Improving Early Sepsis Management Compliance in the Emergency Care Setting

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McKayla Howie

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NURS 635: Internship

Mallory Manuel, MSN, RN, CEN

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Abstract

This quality improvement project implements educational materials informed by organization-dependent nursing informatics and SEP-1 campaign metrics to improve early sepsis management compliance in the emergency department setting. The microsystem scored below a 90% compliance target in first vital to lactic acid result within one hour, lactic acid result to antibiotic administration within one hour, and antibiotic order to administration within thirty-five minutes before implementation. Factors identified as contributing to low compliance include rates of timely and accurate sepsis screening, use of a standardized sepsis order set, and intervention documentation. An educational inservice covering correct sepsis workflow in the electronic health record was implemented and addressed a computer-assisted sepsis triage and screening algorithm, correct use of a nurse-driven order set, and documentation of interventions as part of the SEP-1 Bundle. After implementation, all three compliance outcome measures saw improvement. SEP-1 compliant care increased through this change process.

Keywords: sepsis/septic, early, therapy, recognition, intervention, compliance, SEP-1, emergency.
Improving Early Sepsis Management Compliance in the Emergency Care Setting

Early sepsis management is a critical patient care element that requires microsystem congruence. Each hour of delay in sepsis treatment is associated with a 9% increased rate of patient mortality (Liu et al., 2017). Costs of sepsis management is the highest among all diseases, hospital costs for sepsis are increasing at three times the rate of other conditions, and hospital costs and patient mortality increase with each severity level of sepsis (Paoli et al., 2018). Full compliance of early sepsis management can decrease patient mortality and hospital costs (Townsend et al., 2022). For these reasons, an improvement project focused on improving early sepsis management is critical for patients and healthcare systems.

Problem Description

There is ample room for improvement in early sepsis management in the emergency department (ED) of this urban, not-for-profit, public hospital. For the past year, compliance with early identification and rapid treatment of sepsis in the ED has averaged below target. A randomized audit of the Epic charting system showed that sepsis triage screenings were not always completed within a three-hour window of admission or completed accurately, both of which alter compliance (Barbash et al., 2019). This audit revealed that usage rates of sepsis order sets could be improved as well. Even if a registered nurse (RN) completes an accurate and timely sepsis screening, compliance could be missed through inaccurate ordering of the sepsis order set. Furthermore, documentation of interventions at times zero, one hour, and three hours could be improved. Barriers identified included lack of knowledge among nursing staff about the ability to use an RN-driven sepsis order set and an unreliable antibiotic stock and stocking process.
Literature Review

In gathering evidence for this improvement project, the following question was proposed: In adult septic patients, how does therapy initiated within six hours of recognition compared to greater than six hours influence the risk of in-hospital mortality? The keywords used for research were sepsis/septic, early, therapy, recognition, and mortality.

SEP-1 compliance has been assessed as a quality metric throughout the literature. Within SEP-1 are individual bundle components such as lactate levels, blood cultures, antibiotic and fluid treatments (Appendix A). A post hoc analysis examined the association between SEP-1 compliance with 30-day mortality and length-of-stay, where compliance was defined as completion of the full bundle from initiation of time zero. Full SEP-1 compliance was associated with decreased 30-day mortality and median length-of-stay (Townsend et al., 2022).

Overwhelmingly, antibiotics are associated with reduced mortality for hospital-onset septic patients. Multiple studies show that a delay in antibiotic treatment increases mortality. The greatest decreases in mortality and therefore the greatest impact for improvement are for septic shock patients (Liu et al., 2017). In fact, it is widely supported that antibiotic therapy should be given within one hour of suspected sepsis (Martinez et al., 2020). Initial antimicrobial therapy should be broad-spectrum yet considerate to the site of infection and hemodynamic profile of the patient (Gavelli et al., 2021). Additionally, serum lactate level testing within three hours is associated with reduced mortality for community-onset patients (Baghdadi et al., 2020) and goal-directed therapy initiated within six hours of sepsis recognition was shown to decrease in-hospital mortality (Gauer, 2013). The odds ratio for hospital mortality increased with each hour of delay, with the most significant increase between the fourth hour and fifth hour (Liu et al., 2017). This
improvement aim focuses on lactate levels, antibiotics and fluids occurring within three hours of time zero because the ability to detect and treat sepsis before the progression of organ dysfunction decreases mortality and costs (Paoli et al., 2018).

Organizational interventions on patient mortality were further explored. One quality task force studied a three-tiered intervention that included a nursing-driven protocol for screening and initiating care, a computer algorithm pop-up alert in the electronic medical care record, and automated sepsis-specific suggested order sets. This early screening protocol led to expedited care of sepsis patients and decreased mortality rates in the initial and subsequent years after implementation (Gatewood et al., 2015). Additionally, organizational factors related to SEP-I performance include organization commitment to communication and the use of written protocols (Barbash et al., 2019). This change project will focus on educating nursing staff on navigating the electronic healthcare care record and using computer-assisted triage screening and standardized order sets to expedite sepsis care.

**Rationale**

Lewin’s Theory of Planned Change was applied to mobilize the organizational components needed for change. Lewin’s Theory is composed of three steps: unfreezing, transition, and refreezing. The first step of unfreezing entails recognition of the problem and identification of the needed change. Often this step employs the leadership of change agents (Cummings et al., 2016). For this project, a group of three change leaders met with organizational stakeholders to discuss the urgency of early sepsis management and identify unit-specific needs for change. An educational inservice was selected as a solution. A part of Lewin’s first stage is identifying strengths and weaknesses for change. A strength was identified in a computer-assisted workflow,
but the weakness was in compliance with the workflow. Preparing an educational inservice targets these elements.

The secondary transition step involves engagement with the organization to elicit an internal response (Cummings et al., 2016). The change agents created an educational inservice with insight from stakeholders and distributed the information to staff. The difficulties associated with this stage are marked by uncertainty. The degree to which staff engages and reacts to this step is unknown. However, clear communication is used to overcome this. Change agents are again critical to this step to further facilitate engagement and communication.

Lastly, the refreezing step occurs when the change has become standardized or sustained (Cummings et al., 2016). Once nursing staff are aware of proper documentation of sepsis screening and interventions, the change can become embedded into practice. This step makes further use of the strengths and weaknesses identified in the initial phase by highlighting how computer-assisted documentation expedites care and overcoming the knowledge deficit on proper charting. This step ends once a higher level of compliance is achieved.

**Aim Statement**

We aim to improve compliance in early management of sepsis in the emergency department of this urban, not-for-profit, public hospital. The process begins with accurate sepsis screening using a standardized screening tool. The process ends with complete documentation of actions taken in response to a computer-assisted positive screening. By working on the process, we expect reduced time between sepsis-onset and intervention, decrease in sepsis related patient mortality rates, savings on cost of care and improved rates of early sepsis management compliance and documentation.
Methods

Context

The 5P framework was used to conduct a microsystem assessment in this emergency care setting through the lens of early sepsis care. Utilizing the 5P framework highlights microsystem strengths and weaknesses on five axes: purpose, patients, professionals, processes, and patterns (Wilcox & Deerhake, 2020). The purpose of this emergency department is to stabilize patients coming from the local urban community for discharge or care transfer. The purpose as it relates to early sepsis management was defined as to provide high quality, timely sepsis screening and decrease time to treatment for septic patients presenting to the emergency department. The patients this ED serves are diverse, but patients included in this project were specified as non-pregnant adults at high risk for sepsis with signs and symptoms including infection, fever, tachycardia, tachypnea, dyspnea, hypotension, pain, and altered level of consciousness. Professionals involved in the sepsis team included registered nurses, graduate nursing students, sepsis coordinator, ED clinical nurse manager, and physicians. For nursing staff, documentation of patient care in the electronic health record is a core responsibility that serves as both a database and communication tool for use by the healthcare team. As part of the 5P framework, the key processes involved with early sepsis recognition and rapid treatment were documentation based and included screening patients for sepsis at triage, notifying the physician and ED staff when a computer-assisted algorithm identified sepsis at triage, ordering the nursing driven sepsis order set, and documenting lab collections and interventions. Revealing patterns emerged that contributed to timely sepsis care such as early screening, effective staff communication, consistent use of standardized order sets, and accurate documentation (Appendix B).
A sample cost-benefit analysis was also conducted to signify potential cost savings associated with early sepsis management compliance. National average sepsis daily costs were priced as $1,830 for sepsis, $2,193 for severe sepsis, and $3,087 for septic shock, and associated length-of-stays were 4.5, 6.5, and 16.5 days respectively (Paoli et al., 2018). Early treatment from sepsis onset is associated with decreased length-of-stay. For example, when intravenous fluids are initiated within three hours of time zero identified by sepsis screening, length-of-stay days are decreased by 1.39 overall, 2.3 for severe sepsis, and 3.07 for septic shock (Sudat, 2021). It is important to note that daily cost figures were pulled from 2013 national averages, and the actual costs for our urban microsystem in 2022 are much higher. Therefore, early recognition and timely intervention of sepsis is associated with significant hospital savings (Appendix C).

**Intervention**

The initial approach to improve compliance data was multi-faceted and included an educational inservice to encourage nurses to use a standardized order set, advocate for antibiotics to be ordered earlier, and ensuring correct fluid orders and documentation as well as an antibiotic log sheet to be placed in the medication room to obtain data on incidence of missing ordered antibiotics. Through continual reassessment, the educational inservice went through three iterations before being sent to nursing staff and the implementation of an incidence log was placed on hiatus to be reviewed in the next change cycle. Through continued conversation with stakeholders, it was decided to focus on individual aspects of SEP-1 practice rather than hitting multiple marks on the bundle. The second iteration of the educational materials focused on the sepsis order set and effective notification and communication between the treatment team. The third and final iteration of the educational materials were adapted to a video voiceover following the sepsis
workflow in the electronic health record from the computer-assisted positive sepsis screening at triage to then ordering the sepsis order set through to documentation of interventions including notifying the physician. This intervention focused on workflow documentation to increase compliance data. The video voiceover was sent to nursing staff through email.

**Measures**

Data was collected from and summarized by quality improvement and nursing management teams that pulled from cases in the electronic health record. Ultimately, the compliance metrics of first vital to lactic acid result within one hour, lactic acid result to antibiotic administration within one hour, and antibiotic order to administration within thirty-five minutes were selected to track improvement as well as the median time in between. These metrics are measured monthly.

**Results**

Compliance data for first vital to lactic acid result within one hour, lactic acid result to antibiotic administration within one hour, and antibiotic order to administration within thirty-five minutes metrics all saw improvement. All three metrics exceeded the target of 90% compliant in the month following implementation. The median time from first vital to lactic acid result decreased by over twenty minutes in the month of implementation. With education on proper sepsis workflow documentation, these improvements were made within one month.

While the compliance data increased for all three measure outcomes, the median time increased between lactic acid result and antibiotic administration as well as antibiotic order and administration. The median time between lactic acid result and antibiotic administration saw an increase of nearly twenty-five minutes and antibiotic order to administration increased by nearly
ten minutes. An unintended consequence of compliance data increasing is capturing downward trending performance data. However, this is significant to fully appreciate microsystem processes and for the future of improvement aims.

**Discussion**

SEP-1 compliant care increased through this change process. If the relationship between SEP-1 compliant care and 30-day mortality is casual, then this change project prevented added mortality and hospital costs related to untimely sepsis care (Townsend et al., 2022).

The unfreezing process, which entailed creating a sense of urgency among the microsystem and highlighting the need for improvement brought the appropriate attention to the change intervention. With this renewed sense of awareness toward early sepsis management, the educational intervention helped further guide staff in conducting complete and accurate documentation of sepsis workflow. By increasing awareness and knowledge of early sepsis management and microsystem goals aligned with the SEP-1 campaign, the microsystem experienced improved compliance on target metrics. With increased compliance, the data helped paint a better picture of microsystem processes involved in early sepsis management. Now, areas for further improvement include decreasing the median time between lactic acid result and antibiotic administration as well as antibiotic order to administration.

The strengths of this quality improvement project include assessing the microsystem, identifying areas for improvement and education, and inspiring change. Unfortunately, the degree to which staff gained knowledge of the education material was not assessed nor can causation of the improvement be statistically proven. Recommendations for the future would be to
hold pre- and post-intervention quantifiable surveys on staff knowledge so covariance between knowledge data and compliance data could be examined for a given time.
References


Rhee, C., Strich, J. R., Klompas, M., Yealy, D. M., & Masur, H. (2020). SEP-1 has brought much needed attention to improving sepsis care…but now is the time to improve SEP-1. *Critical Care Medicine, 48*(6), 779–782. https://doi.org/10.1097/CCM.0000000000004305


## Appendix A

**SEP-1 Bundle**

<table>
<thead>
<tr>
<th>Required Action</th>
<th>Severe Sepsis</th>
<th>Septic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Three Hour Bundle</td>
<td>Six Hour Bundle</td>
</tr>
<tr>
<td>Initial Lactate Collection</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Blood Culture Collection</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Initial Antibiotic Started</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Repeat Lactate Collection (if Initial Lactate is greater than two)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>30mL/kg Crystalloid Fluids Started</td>
<td>Yes for initial hypotension</td>
<td>N/A</td>
</tr>
<tr>
<td>Vasopressor Given (if decreased BP persists)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Repeat Volume Status/ Tissue Perfusion Assessment</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Appendix B

5 P’s Framework

5 P’s

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Patients</th>
<th>Professionals</th>
<th>Processes</th>
<th>Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-quality, timely sepsis screening and treatment for patients in the Emergency Department</td>
<td>ED patients at high risk for sepsis. S/S: tachycardia, fever, altered LOC, dyspnea, tachypnea, pain, diaphoretic, infection, hypotension (CDC, 2021; Liu et al., 2017)</td>
<td>- Nurses &lt;br&gt;- Sepsis coordinator &lt;br&gt;- ED clinical nurse manager &lt;br&gt;- Physicians &lt;br&gt;- Graduate nurse interns</td>
<td>- Screen patient for sepsis at triage &lt;br&gt;- Use Vocera to broadcast to ED and notify MD &lt;br&gt;- Order the standardized order set for sepsis &lt;br&gt;- Document lab collection</td>
<td>- Effective communication &lt;br&gt;- Timely screening &lt;br&gt;- Accurate Documentation and metrics &lt;br&gt;- Consistent use of standardized order sets</td>
</tr>
</tbody>
</table>
Appendix C

Cost-Benefit Analysis

<table>
<thead>
<tr>
<th></th>
<th>Sepsis</th>
<th>Severe Sepsis</th>
<th>Septic Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. LOS</td>
<td>4.5</td>
<td>6.5</td>
<td>16.5</td>
</tr>
<tr>
<td>Cost per day</td>
<td>$1,830</td>
<td>$2,193</td>
<td>$3,087</td>
</tr>
<tr>
<td>Total cost per case</td>
<td>$8,235</td>
<td>$14,254</td>
<td>$50,935</td>
</tr>
<tr>
<td>LOS decrease w/ SEP-1 Compliance</td>
<td>1.39</td>
<td>2.3</td>
<td>3.07</td>
</tr>
<tr>
<td>Total savings per case</td>
<td>$2,544</td>
<td>$5,044</td>
<td>$9,477</td>
</tr>
</tbody>
</table>
Appendix D
Statement of Determination

Project: Statement of Determination and Non-Research Determination Form

Student Name: McKayla Howie

Title of Project: Decreasing In-Hospital Mortality Rates Through Compliance of Early Sepsis Intervention (SEP-1)

Brief Description of Project

- Data that Shows the Need for the Project
  Each hour of delay in sepsis treatment is associated with a 9% increased rate of patient mortality (Liu et al., 2017). Costs of sepsis management is the highest among all diseases and hospital costs for sepsis is increasing at three times the rate of other conditions. Furthermore, hospitals costs and patient mortality increase with each severity level of sepsis (Paoli et al., 2018).

- Aim Statement
  We aim to improve compliance in early management of sepsis in CPMC Mission Bernal Emergency Department. The process begins with timely sepsis recognition using a standardized SEP-1 screening tool. The process ends with the appropriate and early intervention of sepsis identified patients. By working on the process, we expect (1) reduced time between sepsis-onset and intervention (2) decrease in sepsis related patient mortality rates (3) reduced cost of care and (4) improved rates of SEP-1 compliance and documentation.

- Description of Intervention(s)
  Compliance of SEP-1 is defined as the completion of the full bundle including serum lactate levels, blood cultures, broad-spectrum antibiotic administration, 30 mL/kg crystalloid fluid administration, application of vasopressors, and patient reassessment.

- Desired Change in Practice
  We hope to see completion and documentation of the full bundle, initiation of antibiotics and fluids within one hour of time zero, as well as decreased time from antibiotics order to infusion.

- Outcome measurement(s)
  The primary outcomes to measure will be in-hospital mortality. The secondary outcome will be median length-of-stay.
References


To qualify as an Evidence-based Change in Practice Project, rather than a Research Project, the criteria outlined in federal guidelines will be used: (http://answers.hhs.gov/ohrp/categories/1569)

☐ This project meets the guidelines for an Evidence-based Change in Practice Project as outlined in the Project Checklist (attached). Student may proceed with implementation.

☐ This project involves research with human subjects and must be submitted for IRB approval before project activity can commence.

Comments:
## EVIDENCE-BASED CHANGE OF PRACTICE PROJECT CHECKLIST *

Instructions: Answer YES or NO to each of the following statements:

<table>
<thead>
<tr>
<th>Project Title:</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>The aim of the project is to improve the process or delivery of care with established/accepted standards, or to implement evidence-based change. There is no intention of using the data for research purposes.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The specific aim is to improve performance on a specific service or program and is a part of usual care. ALL participants will receive standard of care.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The project is NOT designed to follow a research design, e.g., hypothesis testing or group comparison, randomization, control groups, prospective comparison groups, cross-sectional, case control. The project does NOT follow a protocol that overrides clinical decision-making.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The project involves implementation of established and tested quality standards and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does NOT develop paradigms or untested methods or new untested standards.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The project involves implementation of care practices and interventions that are consensus-based or evidence-based. The project does NOT seek to test an intervention that is beyond current science and experience.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The project is conducted by staff where the project will take place and involves staff who are working at an agency that has an agreement with USF SONHP.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The project has NO funding from federal agencies or research-focused organizations and is not receiving funding for implementation research.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The agency or clinical practice unit agrees that this is a project that will be implemented to improve the process or delivery of care, i.e., not a personal research project that is dependent upon the voluntary participation of colleagues, students and/or patients.</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If there is an intent to, or possibility of publishing your work, you and supervising faculty and the agency oversight committee are comfortable with the following statement in your methods section: “This project was undertaken as an Evidence-based change of practice project at X hospital or agency and as such was not formally supervised by the Institutional Review Board.”</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**ANSWER KEY:** If the answer to ALL of these items is yes, the project can be considered an Evidence-based activity that does NOT meet the definition of research. **IRB review is not required. Keep a copy of this checklist in your files.** If the answer to ANY of these questions is **NO**, you must submit for IRB approval.
STUDENT NAME (Please print):

McKayla Howie

Signature of Student:

_____________________________ DATE 09/17/22

SUPERVISING FACULTY MEMBER NAME (Please print):

Signature of Supervising Faculty Member

_____________________________ DATE 9/17/22