



AN INTERDISCIPLINARY CODE SEPSIS TEAM TO IMPROVE SEPSIS-BUNDLE COMPLIANCE: A QUALITY IMPROVEMENT PROJECT

Authors: Jill M. Delawder, DNP, RN, ACCNS-AG, CCRN-CSC, and Linda Hulton, PhD, RN, Harrisonburg, VA

CE Earn Up to 8.0 Hours. See page 134.

Contribution to Emergency Nursing

- The current literature on sepsis bundles indicate that an interdisciplinary team approach improves compliance in the emergency department.
- This article contributes information on procedures to improve sepsis-bundle compliance and decrease mortality in patients with sepsis presenting to the emergency department.
- Key implications for emergency nursing practice found in this article are that interdisciplinary collaboration, involvement of key stakeholders, and use of available tools can lead to early recognition and improved quality outcomes for patients with sepsis.

Abstract

Problem: Sepsis is one of the leading causes of mortality, with more than 700,000 hospitalizations and 200,000 deaths annually. Various tools exist to aid in the early identification and treatment of sepsis, including electronic alert systems, standardized order sets, nurse-initiated protocols (NIPs) and specially trained teams. Despite available guidelines, mortality rates for severe sepsis and septic shock are near 50%.

Methods: The aims of this rapid cycle quality improvement project were to develop and implement an interdisciplinary

team to address early implementation of sepsis bundles in the emergency department and to compare sepsis bundle compliance 3 months pre- and 3 months postintervention implementation. The population included all patients above 18 years of age presenting to the emergency department with clinical indications of sepsis, severe sepsis, or septic shock. Data were collected via electronic health records (EHRs), switchboard-paging records, and a billing database.

Results: The pre-post intervention analysis shows an improvement in time to each bundle element except antibiotics and completion of blood cultures. There were noteworthy changes in meeting bundle compliance in fluid resuscitation volume ($\chi^2 = 16.3$, $P \leq 0.001$): initial lactate collected within 180 min ($\chi^2 = 11.3$, $P \leq 0.01$) and time to second lactate within 360 min ($\chi^2 = 27.7$, $P \leq 0.001$). Mortality rates showed a steady decline from over 12% to 5%. No differences were found in mortality rates related to age or gender.

Discussion: Interprofessional teams can use existing knowledge, skills, and tools to improve sepsis-bundle compliance and mortality outcomes in patients with sepsis presenting to the emergency department.

Key words: Interdisciplinary; Sepsis alert; Code sepsis; Emergency department

Jill M. Delawder is Clinical Nurse Specialist, Sentara SRMH Medical Center, Harrisonburg, VA.

Linda Hulton is Professor of Nursing, James Madison University, Harrisonburg, VA.

For correspondence, write: Jill M. Delawder, DNP, RN, ACCNS-AG, CCRN-CSC, P.O. Box 455, Timberville, VA 22853; E-mail: JMDelawd@sentara.com.

J Emerg Nurs 2020;46:91-8.

Available online 25 September 2019

0099-1767

Copyright © 2019 Emergency Nurses Association. Published by Elsevier Inc. All rights reserved.

<https://doi.org/10.1016/j.jen.2019.07.001>

Sepsis is defined as suspected or confirmed infection combined with 2 or more systemic inflammatory response syndrome (SIRS) criteria.¹ Severe sepsis is defined as sepsis with organ dysfunction or hypoperfusion and septic shock being the presence of sepsis unresponsive to fluid resuscitation.¹ There continues to be controversy over the definition of sepsis, as medical professionals and professional organizations attempt to identify the best indicators of this infectious and inflammatory process that can be so devastating. As the Centers for Medicare and Medicaid Services (CMS) continue to link reimbursement to sepsis quality metrics, many health care

organizations have leveraged clinicians to address methods that may improve outcomes. To improve compliance with use of the sepsis bundles, many interventions have been suggested to aid clinicians and providers. However, at present, there is no single intervention that has been identified to improve overall bundle compliance.

Problem

Sepsis is 1 of the leading causes of mortality with more than 700,000 hospitalizations and 200,000 deaths annually.² The Society of Critical Care Medicine (SCCM) released guidelines, known as the Surviving Sepsis Campaign (SSC), that include 3- and 6-hour bundles meant to guide early identification and early goal-directed therapy (EGDT) for the sepsis population. Bundle elements include antibiotic and fluid administration, as well as collection of blood cultures and lactate levels. Various tools exist to aid in the early identification and treatment of sepsis including electronic alert systems, standardized order sets, nurse-initiated protocols (NIPs), and specially trained teams. Even with evidence-based guidelines available to guide practice, many organizations continue to struggle with the outcome measure owing to lack of compliance with the bundle elements.³ In addition, despite available guidelines, mortality rates for severe sepsis and septic shock are near 50%.⁴ At present, our organization uses electronic sepsis screening, best-practice alerts (BPAs), NIPs, and standardized order sets. Our organization had the following bundle compliance: blood cultures 90%, correct antibiotic within specified time frame 84%, initial lactate collected 92%, second lactate if initial lactate greater than 2 mmol/L 10%, and adequate crystalloid fluid resuscitation 37%. Based on these initial data, we were meeting bundle requirements 10% of the time with a concurrent mortality of 1 in every 64 patients, or approximately 12.45%.

FRAMEWORK

The Rapid-Cycle Quality Improvement (RCQI) model was used for this project. This model contains 2 parts, the first of which must address 3 key questions: What are we trying to accomplish; is a change actually an improvement; and what change will result in an improvement?⁵

PURPOSE

A review of internal data from the health care system suggested that 90% of septic patients requiring hospitalization present to emergency departments. Early recognition and intervention in the emergency department is essential for early goal-directed therapy and reduction of mortality.

The purposes of this single-site project were to determine if implementation of an interdisciplinary sepsis response team in the emergency department would result in improved bundle compliance, subsequent reduction in mortality, and identification of any demographic differences in age and gender within and between the pre/post groups that would have impact on sepsis-bundle compliance. Another purpose was to answer the following clinical question: What is the effect of implementing a code sepsis team on outcome measures and sepsis-bundle compliance compared with the current standard of care? The current standard of care involved use of an electronic alert system, NIPs, and standardized order sets alone.

Methods

DESIGN AND PATIENT POPULATION

The design is a single-site quality improvement intervention comparing post-intervention patients to historic controls. We conducted a retrospective review of all patients above 18 years of age presenting to the emergency department with clinical indications of sepsis, severe sepsis, or septic shock over 6 months. Patients with hospice orders were excluded. This project was conducted in the 54-bed emergency department of a 238-bed community hospital in a mid-Atlantic state. Our emergency department has an average volume of 75,000 patients annually, with 35 to 38 admissions daily.

INTERVENTION

Phase 1 Team Development

The initial phase of this project began in April 2017, by developing a project team that included key stakeholders. The team was composed of the following members: project lead, quality department director and sepsis data coordinator, ED clinical nurse specialist, ED clinical nurse champion, ED physician champion, intensive care unit (ICU) medical director (sepsis physician lead), ED pharmacist, ED satellite laboratory representative, respiratory therapist

(RT), switchboard manager, clinical process improvement engineer, and administrative sponsor.

Phase 2 Process Development

In the second phase that began in June 2017, the clinical process improvement engineer mapped current ED practice in managing patients presenting with sepsis. Meeting biweekly, the team determined an appropriate process for paging the sepsis-response team upon electronic notification of sepsis to the bedside nurse. The process was outlined in an ED sepsis-alert algorithm. The process incorporated key words to be communicated to switchboard to ensure the alert was translated to appropriate team members, who from the team, and how they would respond to the page. The ED sepsis-alert algorithm was developed to guide when a nurse would initiate a sepsis alert. The nurses in triage and the primary emergency nurse used an existing best practice alert (BPA) to trigger completion of a full sepsis assessment. When completing the full sepsis screen, if the patient had suspected or confirmed infection along with 3 SIRS criteria, 1 being temperature of less than 36°C (96.8°F) or greater than 38.3°C (100.9°F) or white blood cell (WBC) count of less than 4,000 or greater than 12,000, the screen was considered positive, and the nurse would proceed with a sepsis alert. Three SIRS criteria became the trigger for this project because the providers and bedside staff were concerned that 2 SIRS criteria would lead to a high volume of false positive alerts and alarm fatigue. It is important to note that 3 SIRS criteria deviates from the standard set by the SCCM guidelines that require only 2 SIRS criteria. The BPA itself was triggered based on 2 SIRS criteria (respiratory rate [RR] > 20, heart rate [HR] > 90, or temperature <36°C or >38.3°C). To initiate a sepsis alert, the nurse would call the switchboard and use the key words developed by the project team for consistency and clarity. The nurse would state, “sepsis alert ED room 4, patient name or MR number.” The page, sent via a secured firewall network, was sent to the unit coordinator, technician, pharmacist, RT, and sepsis project lead. The unit coordinator would notify the physician in closest proximity or the assigned provider (if the patient had already been assigned). The team would respond and begin a sepsis checklist that outlined bundle elements by 1-, 3-, and 6-hour intervals. The group also worked to use the sepsis order set to ensure proper antibiotic orders, fluid resuscitation, and reflex lactates. The sepsis checklist

then followed the patient to the admitting unit and was used as part of the handoff among staff. Communication also occurred between the nurse and admitting provider to address any remaining bundle elements.

Phase 3 Education

The third phase involved education of all areas involved in the project rollout such as ED staff and physicians, satellite laboratory, main laboratory, pharmacy, RT, ICU nurses, ICU physicians, and switchboard. Education included inservices, quick tip sheets, and electronic communication. An inservice was provided to ED physicians during their monthly medical staff meeting with 95% attendance. The remaining providers were given handouts and verbal communication by the ED medical director. Training was provided to the 3 ED bedside sepsis champions, who then assisted with training via handouts, computer-based education, and didactic sessions during staff meetings and separately offered makeup sessions. The training lasted approximately 1 hour, and after 4 staff meetings and 3 makeup sessions, 100% of staff had completed the training. To ensure that all hospital staff members were aware of the quality improvement project, an article was placed in the “Now You Know,” a weekly electronic newsletter. Cycle 1 of RCQI began with a “mock” sepsis alert drill before implementation to ensure that paging, equipment, and other processes were functioning as intended.

Phase 4 Implementation

Project implementation and RCQI cycle 2 began September 1, 2017. During the initial 2 months of the project, no data were collected, and a RCQI process was used to identify barriers based on team feedback and retrospective data review. The project team met biweekly to review data metrics, process failures, and to develop action items to address barriers prior to collection of postimplementation data. The final 3 months of the project included data collection that was compared with preintervention data to assess success or failure of the project in improving compliance with sepsis-bundle measures.

Phase 5 Evaluation

RCQI processes were used to evaluate code-sepsis team function prior to postintervention data collection. Process failures included issues with paging through switchboard,

incomplete sepsis screening in the emergency department, failure of team to respond to sepsis alert page, failure to use the sepsis order set, and problems with timing for laboratory interpretation.

OUTCOME MEASUREMENTS

The primary outcome was mortality rate in sepsis present on admission. Secondary outcomes were time to 3- and 6-hour sepsis-bundle measures: blood cultures; antibiotics, collection of initial and second lactate, if indicated; and fluid resuscitation. A second lactate was only indicated if the initial lactate was greater than 2 mmol/L, and fluid resuscitation was only indicated if blood pressure was documented as less than 90 mm Hg or if the initial lactate was greater than 4 mmol/L, as per SCCM guidelines. All 3- and 6-hour bundle elements were included in our review except for tissue-perfusion reassessment and use of vasopressors. We wanted to ensure that our focus remained on initial presentation that primarily affected the ED setting. In addition, completion of measures, when indicated, was compared pre- and postintervention. Basic demographic information including age and gender were retrospectively collected from the EHR. A comprehensive chart review was performed including vital signs, laboratory values, blood culture results, and administration of medication. Laboratory values reviewed include WBCs, blood glucose, bilirubin, platelet counts, creatinine, lactate, and international normalized ratio (INR) values. Laboratory values, along with documentation of suspected or confirmed infection, allowed the reviewer to determine time-zero for sepsis presentation. Sepsis-alert paging information was collected through an automated report provided by switchboard. Mortality data were provided by Crimson, a billing and coding database. Crimson is a performance data management platform under the Advisory Board geared to help health care organizations thrive under value-based purchasing. This health care organization is under contract with the Advisory Board and uses the Crimson platform to allow for rapid drill down of individual patient-level data. All mortality data were 30-day risk stratified.

DATA ANALYSIS

Following Institutional Review Board (IRB) approval to ensure ethical aspects of implementing and studying the intervention were met, we began data collection. Data collection included 3 months of baseline data and 3 months of data postproject implementation. A systematic sampling of every third chart to total approximately 35 charts per month was included in the analysis. Only charts that had the required documented

data were included in the study to avoid any missing data. Categorical data were analyzed using χ^2 tests. Continuous data were analyzed using an independent sample Student's *t*-test. A 1-way analysis of variance (ANOVA) was performed using the independent variables of age, gender, and group to determine if the demographic data affected the dependent variables of the sepsis-bundle compliance within and among the groups. Nonparametric tests, Mann-Whitney U tests, and χ^2 tests were used to determine any differences in age or gender in mortality rates. Missing data was excluded from the analyses. For example, if antibiotics, blood cultures, or initial lactate were not completed, the sample did not reflect that participant in the time to sepsis-bundle measure analysis, because there would be no "time" or "minutes" to analyze. Or for fluid resuscitation or second lactate, if indications were not met, that participant was not included in the analysis for completion of sepsis bundle measures or time to sepsis bundle measure.

Results

A total of 214 patients with sepsis present on admission (POA) were included in the analysis. In a review of demographic data, the patient population ranged from 23 to 100 years of age, with a mean age of 70 years. There was also an equal number of male compared with female patients in pre/post data. Note there were differences in the sample size for completion of sepsis bundle measure and time to sepsis bundle measure, dependent upon whether the element occurred or was indicated (Table 1).

BUNDLE-ELEMENT COMPLETION

In Table 1, the χ^2 analysis review of bundle elements was completed for patients meeting criteria. Results suggest that although timing for antibiotics did not improve, antibiotics were provided to more patients who met sepsis criteria. However, a shortage of minibags was identified as a limitation. More information is provided in the limitations section. The number of patients who had initial and second lactate collected also showed considerable improvement ($\chi^2 = 11.5$, $P \leq 0.001$ and $\chi^2 = 27.6$, $P \leq 0.001$, respectively). "Fluid resuscitation volume met" increased from 31% at baseline to 81%.

TIME TO BUNDLE-ELEMENT COMPLETION

Table 2 reviews the sample Student's *t*-test results, which compared the time-to-bundle elements pre- and postintervention. The time to intervention was affected for all but 1 bundle

TABLE 1

 χ^2 analysis of group differences in completion of sepsis-bundle measures pre- and postintervention

Variable	Total Preintervention (n)	Goal met (n)	Goal met: yes (%)	Total Postintervention (n)	Goal met (n)	Goal met: yes (%)	χ^2
Antibiotics 180 min	107	74	69%	107	76	71%	0.09
Fluid resuscitation 180 min	48	42	88%	29	27	93%	7.89 [†]
Fluid resuscitation volume met	45	14	31%	26	21	81%	16.25 [‡]
Initial lactate 180 min	107	83	78%	107	101	94%	11.52 [†]
Blood cultures 180 minutes	107	84	79%	107	84	79%	.00
Second lactate 360 minutes	51	11	22%	52	38	73%	27.69 [‡]

* $P \leq 0.05$ † $P \leq 0.01$ ‡ $P \leq 0.001$

element. The time to antibiotics slightly increased in the post-intervention period, and there was no significant change in time to blood culture collection. A change in provider practice related to blood culture collection in the emergency department was identified as a barrier. This is further discussed under "Limitations." The most frequent missed opportunity preintervention, which was a 22% compliance with completion of the second lactate, had a noteworthy improvement of 179 min or 73% in the postintervention period ($t =$

3.47, $P \leq 0.01$). In a 1-way ANOVA, the demographic variables of age and gender did not affect pre/post data sepsis-bundle compliance. It was, however, related to collection of blood cultures in both pre- and postintervention groups. Table 3 highlights the relationship of age ($F = 3.68$, $P = 0.05$) and gender ($F = 8.32$, $P \leq 0.01$) to the time to blood culture. The younger the patient, the more significant the delay in time to collection of blood cultures. This same analysis revealed a gender bias, suggesting that female patients had

TABLE 2

 t -test analysis of group differences in time to sepsis-bundle measures pre- and postintervention

Variable	Pre-intervention Mean	Post-intervention Mean	t value	95% confidence intervals
Time to antibiotics	162.96 N = 104	163.31 N = 106	0.984	-33.91 to 33.21
Time to blood cultures	88.67 N = 94	71.81 N = 94	0.265	-12.86 to 46.58
Time to initial lactate	83.98 N = 94	70.56 N = 106	0.313	-12.72 to 39.56
Time to fluid resuscitation	67.60 N = 42	67.08 N = 26	0.265	-24.71 to 25.74
Time to second lactate	484.92 N = 26	305.86 N = 42	3.47*	92.23 to 265.89

* $P \leq 0.01$

TABLE 3

ANOVA analysis of group differences in age and gender relationship to time to blood cultures in minutes (goal within 180 minutes)

Variable	Sum of squares	Degrees of freedom	Mean square	F	P value
Gender	83,947.0	1	83,947.0	8.32	≤0.01
Age	37,127.3	1	37,127.3	3.68	0.05
Group	9,117.4	1	9,117.4	0.905	0.34
Corrected model	143,128.9	3	47,709.6	4.7	<0.01

a 40 min to 50 min delay in time to treatment. The gender bias was present in pre- and post-data.

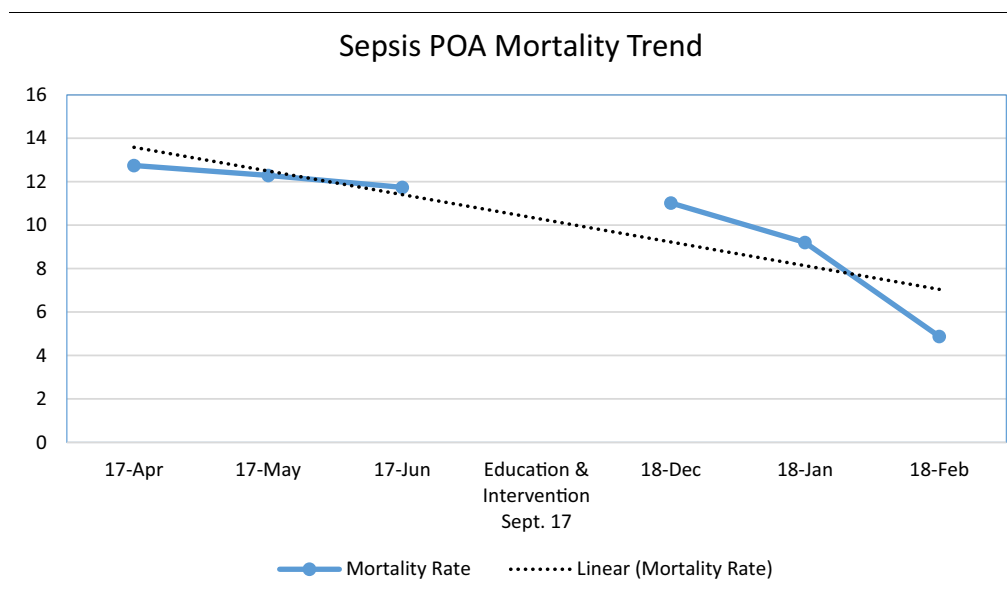
Mortality

Nonparametric tests were completed to analyze any demographic differences in age or gender on mortality using Mann-Whitney U and Pearson χ^2 tests respectively. Results demonstrated no differences in these demographic variables ($z = 161.5$, $P = 0.22$; $\chi^2 = 2.23$, $P = 0.22$).

Data analysis also revealed an improvement from a baseline monthly mortality rate of 12.75% with a steady decline to 4.88% in the final month of postintervention data. See the Figure for a complete mortality trend of patients with sepsis POA pre- and postintervention.

Discussion

The purpose of this project was to determine if implementation of an interdisciplinary sepsis-response team in the emergency department would result in improved bundle compliance and subsequent reduction in mortality. Only 3 studies reviewed addressed the use of a specially trained interdisciplinary team activated by an electronic sepsis alert to implement bundle elements.² A retrospective study suggests that an interdisciplinary team approach to sepsis care can be applied to inpatient medical response teams.⁶ These results, in conjunction with the key findings of this quality improvement project show promise for implementing a code sepsis team, in addition to use of electronic alerts, nurse-driven protocols, and order sets to improve bundle compliance and patient outcomes. The program improved 4 out of 5 sepsis-bundle measures, as well as mortality.



FIGURE

Sepsis presentation on admission (POA) mortality trend.

Key findings of this project include that although clinicians expressed concern of high false positive alert rate, use of original guidelines requiring only 2 SIRS criteria would avoid missing patients who would require early bundled care. In addition, sepsis screening at triage further promotes early goal-directed therapy. This finding is consistent with the findings of Mitzkewich,⁷ in that triage screening did not affect nursing workflow and allowed the patient to receive early treatment. Investigation of the EHR and cultural and systemic factors will continue in an effort to address gaps in care related to the gender bias revealed during data analysis.

This project contributes to the literature by supporting previous study recommendations that an interdisciplinary approach and the combination of existing tools can improve sepsis outcomes and process measures. Anecdotal data regarding age and gender bias may be key to addressing bundle compliance in other organizations. One previous retrospective cohort study of patients in the ICU with severe sepsis/septic shock identified subtle but significant gender differences in processes of care that did not affect mortality outcomes.⁸ These gender and age disparities related to sepsis care need further exploration in future studies.

This quality improvement project had several limitations related to its retrospective design and the patient sample by using 3 SIRS criteria rather than 2; there were patients missed in the sepsis-alert process. No false positive alerts were identified during chart review. During the postintervention period, a hurricane in Puerto Rico destroyed several medical product-manufacturing plants. The backorder of minibags led to removal of antibiotics from automated medication dispensing systems and prompted use of alternative methods for administration of medication. Overall, this led to a delay in administration of antibiotics. An issue involving blood culture reporting by ED providers also led to a reduction in blood culture collection practices in the postintervention period that may have skewed results. This was a key limitation, as the study design does not negate other events occurring at the same time as the intervention.^{2,9} We have corrected the problem that was leading to the reduction in blood-culture collection and are currently back to receiving adequate IV solution to stock antibiotics in our medication-dispensing systems. At the time of planning and implementation for this project, influenza season was beginning, which may have influenced provider concerns over a high false positive alert rate in addition to influencing overall results. Finally, despite involvement and education, there remains variation in provider engagement. This is even more difficult when considering patients with uncomplicated sepsis and supporting the need for aggressive treatment. ED volumes fluctuate, and with a focus on throughput, engaging

clinicians to ensure proper bed placement—even if diagnostic values do not appear critical—is crucial.

Although the RCQI model was successfully applied to this project, future projects may benefit from following some major tenets of implementation science that focus more on understanding gaps between expected results and observed outcomes. Studies that identify barriers and facilitators to implementation of evidence-based practice can use behavioral theories to guide mechanisms of change to improve the process of implementation.¹⁰

Implications for Emergency Nursing

These findings have several implications for ED clinicians. As the prevalence of sepsis continues to rise, raising the cost of health care, insurance, and regulatory entities have taken interest. In 2012, the National Quality Forum began work on endorsing sepsis measures, and the CMS has started the initial phases of regulating sepsis outcomes related to use of the evidence-based bundle elements.¹¹

Although various tools exist to aid clinicians in the early diagnosis and treatment of sepsis, no single tool has been shown to improve bundle compliance. However, this project, along with the literature, reinforces that incorporating an interdisciplinary approach to existing decision-support tools improves care and patient outcomes.^{6,12-14} Informing clinicians through use of a sepsis-alert algorithm only further encourages early identification and treatment.^{14,15} Use of interdisciplinary sepsis champions to guide implementation of evidence-based care and provide peer coaching is crucial.¹⁴ Health care organizations should consider adopting an interdisciplinary team approach to sepsis care in the emergency department to encourage a high reliability organization through the combination of diverse skills and perspectives.¹⁴

Continuous education and awareness initiatives can help support sustainability and maintain focus on the importance of early recognition and goal-directed care.¹⁵ With the fast pace of health care, frequent reinforcement of the 3- and 6-hour bundles—noted in the effect on blood culture collection during data analysis—process changes that may unintentionally affect multiple initiatives; therefore, clear communication and involvement of key stakeholders is necessary to avoid unwanted effects on outcomes. Although no single intervention has been shown consistently to improve sepsis-bundle compliance and outcome measures, this project supports that the combination of existing tools—in addition to specially trained teams—can have a positive impact.

Conclusions

In conclusion, this quality improvement project used an interprofessional code sepsis team that utilized existing knowledge, skills, and tools. The results improved bundle/compliance and reduced mortality in patients with sepsis who presented in the emergency department.

Author Disclosures

Conflict of interest: none to report.

REFERENCES

- Dellinger RP, Levy MM, Rhodes A, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock. *Crit Care Med*. 2012;41(2). <https://doi.org/10.1097/CCM.0b013e31827e83af>.
- LaRosa JA, Ahmad N, Feinberg M, Shah M, DiBrienza R, Studer S. The use of an early alert system to improve compliance with sepsis bundles and to assess impact on mortality. *Crit Care Res Pract*. 2012;2012(980369):1-8. <https://doi.org/10.1155/2012/980369>.
- Semlar MW, Weavind L, Hooper MH, et al. An electronic tool for evaluation and treatment of sepsis in the ICU: a randomized controlled trial. *Crit Care Med*. 2015;10(6):1595-1602. <https://doi.org/10.1097/CCM0000000000001020>.
- Schub E, Schub T. *Sepsis and septic shock*. CINAHL Information Systems; 2013:1-3. Retrieved from CINAHL Plus with Full Text Database. <http://0516csulbtrimester.files.wordpress.com/2015/02/sepsis-and-septic-shock.pdf>. Accessed March 5, 2016.
- School of Public Health. *Rapid Cycle Quality Improvement (RCQI): A Resource Guide to Accelerate Improvement Efforts for Health Resources and Services Administration (HRSA) Grantees*. Rensselaer, NY: Center for Health Workforce Studies; 2016.
- Guirgis FW, Jones L, Esma R, et al. *Managing Sepsis: Electronic Recognition, Rapid Response Teams, and Standardized Care Save Lives*. <http://doi.org/10.1016/j.jerc.2017.04.005>; 2017.
- Mitzkewich M. Sepsis screening in triage to decrease door-to-antibiotic time. *J Emerg Nurs*. 2019;45(3):254-256. <http://doi.org/10.1016/j.jen.2018.08.002>.
- Pietropaoli AP, Glance LG, Oakes D, Fisher S. Gender differences in mortality in patients with severe sepsis or septic shock. *Gen Med*. 2010;7(5):422-437. <https://doi.org/10.1016/j.genm.2010.09.005>.
- Coly A, Parry G. *Evaluating Complex Health Interventions: A Guide to Rigorous Research Designs*. Washington, DC: AcademyHealth; 2017.
- Handley M, Gorukanti A, Cattamanchi A. Strategies for implementing implementation science: a methodological overview. *J Emerg Med*. 2016;33:660-664. <https://doi.org/10.1136/emered-2015-205461>.
- Dellinger RP. Where have we been and where are we going? *Cleve Clin J Med*. 2015;82(4):1516-1525. <https://doi.org/10.3949/ccjm.82gr.15001>.
- Hayden GE, Tuuri RE, Scott R, et al. Triage sepsis alert and sepsis protocol lower times to fluids and antibiotics. *Am J Emerg Med*. 2016;34(1):1-9. <https://doi.org/10.1016/j.ajem.2015.08.039>.
- Umscheid CA, Betesh J, VanZandbergen C, et al. Development, implementation, and impact of an automated early warning and response system for sepsis. *J Hosp Med*. 2015;10(1):26-31. <https://doi.org/10.1002/jhm.2259>.
- Bruce H, Maiden J, Fedullo P, Kim S. Impact of nurse-initiated ED sepsis protocol on compliance with sepsis bundles, time to initial antibiotic administration, and in-hospital mortality. *J Emerg Nurs*. 2015;41(2):130-137. <https://doi.org/10.1016/j.jen.2014.12.007>.
- Tedesco E, Whiteman K, Heuston M, Swanson-Bieaerman B, Stephens K. Interprofessional collaboration to improve sepsis care and survival within a tertiary care emergency department. *J Emerg Nurs*. 2017;43(6):532-538. <https://doi.org/10.1016/j.jen.2017.014>.

Editor's Note:

Strategies in this performance improvement project can be applied to optimize care using the current Surviving Sepsis Campaign guidelines, which have been updated and approved, effective January 10, 2019. Readers are encouraged to review the updated bundle time frames (Hour-1 Bundle) and terminology for the Surviving Sepsis Campaign at <http://www.survivingsepsis.org/Guidelines/Pages/default.aspx> and in the related guidelines.¹⁻³

References

- Levy MM, Evans LE, Rhodes A. The surviving sepsis campaign bundle: 2018 update. *Crit Care Med*. 2018;46(6):997-1000. <https://doi.org/10.1097/ccm.0000000000003119>.
- Rhodes A, Evans LE, Alhazzani W, et al. Surviving sepsis campaign: International guidelines for management of sepsis and septic shock: 2016. *Crit Care Med*. 2017;45(3):486-552. <https://doi.org/10.1097/CCM.0000000000002255>.
- Rhodes A, Evans LE, Alhazzani W, et al. Surviving sepsis campaign: International guidelines for management of sepsis and septic shock: 2016. *Intensive Care Med*. 2017;43(3):304-377. <https://doi.org/10.1007/s00134-017-4683-6>.