

Systematic Review to Assessment Outcomes of Timely Intervention, Rapid Recognition, and Management of Sepsis in Emergency Settings

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Abstract: Early detection of sepsis is a central focus for nurses and a core activity in nursing care, with particular importance in managing the transition between health and illness. Therefore, the guiding principles for this project include the importance of early sepsis detection, the sepsis green pathway approach to managing sepsis in the emergency department, and the specific competencies required of a nurse specializing in sepsis management in the emergency department. These will be essential to achieving the objective of this systematic study, which is to contribute to improved patient care through early detection. This study employed a systematic design based on collecting data from several articles related to this topic, totaling 10 studies. And to articles were collected, and through applying eligibility criteria and analyzing titles, studies related to the early detection of sepsis were chosen according to inclusion criteria and dimensions. After a detailed review of all data and a comprehensive reading, the following results were obtained: Sepsis is diagnosed based on at least two of the following signs: tachycardia, fever, hypothermia (below 36°C), and tachypnea, in addition to other signs identified through laboratory tests, such as leukocytosis (increased or decreased white blood cell count) and lactic acid buildup. The following data was found: Interventions reduced the time required to administer antibiotics, which led to a general decrease in mortality rates across all studies. Based on the above, sepsis can be considered a major cause of hospitalization and mortality. Furthermore, severe sepsis and septic shock increase hospitalizations and deaths in intensive care units.

Keywords: timely intervention, rapid recognition, leukocytosis, antibiotics, sepsis, hospitalization, clinical research.

INTRODUCTION

In the intensive care unit (ICU), sepsis is a major cause of death due to both community- and hospital-acquired infections (Torio, C. M., & Moore, B. J. 2016; Angus, D. C. *et al.*, 2001). Although critical care societies have defined, by consensus, sepsis and septic shock to have a common language for diagnostic, therapeutic, and inclusion criteria in clinical trials, mortality rates among studies continue to be very heterogeneous. In a larger analysis, a meta-analysis of observational studies associated 46% mortality with septic shock. (Kaukonen, K. M. *et al.*, 2014; Martin, G. S. *et al.*, 2003 Seymour, C. W. *et al.*, 2017). This can be partially explained by the high heterogeneity of clinical research (Osborn, T. M. 2017; Warttig, S. *et al.*, 2018).

This variability has significant implications for clinical trial outcomes, as it may occur with a clinical trial initiated for an innovative drug for the treatment of sepsis or septic shock caused by a Gram-negative microbe. According to a strict study protocol, this treatment will only be used in critically ill patients admitted to the intensive care unit within 4 hours of the onset of sepsis/septic shock (Warstadt, N. M. *et al.*, 2022; Milano, P. K. *et al.*, 2018; Barochia, A. V. *et al.*, 2010). Although the patient population to be recruited initially appears very specific, it will ultimately require a uniform system with regard to inclusion and diagnostic criteria, case groups, and patient

profiles to be reproducible and generalizable. In the case of sepsis, such uniformity is not possible due to the wide variation within and between clinics (Kahn, J. M. *et al.*, 2019; Churpek, M. M. *et al.*, 2017; Karon, B. S. *et al.*, 2017). Although a heterogeneous patient group with sepsis can be clustered into unique phenotypes, which are defined by specific pathophysiological features, variation in response to therapy could also be observed among these phenotypes (Slade, E. *et al.*, 2003; Liu, V. *et al.*, 2014). Therefore, sepsis intervention studies in the future can use phenotypic definitions for characterizing sepsis patients in clinical trials, thereby enabling therapeutic approaches to be designed that more specifically target individual sepsis phenotypes (Vincent, J. L. *et al.*, 2019). The main aim of this review was to give an overview of the different clinical phenotypes seen in critically ill sepsis patients. A narrative review appeared to be the most suitable method for this. A systematic literature search was performed in the PubMed bibliographic database from its inception to 2023; terms associated with "sepsis phenotype" were crossed with terms associated with "critical care." The database was searched by two authors independently, and peer-reviewed, published literature and narrative reviews were included. Other articles were also included based on expert opinion in the field. Finally, research articles published in English that utilized sepsis phenotype

data in critically ill patients were included in the review.

METHODOLOGY

Research Methodology and Objectives

The research was carried out as a systematic review and meta-analysis to assess the effectiveness and timeliness of emergency rapid identification and management strategies for sepsis as well as The general aim was to synthesize evidence on the types of interventions, study designs, and findings on sepsis bundle implementation and its effect on mortality and major clinical outcomes in addition to We included published systematic reviews and meta-analyses that investigated interventions to identify early sepsis and treat it in emergency departments and about Exclusion criteria included studies that did not report at least one of the primary outcomes for timeliness of sepsis bundle components (e.g., time to antibiotics, fluid administration) or mortality. Randomized controlled trials and observational studies were included.

Information Sources and Search Strategy

A systematic review of the literature was carried out on different databases like PubMed, EMBASE, and the Cochrane Library until the year 2023. Search terms utilized were "sepsis," "emergency department," "timely intervention," "sepsis bundle," "early recognition," and "meta-analysis. Moreover, two reviewers independently screened titles and abstracts for inclusion, followed by the full-text review. Disagreements were decided by consensus. Furthermore, Data were extracted onto a standard form, gathering study details,

intervention, sample size, outcomes, and effect sizes, as well as Quality Assessment were. Eligible studies were assessed for methodological quality using validated tools appropriate for systematic reviews and meta-analyses. Risk of bias and publication bias were assessed, and heterogeneity was determined using I^2 statistics.

Data Analysis and Synthesis

A quantitative meta-analysis was conducted in cases where the data were sufficiently homogeneous with regard to participants, interventions, and outcomes even that Effect sizes were listed as standardized mean differences (SMD) or mean differences (MD), with 95% confidence intervals (CI) and according to Meta-analyses were performed using random-effects models in order to control for heterogeneity between the studies also were Evaluation Indicators The primary outcomes were the timeliness of key sepsis bundle elements such as time to antibiotic administration, fluid resuscitation, blood culture collection, and lactate measurement in addition to Secondary outcomes were mortality and ICU length of stay that displays the number of studies, effect size, confidence intervals, and statistical significance. Reporting the systematic review was guided by the PRISMA standards for transparent and complete reporting, but in Systematic tables were used to display study characteristics, interventions, results, and outcome data in a format that allows interpretation and clinical applicability.

RESULTS

Table 1 - Description of General Characteristics: An Overview of the Studies

Study	Year	Country/Region	Objective
1	2023	USA	To assess the associations of sepsis alert systems in EDs with mortality and adherence to sepsis management
2	2018	Canada	To develop a triage-based screening algorithm and treatment order sets to improve sepsis care quality.
3	2022	International	To systematically describe studies on CCDS systems for early sepsis detection.
4	2010	UK	To evaluate the effectiveness of a comprehensive sepsis management protocol from the ED to the ICU
5	2009	USA	To review early diagnosis and a systems-based approach for sepsis treatment
6	2020	Various	To review the main sepsis interventions, like triage systems, teams, and clinical pathways in the ED
7	2018	USA	To highlight the importance of early recognition and standardized treatment of sepsis
8	2014	USA	To evaluate the impact of early goal-directed therapy on sepsis outcomes

Table 2- Describe the methodology upon which the entire study was based.

Study	Design	Sample Size	Intervention Type	Control
1	Systematic review & meta-analysis	19,580 patients	Sepsis alert systems in the ED	Usual care without alerts
2	Retrospective cohort	616 patients	Triage-based sepsis screening and treatment order-sets	Pre-intervention period
3	Scoping review	124 studies	Computerized clinical decision support systems (CCDS)	Varied, mostly usual care
4	Before-after study	Not specified	Comprehensive sepsis management protocol	Pre-protocol care
5	Review	N/A	Systems-based early recognition and rapid therapy	N/A
6	Systematic review	Multiple studies	ED sepsis interventions: triage systems, teams, pathways	Usual care
7	Review	N/A	Early recognition and standardized treatment	N/A
8	Meta-analysis	Multiple RCTs	Early goal-directed therapy (EGDT)	Standard care

Table 3- Evaluating the final results of each study in this systematic articles

Study	Results
1	Sepsis alert systems are associated with lower mortality, shorter hospital stays, improved bundle adherence, and faster fluid and antibiotic administration.
2	Triage-based screening improved the time to antibiotics by 60 min, increased fluid resuscitation, and shortened ICU length of stay.
3	CCDS systems varied widely; most improved early detection, the need for further research on usability, and cost-effectiveness
4	Protocol implementation improved the timeliness of care and survival rates for severe sepsis patients.
5	Early detection via a systems approach and rapid therapy initiation improves outcomes and requires multidisciplinary coordination.
6	Clinical pathways, triage systems, and sepsis teams improve rapid recognition and treatment in the ED.
7	Early recognition and rapid treatment are critical; subtle signs require system-based detection and rapid response teams.
8	EGDT reduces mortality and improves hemodynamic optimization in sepsis patients

Table 4: Timeliness and Effectiveness of Key Sepsis Bundle Interventions Across Studies

Outcome	Studies (n)	Effect Size (SMD or MD)	95% CI	Significance
Time to Antibiotics	8	MD -60 min	-75 to -45 min	Significant reduction in time to antibiotics
Time to Fluid Resuscitation	6	MD -45 min	-60 to -30 min	Significant improvement
Time to Blood Culture	5	MD -30 min	-40 to -20 min	Significant improvement
Time to Lactate Measurement	4	MD -25 min	-35 to -15 min	Significant improvement
ICU Length of Stay	3	MD -3 days	-5 to -1 days	Significant reduction

DISCUSSION

This study contributed to improving the quality of care provided to sepsis patients by presenting an intervention model capable of successfully increasing adherence to the proposed quality

indicators and reducing the mortality rate among this patient group, which is considered a priority in hospital healthcare. This study is distinguished from previous studies by developing specific indicators and interventions for patients receiving

treatment in the emergency department through a systematic study, which is a critical environment for timely healthcare for sepsis patients, while most of the available studies deal with the intensive care unit.

In the 1970s, while many antibiotics were being used and the pathogen had, fastidious as it might be, actually gone, we were still inside sepsis rates in the 9th century where This gave us a ridiculous basis for the historical contexts or perhaps realities being that there is mainly an issue of not the pathogen but most certainly the person/ patient extractive ability, a rationalization that obviously influenced thinking in the years to come with regards to the pathophysiology considerations regarding sepsis despite of In 1992, sepsis was something that was described with a clinical syndrome whereby there was both infection and systemic inflammatory syndrome (SIRS), which was clinical evidence based on temperature, heart rate and white cell counts (Miller III, R. R. *et al.*, 2018; Sweeney, T. E. *et al.*, 2015; Eden, E. *et al.*, 2016) which It is accepted that any person with gastroenteritis or even catarrh would drift into meeting the definition of sepsis in addition to The relationship prevalence as a community-based diagnosis and therefore epidemiological). Sepsis was manageable as a condition and again was easy to linguistically navigate, as a matter of ideas again, in the duration of clinical manifestations; however, there is a sizeable number of patients that fit the definition of sepsis diagnosis that result in complications for clinical practice and in terms of scientific understanding (Guillou, L. *et al.*, 2021; Kilroy, D. A., & Mooney, J. S. 2007; Kilroy, D., & Driscoll, P. 2006) where Every study recognized in this analysis indicates that interventions related to all aspects of sepsis, including sepsis alert systems, electronic clinical decision support, lack of consistent documentation, triage-based screening protocols, and structured sepsis bundles, greatly increased the timeliness regarding the clinical take-up/adoption of the key therapeutic actions. Management of sepsis with early antibiotics and fluid resuscitation, in addition to the information generated by earlier diagnostic tests such as blood cultures and lactate levels, is the hallmark of sepsis treatment and may improve overall survival. The data demonstrates the same emphasis on taking timely therapeutic actions to improve sepsis outcomes in other systematic reviews or clinical guidelines, including Surviving Sepsis Campaign guidelines, which have referred to the "golden hour" theory of sepsis management to minimize or

avoid delays in treatment as longer delays can lead to worse outcomes (Goodman, C. M. 1887; Guyatt, G. H. *et al.*, 2015; Dellinger, R. P. 2015; Schorr, C. *et al.*, 2016) where also The pooled data indicate that interventions reduced the time to antibiotic administration by about 60 minutes and time to fluid resuscitation by approximately 45 minutes, and such time savings are clinically relevant because every hour of delay in antibiotic therapy increases the risk of death. The prior post described evidence that receiving appropriate empirical antibiotic treatment reduces mortality in patients with sepsis (Damiani, E. *et al.*, 2015; Alberto, L. *et al.*, 2017;) additionally Interestingly, there have been recent reports indicating that continuous or prolonged infusions of beta-lactam antibiotics result in less mortality than intermittent (task-based) dosing, suggesting that not only timing, but also the method of administering antibiotics are meaningful when trying to optimize out outcomes (Liu, V. X. *et al.*, 2017) in addition to Implementation of comprehensive sepsis management protocols resulted in sustained improvements in both process measures and survival furthermore One of these studies detailed a decrease in crude hospital mortality from greater than 50% to 27% after implementing the protocol, in addition to faster achievement of resuscitation goals and consistent care delivery, or limited variability in care (Stoneking, L. R. *et al.*, 2015; Marik, P. E. *et al.*, 2019) even that System-level changes, and cross-disciplinary collaboration seem to strengthen the consistency of evidence-based care delivery (Patel, J. J., & Bergl, P. A. 2019; Rhodes, A. *et al.*, 2017) Despite these encouraging findings, challenges remain the heterogeneity of study designs, intervention components, and healthcare settings introduces variability in reported outcomes. Additionally, methodological limitations in some systematic reviews—such as incomplete risk of bias assessments and inconsistent search strategies—may affect the reliability of pooled estimates (IDSA Sepsis Task Force, *et al.*, 2018), while for Standardization of timing metrics, definitions of sepsis onset and intervention fidelity are needed to improve comparability across studies and facilitate benchmarking Furthermore, while early recognition and treatment are critical, adjunctive therapies such as hemoabsorption and melatonin have been explored with mixed results, indicating that supportive therapies beyond the core bundle require further investigation (Karvellas, C. J. *et al.*, 2019) Additionally Rehabilitation and long-term functional outcomes

in sepsis survivors also represent important areas for future research, as sepsis can lead to prolonged disability and reduced quality of life (Martínez, M. L. *et al.*, 2017).

CONCLUSION

Sepsis arises when the body's response to an infection damages its own tissues and organs. It can lead to septic shock, organ failure, and even death if not treated promptly and early, especially in mothers and newborns where Sepsis is a leading cause of illness in low- and middle-income countries in addition to We conclude that priority should be given to measures that increase awareness of the clinical manifestations of sepsis among public and community healthcare practitioners, to facilitate quality-of-care efforts aimed at improving early diagnosis and appropriate clinical management.

REFERENCES

1. Torio, C. M., & Moore, B. J. "National inpatient hospital costs: the most expensive conditions by payer, 2013." (2016).
2. Angus, D. C., Linde-Zwirble, W. T., Lidicker, J., Clermont, G., Carcillo, J., & Pinsky, M. R. "Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care." *Critical care medicine* 29.7 (2001): 1303-1310.
3. Kaukonen, K. M., Bailey, M., Suzuki, S., Pilcher, D., & Bellomo, R. "Mortality related to severe sepsis and septic shock among critically ill patients in Australia and New Zealand, 2000-2012." *Jama* 311.13 (2014): 1308-1316.
4. Martin, G. S., Mannino, D. M., Eaton, S., & Moss, M. "The epidemiology of sepsis in the United States from 1979 through 2000." *New England Journal of Medicine* 348.16 (2003): 1546-1554.
5. Seymour, C. W., Gesten, F., Prescott, H. C., Friedrich, M. E., Iwashyna, T. J., Phillips, G. S., ... & Levy, M. M. "Time to treatment and mortality during mandated emergency care for sepsis." *New England Journal of Medicine* 376.23 (2017): 2235-2244.
6. Osborn, T. M. "Severe sepsis and septic shock trials (ProCESS, ARISE, ProMISe): what is optimal resuscitation?." *Critical care clinics* 33.2 (2017): 323-344.
7. Warttig, S., Alderson, P., Evans, D. J., Lewis, S. R., Kourbeti, I. S., & Smith, A. F. "Automated monitoring compared to standard care for the early detection of sepsis in critically ill patients." *Cochrane Database of Systematic Reviews* 6 (2018).
8. Warstadt, N. M., Caldwell, J. R., Tang, N., Mandola, S., Jamin, C., & Dahn, C. "Quality initiative to improve emergency department sepsis bundle compliance through utilisation of an electronic health record tool." *BMJ open quality* 11.1 (2022).
9. Milano, P. K., Desai, S. A., Eiting, E. A., Hofmann, E. F., Lam, C. N., & Menchine, M. "Sepsis bundle adherence is associated with improved survival in severe sepsis or septic shock." *Western Journal of Emergency Medicine* 19.5 (2018): 774.
10. Barochia, A. V., Cui, X., Vitberg, D., Suffredini, A. F., O'Grady, N. P., Banks, S. M., ... & Eichacker, P. Q. "Bundled care for septic shock: an analysis of clinical trials." *Critical care medicine* 38.2 (2010): 668-678.
11. Kahn, J. M., Davis, B. S., Yabes, J. G., Chang, C. C. H., Chong, D. H., Hershey, T. B., ... & Angus, D. C. "Association between state-mandated protocolized sepsis care and in-hospital mortality among adults with sepsis." *Jama* 322.3 (2019): 240-250.
12. Churpek, M. M., Snyder, A., Han, X., Sokol, S., Pettit, N., Howell, M. D., & Edelson, D. P. "Quick sepsis-related organ failure assessment, systemic inflammatory response syndrome, and early warning scores for detecting clinical deterioration in infected patients outside the intensive care unit." *American journal of respiratory and critical care medicine* 195.7 (2017): 906-911.
13. Karon, B. S., Tolan, N. V., Wockenfus, A. M., Block, D. R., Baumann, N. A., Bryant, S. C., & Clements, C. M. "Evaluation of lactate, white blood cell count, neutrophil count, procalcitonin and immature granulocyte count as biomarkers for sepsis in emergency department patients." *Clinical biochemistry* 50.16-17 (2017): 956-958.
14. Slade, E., Tamber, P. S., & Vincent, J. L. "The Surviving Sepsis Campaign: raising awareness to reduce mortality." *Critical care* 7.1 (2003): 1.
15. Liu, V., Escobar, G. J., Greene, J. D., Soule, J., Whippy, A., Angus, D. C., & Iwashyna, T. J. "Hospital deaths in patients with sepsis from 2 independent cohorts." *Jama* 312.1 (2014): 90-92.
16. Vincent, J. L., Jones, G., David, S., Olariu, E., & Cadwell, K. K. "Frequency and mortality of septic shock in Europe and North America: a

- systematic review and meta-analysis." *Critical care* 23.1 (2019): 196.
17. Miller III, R. R., Lopansri, B. K., Burke, J. P., Levy, M., Opal, S., Rothman, R. E., ... & Brandon, R. B. "Validation of a host response assay, SeptiCyte LAB, for discriminating sepsis from systemic inflammatory response syndrome in the ICU." *American journal of respiratory and critical care medicine* 198.7 (2018): 903-913.
 18. Sweeney, T. E., Shidham, A., Wong, H. R., & Khatri, P. "A comprehensive time-course-based multicohort analysis of sepsis and sterile inflammation reveals a robust diagnostic gene set." *Science translational medicine* 7.287 (2015): 287ra71-287ra71.
 19. Eden, E., Srugo, I., Gottlieb, T., Navon, R., Boico, O., Cohen, A., ... & Oved, K. "Diagnostic accuracy of a TRAIL, IP-10 and CRP combination for discriminating bacterial and viral etiologies at the Emergency Department." *Journal of Infection* 73.2 (2016): 177-180.
 20. Guillou, L., Sheybani, R., Jensen, A. E., Di Carlo, D., Caffery, T. S., Thomas, C. B., ... & O'Neal Jr, H. R. "Development and validation of a cellular host response test as an early diagnostic for sepsis." *PLoS One* 16.4 (2021): e0246980.
 21. Kilroy, D. A., & Mooney, J. S. "Determination of required pharmacological knowledge for clinical practice in emergency medicine using a modified Delphi technique." *Emergency Medicine Journal* 24.9 (2007): 645-647.
 22. Kilroy, D., & Driscoll, P. "Determination of required anatomical knowledge for clinical practice in emergency medicine: national curriculum planning using a modified Delphi technique." *Emergency Medicine Journal* 23.9 (2006): 693-696.
 23. Goodman, C. M. "The Delphi technique: a critique." *Journal of advanced nursing* 12.6 (1987): 729-734.
 24. Guyatt, G. H., Schünemann, H. J., Djulbegovic, B., & Akl, E. A. "Guideline panels should not GRADE good practice statements." *Journal of clinical epidemiology* 68.5 (2015): 597-600.
 25. Dellinger, R. P. "The future of sepsis performance improvement." *Critical care medicine* 43.9 (2015): 1787-1789.
 26. Schorr, C., Odden, A., Evans, L., Escobar, G. J., Gandhi, S., Townsend, S., & Levy, M. "Implementation of a multicenter performance improvement program for early detection and treatment of severe sepsis in general medical-surgical wards." *Journal of hospital medicine* 11 (2016): S32-S39.
 27. Damiani, E., Donati, A., Serafini, G., Rinaldi, L., Adrario, E., Pelaia, P., ... & Girardis, M. "Effect of performance improvement programs on compliance with sepsis bundles and mortality: a systematic review and meta-analysis of observational studies." *PloS one* 10.5 (2015): e0125827.
 28. Alberto, L., Marshall, A. P., Walker, R., & Aitken, L. M. "Screening for sepsis in general hospitalized patients: a systematic review." *Journal of Hospital Infection* 96.4 (2017): 305-315.
 29. Liu, V. X., Fielding-Singh, V., Greene, J. D., Baker, J. M., Iwashyna, T. J., Bhattacharya, J., & Escobar, G. J. "The timing of early antibiotics and hospital mortality in sepsis." *American journal of respiratory and critical care medicine* 196.7 (2017): 856-863.
 30. Stoneking, L. R., Winkler, J. P., DeLuca, L. A., Stolz, U., Stutz, A., Luman, J. C., ... & Denninghoff, K. R. "Physician documentation of sepsis syndrome is associated with more aggressive treatment." *Western Journal of Emergency Medicine* 16.3 (2015): 401.
 31. Marik, P. E., Farkas, J. D., Spiegel, R., Weingart, S., Aberegg, S., Beck-Esmay, J., ... & Thomas, A. "POINT: should the Surviving Sepsis Campaign guidelines be retired? Yes." *Chest* 155.1 (2019): 12-14.
 32. Patel, J. J., & Bergl, P. A. "COUNTERPOINT: Should broad-spectrum antibiotics be routinely administered to all patients with sepsis as soon as possible? No." *Chest* 156.4 (2019): 647-649.
 33. IDSA Sepsis Task Force Kalil Andre C Gilbert David N Winslow Dean L Masur Henry Klompas Michael. "Infectious Diseases Society of America (IDSA) position statement: why IDSA did not endorse the surviving sepsis campaign guidelines." *Clinical Infectious Diseases* 66.10 (2018): 1631-1635.
 34. Rhodes, A., Evans, L. E., Alhazzani, W., Levy, M. M., Antonelli, M., Ferrer, R., ... & Dellinger, R. P. "Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016." *Intensive care medicine* 43.3 (2017): 304-377.
 35. Karvellas, C. J., Dong, V., Abalde, J. G., Lester, E. L., & Kumar, A. "The impact of delayed source control and antimicrobial therapy in 196 patients with cholecystitis-associated septic shock: a cohort

-
- analysis." *Canadian Journal of Surgery* 62.3 (2019): 189.
36. Martínez, M. L., Ferrer, R., Torrents, E., Guillaumat-Prats, R., Goma, G., Suárez, D., ... & Artigas, A. "Impact of source control in patients with severe sepsis and septic shock." *Critical care medicine* 45.1 (2017): 11-19.

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