

## QATAR CRITICAL CARE CONFERENCE ABSTRACT

# The use of screening tools in the early recognition of sepsis in the prehospital adult patient: a review of the literature

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### ABSTRACT

**Background:** Sepsis has been identified as a time critical and life-threatening condition resulting from the body's own systemic response to infection leading to multi-organ dysfunction and failure, and remains a major frontrunner in the morbidity and mortality of critically ill patients<sup>1-3</sup>. The 2016 Surviving Sepsis Campaign<sup>1</sup> identified that similar to patients with polytrauma, stroke and acute myocardial infarction, the early identification and timeous delivery of appropriate treatment for patients with sepsis could improve patient outcomes and decrease mortality rates<sup>1,4</sup>. Prehospital sepsis screening tools could provide a systematic approach to critically ill patients in order to identify those patients with a high index of suspicion for sepsis and allow for early and aggressive management.

**Methods:** A literature review was conducted for the period January 2011 to September 2017. A database search was conducted via the electronic databases Ovid MEDLINE (without revisions), CINAHL and The Cochrane Library. The websites ScienceDirect, Wiley Online Library, British Medical Journal (BMJ) and Google Scholar were also used in the search for literature. Full search strategies

are detailed in Table 1. The selection and rejection of all articles can be reviewed in Figure 1.

Results: All articles identified for full review (n = 13) were between the period January 2011 and September 2017. The three most common methodologies identified were

systematic review (n = 3), prospective cohort study (n = 3) and prospective observational study (n = 3). Other methodologies included literature review (n = 1), retrospective cohort study (n = 1), retrospective analysis (n = 1), and retrospective cross-sectional study (n = 1).

**Table 1. Literature search strategy.**

Keywords/Terms:	<ul style="list-style-type: none"> <li>- Prehospital sepsis</li> <li>- Prehospital screening tools for sepsis</li> <li>- Early recognition of sepsis out of hospital</li> <li>- Prehospital early recognition of sepsis</li> <li>- Non-hospital setting and early recognition of sepsis</li> <li>- Surviving sepsis campaign</li> <li>- Emergency medical services and sepsis</li> <li>- Use of sepsis screening tools in prehospital care</li> <li>- Combinations and truncated variations of keywords/terms were used</li> <li>- Relevant wildcards were used to account for singular and plural forms of each search term</li> <li>- Variations in spelling were additionally used in varying combinations to broaden the search</li> </ul>
Inclusions: (Search Limits)	<ul style="list-style-type: none"> <li>- Dates between 2011 to present are deemed contemporaneous</li> <li>- English language</li> <li>- Articles relating to humans</li> <li>- Adult patients (&gt; 14 years)</li> </ul>
Exclusions:	<ul style="list-style-type: none"> <li>- Paediatric patients (&lt; 14 years)</li> <li>- Literature dated before 2011</li> <li>- Articles not directly related to the use of screening tools and early recognition of sepsis in prehospital environment</li> <li>- Studies conducted on animals</li> </ul>
Search Results/ Screening	<ul style="list-style-type: none"> <li>- Ovid Medline = 25 results, 0 included</li> <li>- Cochrane Library = 6 results, 1 included</li> <li>- CINAHL = 16 results, 10 included</li> <li>- ScienceDirect = 838 results, 5 included</li> <li>- Wiley Online Library = 304 results, 1 included</li> <li>- Google Scholar = the first 100 hits were scanned for inclusion, 37 included</li> <li>- BMJ = 211 results, 3 included</li> <li>- 57 findings initially selected</li> <li>- 44 descriptive/supportive findings or guidelines</li> <li>- 13 studies to be included for critical analysis</li> </ul>
Additional Evidence	<ul style="list-style-type: none"> <li>- References from the selected articles were reviewed and backward chaining used to identify any additional relevant evidence.</li> <li>- 1 article selected</li> </ul>

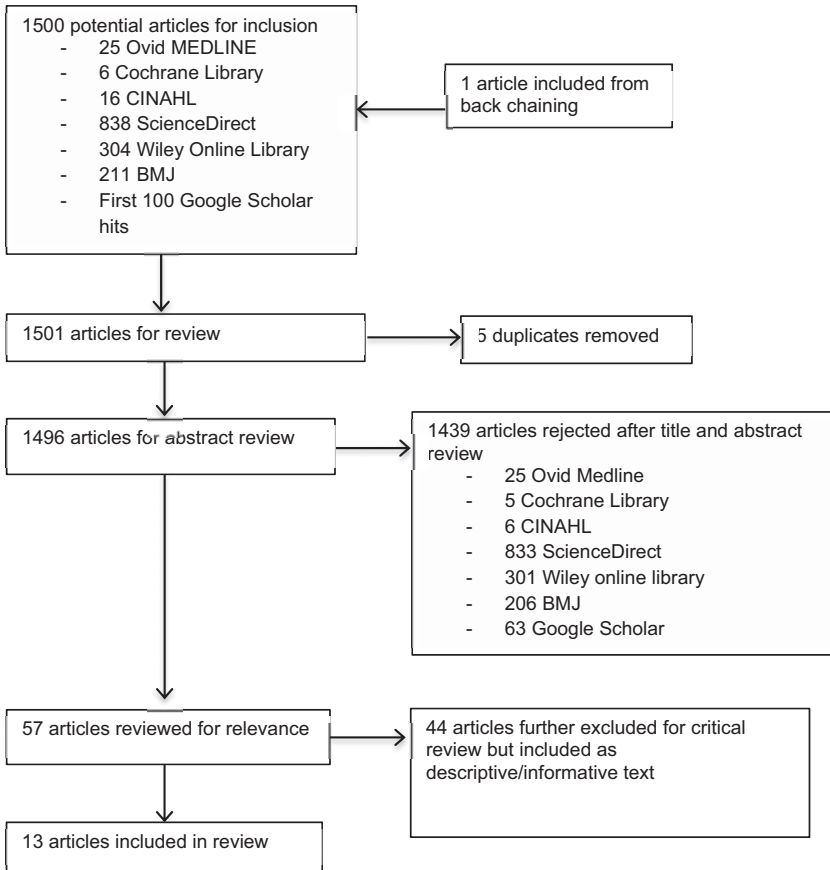


Figure 1. Selection of articles for review.

Through literature analysis, three main areas of interest were identified in which articles were reviewed: the early recognition of sepsis by Emergency Medical Services (EMS) staff (n = 2), the early recognition of sepsis using a prehospital sepsis screening tool by EMS (n = 6), and the impact of EMS sepsis recognition and management on patient outcomes (n = 4). A comparison summary of the various sepsis screening tools can be viewed in Table 2.

Conclusion: Previous literature has described EMS transport rates of approximately 3.3

sepsis patients per 100 and approximately 40% of septic patients admitted having been transported by EMS<sup>5</sup>. Despite this relatively high prevalence, the review identified that recognition of sepsis by EMS personnel was poor. The use of various sepsis screening tools showed improved recognition by EMS but validation studies on the accuracy of these tools is required. In patients in whom a screening tool was used and early pre-notification given to receiving facilities, a decrease time to definitive management of these patients was identified. These varied findings in outcomes of septic patients

Table 2. Comparison summary of the various screening tools.

Author	Journal	Sepsis Tool	Sensitivity	Specificity	PPV	NPV	Accuracy	Sepsis diagnosis	Severe sepsis diagnosis	Other findings
Hunter et al. [6]	American Journal of Emergency Medicine. 2016; 34: 813-819	Sepsis alert protocol (using ETCO <sub>2</sub> )	-	-	-	-	-	78% vs. 43%, p < 0.001	47% vs. 7%, p < 0.001	-
Guerra et al. [7]	The Journal of Emergency Medicine. 2013; 44(6): 1116-1125	Sepsis screening protocol (using lactate measures)	-	-	-	-	-	47.8%	-	Decreased need for intubation (8 vs. 35%) Decreased time to antibiotics (72.6 vs. 98.5 minutes) Shorter in-hospital stay (7.3 vs. 8.4 days)
Polto et al. [8]	American Journal of Emergency Medicine. 2015; 33: 1119-1125	PRESS score	86%	47%	19%	96%	-	-	-	-
Green et al. [9]	Emergency Medicine International. 2016:1-5	Paper based screening tool	73.2%	78.8%	30.6%	95.9%	78.2%	-	-	-
Bayer et al. [10]	Academy of Emergency Medicine. 2015; 22(7):868-871	PRESEP ≥ 4 MEWS ≥ 4 Robson BAS 90-60-90	85% 74% 95% 62%	86% 75% 43% 83%	63% 41% 32% 51%	95% 91% 97% 89%	-	-	-	-
Wailgren et al. [11]	European Journal of Emergency Medicine. 2014; 21(4):260-265	Sepsis: EMS judgement Modified Robson tool BAS 90-60-90 Severe sepsis: EMS judgement Modified Robson tool BAS 90-60-90	75% 43.4%	-	-	-	-	11.9%	16.8%	-

transported by EMS identifies the need for further studies on EMS recognition of sepsis and the impact it has on the outcomes of these patients. A specific prehospital sepsis screening tool could possibly assist in the early recognition of sepsis. Pre-notification to receiving facilities could allow the facility to prepare for EMS arrival and continue aggressive early goal directed therapy (EGDT) as required.

The author acknowledges the possibility of publication and selection bias within this review due to single author selection and only English studies being included.

Keywords: prehospital, sepsis, screening tools, diagnosis

### Authorship

All listed authors meet International Committee of Medical Journal Editor's specific requirements regarding the duties and responsibilities of authorship.

All listed authors contributed towards the final manuscript. No professional writer assistance or other individuals were paid to

provide manuscript support. All authors have approved final submission of the manuscript. No individual other than the listed authors had control over the data, how the data were analyzed or interpreted, or over the wording or conclusions used by the authors in the manuscript.

### Conflicts of interest

There are no conflicts of interest for any of the authors, as outlined by the ICMJE guidelines. None of the authors or their institutions have received grants, consulting fees or honoraria, support for meeting travel, fees for participation in review activities, payment for writing or reviewing the manuscript, and/or provision of writing assistance, medicines, equipment, or administrative support for this research.

None of the listed authors have had financial relationships in the past 36 months with entities in the biomedical arena that could be perceived to influence, or that give the appearance of potentially influencing, what has been written in the submitted work.

## REFERENCES

- Rhodes A, Evans LE, Alhazzani W, Levy MM, Antonelli M, Ferrer R, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. *Intensive Care Med.* 2017; (3):304–377.
- Smyth MA, Brace-McDonnell SJ, Perkins GD. Identification of adults with sepsis in the prehospital environment: a systematic review. *BMJ Open.* 2016;6(8):1–10.
- Smyth MA, Brace-McDonnell SJ, Perkins GD. Impact of Prehospital Care on Outcomes in Sepsis: A Systematic Review. *West J Emergency Med.* 2016;17(4):427–437.
- De Backer D, Dorman T. Surviving Sepsis Guidelines: A Continuous Move Toward Better Care of Patients With Sepsis. *JAMA.* 2017;317(8):807–808.
- Seymour CW, Rea TD, Kahn JM, Walkey AJ, Yealy DM, Angus DC. Severe sepsis in pre-hospital emergency care: analysis of incidence, care, and outcome. *Am J Respir Crit Care Med.* 2012;186(12):1264–1271.
- Hunter CL, Silvestri S, Ralls G, Stone A, Walker A, Papa L. A prehospital screening tool utilizing end-tidal carbon dioxide predicts sepsis and severe sepsis. *Am J Emerg Med.* 2016;34(5):813–819.
- Guerra WF, Mayfield TR, Meyers MS, Cloutre AE, Riccio JC. Early detection and treatment of patients with severe sepsis by prehospital personnel. *J Emerg Med.* 2013;44(6):1116–1125.
- Polito CC, Isakov A, Yancey AH II, Wilson DK, Anderson BA, Bloom I. Prehospital recognition

- of severe sepsis: development and validation of a novel EMS screening tool. *Am J Emerg Med.* 2015;33(9):1119–1125.
9. Green RS, Travers AH, Cain E, Campbell SG, Jensen JL, Petrie DA. Paramedic Recognition of Sepsis in the Prehospital Setting: A Prospective Observational Study. *Emerg Med Int.* 2016;2016:6717261.
  10. Bayer O, Schwarzkopf D, Stumme C, Stacke A, Hartog CS, Hohenstein C. An Early Warning Scoring System to Identify Septic Patients in the Prehospital Setting: The PRESEP Score. *Acad Emerg Med.* 2015;22(7):886–871.
  11. Wallgren UM, Castrén M, Svensson AE, Kurland L. Identification of adult septic patients in the prehospital setting: a comparison of two screening tools and clinical judgment. *Eur J Emerg Med.* 2014;21(4):260–265.