



## New Tool for Severe Sepsis, Septic Shock Diagnosis



A new study, published in *BMC Medical Informatics and Decision Making*, aimed to determine the diagnostic accuracy of an electronic alert system in detecting severe sepsis or septic shock in ED patients. The study was carried out at a tertiary academic medical centre in Saudi Arabia. The results showed high specificity and sensitivity and negative predictive values of the alert system.

Severe sepsis and septic shock are responsible for significant morbidity and mortality. In the United States, sepsis mortality reportedly occurs in 65.5 per 100,000 persons. Notably, the incidence of sepsis has dramatically increased in recent years, with the sepsis rate per 10,000 admissions doubling between 2000 and 2008. Moreover, in-hospital deaths are reported to be eight times greater for patients hospitalised for sepsis compared to those hospitalised with other diagnoses (17 percent and 2 percent, respectively).

Compliance with evidence-based guidelines for severe sepsis and septic shock management has been shown to be low, which has been attributed to factors such as delayed recognition. Thus, a number of international campaigns (e.g., Surviving Sepsis Campaign and World Sepsis Day) have been launched to raise awareness, improve the care of patients with severe sepsis and septic shock, and emphasise early identification and intervention, which have been shown to reduce mortality.

Early recognition of severe sepsis and septic shock is challenging. The complexity of the sepsis presentation makes it significantly more challenging to identify patients compared to many other time-critical conditions that are treated in the emergency department (ED), such as ST-segment elevation myocardial infarction or acute ischaemic stroke. Another challenge is ED crowding, which has been linked to the decreased likelihood of adherence to guideline-concordant care.

Sepsis is a prime example of a disease in which a screening tool could significantly impact ED management. To be effective, a screening tool must cause little or no patient morbidity, be affordable and easily available, identify the conditions for which treatment exists, and be more effective when applied early in the disease course. This study, published in *BMC Medical Informatics and Decision Making*, aimed to determine the diagnostic accuracy of an electronic alert system in detecting severe sepsis or septic shock in ED patients.

### Materials and Methods

An electronic sepsis alert system was developed as a part of a quality-improvement project at a Joint Commission International-accredited tertiary care academic medical centre. The system screened all ED patients older than 14 years for a combination of systemic inflammatory response syndrome and organ dysfunction criteria (hypotension, hypoxaemia or lactic acidosis).

The screening tool works as follows:

1. The tool automatically scans certain clinical and laboratory parameters, as well as the physician orders for fluid bolus or oxygen therapy.
2. If certain conditions are met (Sepsis-screening tool alert parameters), the system generates a “severe sepsis and septic shock” alert, and the test is considered to be positive.
3. This alert goes to the “nurse work list”.
4. If the criteria are not met, the test is considered to be negative.
5. The nurse responds to the alert and notifies a physician using a paging system, as instructed in the alert message.
6. To avoid multiple activations on the same patient, the alert is deactivated as follows:
  - i. For 48 hours if the patient has suspected severe sepsis and septic shock,
  - ii. For 24 hours if the patient does not have severe sepsis or septic shock, and
  - iii. Indefinitely if the code status precludes intensive care management of sepsis.
7. Alerts do not occur during deactivation time.

The study was performed over a four-month period from 1 October 2012 to 31 January 2013. As a comparator, emergency medicine physicians or the critical care physician identified the patients with severe sepsis or septic shock.

In the ED, vital signs were manually entered into the hospital electronic health record (EHR) every hour in the critical care area and every two hours in other areas. The authors also calculated the time from the alert to the intensive care unit (ICU) referral and values were expressed as medians and quartiles. For patients who were referred to ICU, the authors collected additional demographic and clinical data.

## Results and Discussion

Of the 49,838 patients who presented to the ED, 222 (0.4 percent) were identified to have severe sepsis or septic shock. The electronic sepsis alert had a sensitivity of 93.18 percent (95% CI, 88.78% - 96.00%), specificity of 98.44 percent (95% CI, 98.33% – 98.55%), positive predictive value of 20.98 percent (95% CI, 18.50% – 23.70%) and negative predictive value of 99.97 percent (95% CI, 99.95% – 99.98%) for severe sepsis and septic shock. The alert preceded ICU referral by a median of 4.02 hours (Q1 - Q3: 1.25–8.55).

The electronic sepsis alert had high sensitivity and specificity and negative predictive value. The low positive predictive value probably resulted from the detection criteria used in the alert system, which did not include clinical information, such as presenting symptoms or confirmatory laboratory tests. Notably, in this study, the electronic sepsis alert tool preceded ICU referral for severe sepsis or septic shock. This finding is important and would facilitate time-sensitive sepsis management and early sepsis care beginning in the ED.

The main difference between this study and previous studies is the criteria for activating the alert system. In this study, the authors used a combination of clinical and laboratory parameters and a physician order of fluid or oxygen therapy. The low prevalence found in this study was because the alert system screened all patients who presented to the ED, not only the high-risk patients or those who presented to the ED with infection.

One of the limitations of this study is that it was conducted at a single academic medical centre. EHR systems vary widely amongst institutions, therefore it is not possible for the authors to comment specifically on the ease with which their sepsis recognition strategy might be used in other institutions. -

## Conclusions

The high specificity and sensitivity and negative predictive values of the alert system are promising. An electronic alert preceding ICU referral could lead to earlier sepsis management and minimise delays in recognising sepsis.

Image Credit: CMAJ

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