortality in subjects was 0.92 (95% CI; 0.89–0.94) with 96% sensitivity and 87% specificity in comparison to the AUROC cutoff of SOFA score which was 0.63 (95% CI; 0.55–0.70) with 71% sensitivity and 57% specificity (Fig. 1). In patients with septic shock, the AUROC cutoff of qSOFA for predicting mortality in subjects was 0.89 (95% CI; 0.85–0.92) with 92% sensitivity and 85% specificity in comparison to the AUROC cutoff of SOFA score which was 0.63 (95% CI; 0.55–0.70) with 70% sensitivity and 59% specificity (Fig. 2).

The results confirm that the model for qSOFA appears well-calibrated and has adequate discriminative ability indicating its clinical applicability.

![Fig. 1. QSOFA score in severe sepsis AUROC = 0.92 with 95% CI; 0.89–0.94, sensitivity = 96% and specificity = 87%. And SOFA score in severe sepsis AUROC = 0.63 with 95% CI; 0.55–0.70, Sensitivity = 71%, Specificity = 57%.

In patients with severe sepsis, the AUROC cutoff of qSOFA for predicting mortality in subjects was 0.92 (95% CI; 0.89–0.94) with 96% sensitivity and 87% specificity in comparison to the AUROC cutoff of SOFA score which was 0.63 (95% CI; 0.55–0.70) with 71% sensitivity and 57% specificity (Fig. 1). In patients with septic shock, the AUROC cutoff of qSOFA for predicting mortality in subjects was 0.89 (95% CI; 0.85–0.92) with 92% sensitivity and 85% specificity in comparison to the AUROC cutoff of SOFA score which was 0.63 (95% CI; 0.55–0.70) with 70% sensitivity and 59% specificity (Fig. 2).

The results confirm that the model for qSOFA appears well-calibrated and has adequate discriminative ability indicating its clinical applicability.

4. Discussion

Our study evaluated and compared performance of the qSOFA score and SOFA in septic ED patients from a low to middle income country with a high reported severity of illness and mortality than quoted locally as well as those from high income nations. The utility of qSOFA has been established in numerous instances within and outside the intensive care unit setting. Through our comparison, we have found that the qSOFA score appears well calibrated and has adequate discriminative ability indicating its clinical applicability.

![Fig. 2. QSOFA score in severe sepsis AUROC = 0.92 with 95% CI; 0.89–0.94, sensitivity = 96% and specificity = 87%. And SOFA score in severe sepsis AUROC = 0.63 with 95% CI; 0.55–0.70, Sensitivity = 71%, Specificity = 57%.]
study, we established that qSOFA was reported high (> 1 parameters which are Altered mentation, Systolic Blood Pressure and Respiratory rate) in accordance with the severity of sepsis with cumulative values of 56.5% in severe sepsis and 84.6% in septic shock patients. This is in contrast to prior literature, examples include one study that validated the qSOFA outside the ICU setting concluded with a low sensitivity identified in septic patients in pre-hospital setting.\textsuperscript{23}Churpek et al. found that only 9% of the 30,667 patients admitted to an ED or a ward with defined infection suspicion had a qSOFA $\geq 2$ at time of suspicion of infection$^2$ and the qSOFA only had 29.9% sensitivity for detecting organ dysfunction according to the sepsis-3 definition in an Australian ED.\textsuperscript{20}

Although, it has been reported previously that the discriminative ability of qSOFA is better than SIRS (qSOFA AUROC of 0.81 compared to SIRS AUROC of 0.76),\textsuperscript{24} a recent retrospective study conducted in multicenter ICUs showed that the predictive ability for determining the mortality of the qSOFA score is inferior to SOFA score with AUROC of 0.75 and 0.60 respectively.\textsuperscript{27} We were able to demonstrate that qSOFA score has better discriminative ability than SOFA score in assessing mortality in our ED septic patients. In patients with severe sepsis, the AUROC for predicting mortality was higher for qSOFA score (AUROC cutoff = 0.92 with 95% CI; 0.89–0.94, sensitivity = 96% and specificity = 87%) when compared to SOFA score (AUROC cutoff = 0.63 with 95% CI; 0.55–0.70, Sensitivity = 71%, Specificity = 57%). Similarly, in patients with septic shock, the AUROC for predicting mortality was greater for qSOFA score (AUROC cutoff = 0.89 with 95% CI; 0.85–0.92, sensitivity = 92% and specificity = 85%) when compared to SOFA score (AUROC cutoff = 0.63 with 95% CI; 0.55–0.70, Sensitivity = 70%, Specificity = 59%).

4.1 Limitations

Prospective larger multicenter studies in LMIC settings are needed to validate our results. We were not able to achieve our desired sample size therefore further studies are required. Secondly, our study included more critically-ill septic patients therefore our results may be limited in the application to all septic patients in EDs. The consequences of high predictive performance of qSOFA than SOFA are useful in our setting as this tool allows for rapid bedside analysis with indication for immediate therapy. However, we believe that there is a significant delay in our septic patients for receiving appropriate medical attention and it may be because of this lead time bias that we may be dealing with a sicker cohort of patients that demonstrated higher scoring values.

5. Conclusion

From our study, qSOFA score appears to be an effective tool at predicting in hospital mortality in comparison to SOFA score when applied to severe sepsis and septic shock patients in the setting of a tertiary care hospital ED of a low-middle income country. However, it is still necessary to rigorously evaluate its applicability in settings outside the ICU environment before concluding its utility beyond what it was designed for.

Fundings

N/A.

Acknowledgement

N/A.

References

1. Russell JA, Walley KR, Singer J, et al. Vasopressin versus norepinephrine infusion in patients with septic shock. N Engl J Med. 2008 Feb 28;358(9):877–887.
2. Sprung CL, Annane D, Keh D, et al. Hydrocortisone therapy for patients with septic shock. N Engl J Med. 2008;358:111–124.
3. Khan NU, Razzak JA, Alam SM, et al. Emergency department deaths despite active management: experience from a tertiary care centre in a low-income country. Emerg Med Australasia (EMA). 2007;19:213–217.
4. Vincent JL, Abraham E, Annane D, et al. Reducing mortality in septic new directions. Crit Care. 2002;6(Suppl 3):S1–S8.
5. Rivers EP, Coba V, Whitmil M. Early goal-directed therapy in severe sepsis and septic shock: a contemporary review of the literature. Curr Opin Anaesthesiol. 2008 Apr;21(2):128–140.
6. Bone RC, Balk RA, Cerra FB, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest. 1992;101:1644–1655.
7. Zimmerman JE, Kramer AA, McNair DS, et al. Acute Physiology and Chronic Health Evaluation (APACHE) IV: hospital mortality assessment for today’s critically ill patients. Crit Care Med. 2006;34:1297–1310.
8. Metnitz P, Almeida E, et al. SAPS 3—from evaluation of the patient to the evaluation of the intensive care unit. Part 1: objectives, methods, and cohort description. Intensive Care Med. 2005;31:1336–1344.
9. Le Gall JR, Klar J, Lemeshow S, et al. The Logistic Organ Dysfunction system. A new way to assess organ dysfunction in the intensive care unit. ICU Scoring Group. J Am Med Assoc. 1996;276:802–810.
10. Higgins TL, Teres D, Copes WS, et al. Assessing contemporary intensive care unit outcome: an updated Mortality Probability Admission Model (MPM-III). Crit Care Med. 2007;35:827–835.
11. Jones AE, Fitch MT, Kline JA. Operational performance of validated physiologic scoring systems for predicting in-hospital mortality among critically ill emergency department patients. Crit Care Med. 2005;33:974–987.
12. Shapiro NI, Wolfe RE, Moore RB, et al. Mortality in Emergency Department Sepsis (MEDS) score: a prospectively derived and validated clinical prediction rule. Crit Care Med. 2003;31:670–679.
13. Sankoff JD, Goyal M, Gaiski DF, et al. Validation of the Mortality in Emergency Department Sepsis (MEDS) score in patients with the systemic inflammatory response syndrome (SIRS). Crit Care Med. 2008;36:421–426.
14. Jones AE, Saak K, Kline JA. Performance of the mortality in ED sepsis score for predicting hospital mortality among patients with severe sepsis and septic shock. Am J Emerg Med. 2008;26:689–692.
15. Shapiro N, Howell MD, Bates DW, et al. The association of sepsis syndrome and organ dysfunction with mortality in emergency department patients with suspected infection. Ann Emerg Med. 2006;48:583–590.
16. Vincent JL, Moreno R, Takala J, et al. The SOFA (Sepsis-related organ failure assessment) score to describe organ dysfunction/failure. On behalf of the working group on sepsis-related problems of the European society of intensive care medicine. Intensive Care Med. 1996;22:707–710.
17. Singer M, Deutschman CS, Seymour CW, et al. The third international consensus definitions for sepsis and septic shock (Sepsis-3). J Am Med Assoc. 2016 Feb 23;315(8):801–810.
18. Seymour CW, Liu VX, Iwashyna TJ, et al. Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (Sepsis-3). J Am Med Assoc. 2016;315(8):762–774.
19. Seymour CW, Cooper Smith CM, Deutschman CS, et al. Application of a framework to assess the usefulness of alternative sepsis criteria. Crit Care Med. 2016 Mar;44(3):e122–e130.
20. Antonelli M, Delbacker D, Dorman T, et al. Surviving Sepsis Campaign Responds to Sepsis-3. Surviving sepsis Campaign; 2016 Website. Available at: http://www.survivingsepsis.org/SiteCollectionDocuments/SSC-Statements-Sepsis-Definitions-3-2016.pdf.
21. Dellinger RP, Levy MM, Rhodes A, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock, 2012. Intensive Care Med. 2013 Feb;39(2):165–228.
22. Ulfat AR, Hussain A, Ali I, et al. A prospective observational study assessing the outcome of Septis in intensive care unit of a tertiary care hospital, Peshawar. Pak J Med Sci. 2016;32(3):688–693.
23. Adhikari NKJ, Rubenfeld GD. qSOFA score for patients with sepsis in low- and middle-income countries. J Am Med Assoc. 2016 Jan 5;315(21):2175–2177.
24. Dorsett M, Kroll M, Smith CS, et al. qSOFA has poor sensitivity for prehospital identification of severe sepsis and septic shock. Prehosp Emerg Care. 2017;1–9.
25. Churpek MM, Snyder A, Han X, et al. qSOFA, SIRS, and early warning scores for detecting clinical deterioration in infected patients outside the ICU. Am J Respir Crit Care Med. 2016;195(7):906–911.
26. Williams JM, Greenslade JH, McKenzie JV, et al. SIRS, qSOFA and organ dysfunction: insights from a prospective database of emergency department patients with infection. Chest. 2017;151(3):586–596.
27. Raith EP, Udy AA, Bailey M, et al. Prognostic accuracy of the SOFA score, SIRS criteria, and qSOFA score for in-hospital mortality among adults with suspected infection admitted to the intensive care unit. J Am Med Assoc. 2017;317:290–300.