Early Sepsis Recognition: Improving Sepsis Education in a Medical-Surgical/Telemetry Unit

Kathileen Tran
kathileentrans@gmail.com

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Early Sepsis Recognition: Improving Sepsis Education in a Medical-Surgical/Telemetry Unit

Kathileen Tran, RN, CNL

School of Nursing and Health Professions, University of San Francisco

NURS653-01: Internship

Nneka Chukwu, DNP-HCSL, MBA, RN, CLNC, CNL

May 18, 2023
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Abstract

**Problem:** This quality improvement project aimed to increase sepsis education and bundle compliance within the medical-surgical/telemetry unit to improve sepsis mortality and morbidity rates.

**Context:** A microsystem assessment was completed by Clinical Nurse Leader (CNL) students in the medical-surgical/telemetry unit at Hospital X located in the San Francisco Bay Area. This microsystem cares for patients diagnosed with sepsis, congestive heart failure (CHF), electrolyte imbalance, and alcohol withdrawal.

**Interventions:** Due to time constraints, an intervention was not implemented; however, the students provided recommendations for interventions to the leadership team for follow up. The recommended interventions encompass implementing sepsis protocol reference cards, signage, and an education refresher course.

**Measures:** After completing an assessment of the microsystem, the students collected data to evaluate nurses’ adherence to sepsis protocol and rates of sepsis-related complications in the microsystem. The post-intervention survey measured the effectiveness of the refresher course and the confidence in utilizing the sepsis bundle with the assistance of the reference cards and signage.

**Results:** Analysis from the pre-intervention survey revealed that 83.3% of nurses in this microsystem received sepsis bundle training, and 50% rated their sepsis bundle training at an eight or above on a scale of 0 to 10. Participants disclosed key challenges to sepsis protocol compliance were due to late documentation, substandard training, and time. This study aimed to assess the microsystem at Hospital X, determine the causal factors for decreased compliance
with the sepsis bundle, and develop action plans to increase adherence and reduce mortality and morbidity.

**Conclusions:** The pre-intervention questionnaires demonstrate that this microsystem’s sepsis bundle is underutilized. It was revealed that there was a lack of proper sepsis protocol training and resources. The continuation of this project with the implementation of increased training and accessible resources will hopefully yield increased use of the sepsis bundle and improve sepsis mortality and morbidity rates.

**Keywords:** sepsis, septic shock, education, rapid response, compliance, sepsis bundle, early detection, sepsis protocol
Introduction

Sepsis can be the result of a life-threatening response to an infection and if left untreated, can potentially lead to septic shock, multiple organ failure, and death (World Health Organization [WHO], 2020). Every year, about five million sepsis cases lead to death in over 19 million cases (Taj et al., 2022). To improve patient outcomes, early detection and prompt intervention of sepsis through the use of bundled care, such as the one recommended by the Surviving Sepsis Campaign (SSC), are essential (Semanco et al., 2022). Medicare and Medicaid services utilize a sepsis protocol that requires monitoring serum lactate and blood cultures and administering intravenous (IV) antibiotics and crystalloid fluids within the first three hours of potential sepsis or septic shock (Semanco et al., 2022). Despite improvements in antibiotic and fluid resuscitation management, compliance with the sepsis bundled care among many institutions is not always up-to-standard (Semanco et al., 2022). While enhanced patient outcomes are seen with even low levels of compliance with sepsis bundles, it is clear that nurse response and the initiation of a rapid response team (RRT) make a significant impact on sepsis mortality (Semanco et al., 2022). Due to poor sepsis protocol adherence across different facilities and microsystems, it is imperative that improvements to the education and training of sepsis bundled care are made.

Problem Description

Hospital X is a 244-bed medical center located in the greater San Francisco Bay Area. Stakeholders at Hospital X observed low sepsis bundle compliance and increased incidence of sepsis in the medical-surgical/telemetry unit. Therefore, this quality improvement (QI) project explored the gaps in sepsis education to make recommendations on improving their sepsis bundle compliance.
**PICOT Question**

A Patient, Intervention, Comparison, Outcome, and Time (PICOT) question was created to establish the capacity of this quality improvement project. The PICOT question was stated as follows: Does increased sepsis education provided to registered nurses improve sepsis bundle compliance and decrease sepsis-related morbidity and mortality rates for patients admitted to the medical-surgical/telemetry unit compared to no sepsis education in three months?

**Rationale**

Kurt Lewin’s change theory was adopted as a model to drive change for this microsystem. This change agent involved three components: unfreezing, moving or changing, and refreezing (Mitchell, 2015). The unfreezing stage required an assessment of the current situation, which led to the awareness that change was necessary (Mitchell, 2015). Data from this microsystem demonstrated that early sepsis recognition was low and led to increased sepsis mortality and morbidity. The moving or changing phase encompassed the development of a change implementation that involved participation from key stakeholders (Mitchell, 2015). For this project, questionnaires were administered to the nurses to explore the barriers to sepsis bundle compliance so that recommendations for such a change could occur. The last step of refreezing entailed establishing the change as an integral component of the microsystem and generating strategies to prevent the change from unfreezing (Mitchell, 2015). The hope of this project includes having microsystem leadership implement the suggested changes and evaluate if the change practice warrants any adjustments.

**Search Strategy**

A literature review was conducted from February to March 2022 using PubMed and the Cumulative Index to Nursing and Allied Health (CINAHL) databases. Inclusion criteria for this search included “sepsis,” “septic shock,” “education,” “compliance,” “sepsis bundle,” “rapid
response,” “early detection,” and “sepsis protocol,” for peer-reviewed articles published between 2015 to 2023. To evaluate the level of studies, the Johns Hopkins Research Evidence Appraisal Tool was utilized to grade the evidence levels from Level I to V (Dang et al., 2022).

**Available Knowledge**

A comprehensive literature review of evidence-based practice for early sepsis detection was performed to support this study. The quality of evidence of the articles was evaluated using the Johns Hopkins Evidence-Based Practice for Nurses and Healthcare Professionals: Model and Guidelines (See Appendix B) (Dang et al., 2022). Studies included in this literature synthesis demonstrated the amplified need for sepsis bundled care. Standardized sepsis protocols are used for early detection, leading to prompt treatment (Bruce et al., 2015; Hayden et al., 2015; Jacobs, 2020; Semanco et al., 2022; Taj et al., 2020).

To identify sepsis in a timely manner, standard guidelines must be in place, such as the one recommended by the SSC (Bruce et al., 2015; Semanco et al., 2022). The SSC bundled care includes continuous monitoring of serum lactate levels, obtaining blood cultures, and administering IV antibiotics, crystalloid fluids, and vasopressors as needed within an hour of suspected sepsis (Semanco et al., 2022). A retrospective study that evaluated patients in an acute care unit with possible sepsis determined that initiating an RRT that utilized the sepsis protocol reduced antibiotic management time by half and increased fluid resuscitation treatment (Semanco et al., 2022). Emergency department (ED) nurses, who complied with the three-hour SSC bundle, saw an improvement in serum lactate measurement and antibiotic administration time (Bruce et al., 2015).

Implementing an institution’s standardized sepsis protocol can improve patient outcomes significantly. A retrospective quasi-experimental study investigated the impact of sepsis workup and treatment (SWAT) protocol on patients with suspected sepsis or septic shock in the adult ED
In addition to an electronic health record (EHR) triage alert, the use of SWAT assisted in early recognition and resulted in more prompt initiation of IV fluids and antibiotic management compared to the pre-SWAT group (Hayden et al., 2015). A quasi-experimental study compared patient readmission rates in the acute care unit of those who received adequate standardized sepsis care in an inpatient rehabilitation facility and those who did not (Jacobs, 2020). A reduction in readmission rates was exhibited with the implementation of the sepsis protocol (Jacobs, 2020). The use of a standardized sepsis screening tool allowed patients to receive the proper treatment without the need to transfer (Jacobs, 2020).

Having a simple and accessible sepsis bundle can expand the use of an institution’s sepsis protocol. A systematic review examining sepsis protocols from six studies in EDs revealed standardized and simplified bundled care can improve compliance, especially in settings with limited sepsis resources (Taj et al., 2020). All sepsis protocols appraised included temperature, heart rate, respiratory rate, and systolic blood pressure (Taj et al., 2020). However, only some of the six studies included mean arterial pressure, oxygen saturation, partial pressure carbon dioxide, altered mental status, platelet counts, white blood cell counts, serum creatinine, and serum bilirubin levels (Taj et al., 2020). Simplifying the sepsis screening tool by including a smaller number of components may be less demanding and expand the usage of the tool (Taj et al., 2020). The most common challenges to the implementation of sepsis protocols included a lack of resources, an insufficient number of beds in the intensive care unit (ICU), and limited necessary supplies and equipment (Taj et al., 2020). Inadequate nurse education on the standardized sepsis protocol also resulted in poor execution of the sepsis bundled care (Taj et al., 2020).

Sepsis bundle education can play a significant role in the initiation of sepsis protocol. In a study examining the ED, before the implementation of the sepsis bundle, nurses participated in
mandatory sepsis training, and visuals, in the form of posters and reference cards, were provided to all the nurses (Bruce et al., 2015). Compliance with targets from the sepsis protocol, such as serum lactate evaluation and blood culture attainment before antibiotic administration, in the post-protocol group was 98.7% and 97.3% respectively (Bruce et al., 2015). An increased adherence rate to evidence-based sepsis protocols was seen in groups that were provided with adequate protocol education (Taj et al., 2020). Continued education and frequent refresher training also improved protocol compliance (Taj et al., 2020). The association between sepsis bundled care education and adherence found in these studies conveys the need for increased sepsis education for early detection.

A challenge to timely recognition of sepsis and septic shock can be attributed to documentation. The ED sepsis triage alert on an EHR can be a valuable tool for the development of a complex sepsis workflow pathway (Hayden et al., 2015). Proper screening tools and computer alert systems can assist with early sepsis detection (Hayden et al., 2015). A systematic review investigating sepsis in EDs and ICUs demonstrated the positive effects of machine learning (ML) in early sepsis detection and possible prevention (Yan et al., 2021). Because accurate documentation can help predict sepsis and lead to early intervention, more efforts should be aimed at improving ML to use both structured (e.g., vital signs, laboratory studies, medications) and unstructured (e.g., clinical notes) data from health charts (Yan et al., 2021).

The reviewed literature establishes the urgency to develop quality, evidence-based improvements to detect sepsis and sepsis-related complications early so that treatment can be implemented in a prompt manner. Without the proper use of a systematic sepsis bundle, patients will not receive adequate sepsis treatment before it leads to more serious consequences.

**Specific Project Aim**
The specific aim of this study was to improve compliance with sepsis protocol to reduce sepsis-related morbidity and mortality rates in the medical-surgical/telemetry unit at Hospital X. New-hire nurse sepsis education was evaluated to determine the effectiveness of sepsis prevention. Feedback collected from questionnaires over one month was administered to the nurses in the medical-surgical/telemetry unit and examined to determine the gaps in knowledge for sepsis prevention. Sepsis protocol recommendations presented to the nurse leadership team utilized questionnaire responses and evidence-based principles.

**Methods**

**Project Overview**

A Plan, Do, Study, Act (PDSA) cycle (See Appendix C) was employed to organize this QI project. Using internal data shared by Hospital X nursing leadership, the CNL students created a PICOT question and specific aim statement. A comprehensive literature review regarding sepsis care and compliance was conducted. A thorough microsystem assessment was completed, utilizing the 5 P Assessment and Root Cause Analysis (RCA) (See Appendix D). A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis (See Appendix E) was conducted. A pre-intervention questionnaire (See Appendix F) was created, and data collection forms were printed and distributed. After data collection and analysis, recommendations for interventions were proposed to the leadership team. A Cost-Benefit Analysis (CBA) (See Appendix G) was generated to demonstrate the potential cost-saving benefits for Hospital X. A Gantt Chart was constructed to illustrate the project’s timeline (See Appendix H).

**Microsystem Assessment**

The 5 P assessment, which included purpose, patients, professionals, process, and patterns, was implemented to evaluate the workflow and performance of the unit. The purpose of this study was to increase staff compliance with the sepsis bundle and ultimately improve the
sepsis outcomes. Patients in the medical-surgical/telemetry unit at Hospital X were composed of those who have been diagnosed with sepsis, congestive heart failure (CHF), electrolyte imbalance, and alcohol withdrawal. An interdisciplinary team providing care for patients in this unit included registered nurses, nursing assistants, nurse managers, unit secretaries, physicians, physical therapists, respiratory therapists, phlebotomists, and RRT nurses. To ensure proper sepsis care, nurses were responsible for completing and adhering to processes, such as online new-hire sepsis training, nursing assessments, electronic Cardiac Arrest Risk Triage (eCART) documentation, and the sepsis bundle protocol. Patterns that were instrumental for sepsis care were nurse shift handoff reports, shift huddles, RRT rounds, physician rounds, interdisciplinary communication, and EHR documentation.

**Plan, Do, Study, Act (PDSA) Cycle**

The first phase of the PDSA cycle was the planning process. In the initial planning phase, a collaboration with Hospital X leadership identified sepsis protocol issues in multiple medical-surgical units. A PICOT question and specific aim statement were created on the selected medical-surgical/telemetry unit. A proposal for the study, including the development of a sepsis education questionnaire, was developed and shared with the leadership team. After approval of the proposal, the surveys were ready for administration. The second phase of the PDSA cycle was the implementation process. A microsystem assessment using the 5 P assessment strategy was conducted. An RCA was constructed to investigate the sources for the sepsis-related issue. A questionnaire was administered to registered nurses working in the medical-surgical/telemetry unit, and passive and active observational data was conducted. Data from the pre-intervention questionnaire was analyzed and synthesized to formulate recommendations for improved sepsis protocol adherence in a presentation to nursing leadership on April 17, 2023. Because of the limited time, the suggestions were not initiated. It is hoped that this study will be continued, the
recommended sepsis bundle visuals and increased education will be implemented, and a post-intervention survey will be administered. In the third phase of the PDSA cycle, the data from the post-survey and compliance with the sepsis protocol will be collected and examined. If the interventions yield positive results, the last phase of the PDSA cycle will take place. The use of sepsis protocol references and frequent sepsis education will continue in the microsystem and be monitored quarterly for necessary adjustments.

**Root Cause Analysis (RCA)**

Hospital X identified an issue with sepsis in the medical-surgical/telemetry microsystem, and an RCA was performed to determine the potential reasons for this problem. A fishbone diagram was created to display the RCA. Prospective explanations for the lack of sepsis bundle compliance included problems with documentation, monitoring, policies and procedures, and people. Frequent sepsis charting can lead to documentation fatigue and missed charting opportunities. Reduced sepsis bundle compliance could be due to infrequent sepsis education, accessibility of the sepsis bundle on the unit, and irregular RRT rounding. While processes, such as RRT rounding, are available, they only round on patients flagged on the eCART as at-risk for sepsis once per shift, and their eCART value can often be explained by patient disease rather than sepsis. Additionally, new graduate nurse residents may be less confident in their sepsis care, which can lead to decreased bundle compliance.

**Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis**

A SWOT Analysis was performed to evaluate the current state of the organization’s sepsis protocol and the success of increased sepsis education. Some strengths of the current sepsis bundle included availability on the unit, use of online modules for nursing sepsis education, and accessibility of the eCART on the EHR. Sepsis bundle weaknesses involved
inconsistency of nursing sepsis education, ineffective patient transfer communication, and considerably extensive sepsis bundle. Opportunities for improved sepsis education were composed of increased sepsis bundle compliance, reduced long-term hospital costs and sepsis morbidity and mortality rates, and increased infection control and efficiency of care. Threats to this change included time and cost allocated for more frequent education, documentation fatigue, and nursing staff burden. While this SWOT Analysis explained the state of sepsis care at the beginning of this project, it may need to be revised after the implementation of the suggested sepsis education tools.

**Cost-Benefit Analysis (CBA)**

A CBA was calculated to evaluate the benefits of the recommendations and their potential to outweigh the cost of the advised sepsis improvement strategies. The total annual estimated budget to purchase sepsis care badge reference cards (e.g., “badge buddy”), sepsis bundle signage (e.g., posters), and a sepsis education refresher course (e.g., annual online course renewal) was compared to a decrease in one instance of sepsis-related complication in the microsystem per month (Paoli et al., 2018).

**Timeline**

A Gantt Chart was developed as a time management tool for this QI project. This chart utilized objectives from the PDSA cycle and ran through the course of the QI project from February 2023 to May 2023.

**Intervention**

Due to time constraints, an intervention was not implemented, but recommendations from the questionnaire administered and evidence-based practice will guide the next steps of this project. The purpose of this project was to gain insight into the current state of sepsis education
provided to nurses and the barriers to sepsis bundle compliance. A questionnaire was administered to gather feedback from the nurses regarding their experience with sepsis education, bundled care, and recommendations. The survey was made available to the nurses through a QR code linked to the Google Form questionnaire on a flyer or physical paper copies from February 2023 through March 2023. Respondents were rewarded for their participation with edible incentives. Key questions in the survey focused on the effectiveness of the current sepsis training, accessibility of the eCART, the usefulness of the RRT process, barriers to sepsis care, and recommendations to improve early detection of sepsis. The complete questionnaire can be seen in Appendix F.

In future steps, the recommended interventions, such as sepsis education reference cards, sepsis bundle signage, and sepsis education refresher course, will be implemented and outcomes will be measured to evaluate the success of this project.

**Study of Interventions**

After implementation, the nurse leadership team will evaluate the effectiveness of the increased education and resources quarterly. A post-intervention survey will be conducted to determine the nurses’ confidence in utilizing the sepsis bundle. The team will also examine the rate of sepsis bundled care adherence. Building nurse confidence in early recognition of sepsis by increasing adherence to sepsis protocol can decrease morbidity and mortality sepsis rates, which were substandard at the beginning of this project.

**Measures**

Data from the questionnaire and passive and active observations were collected to evaluate the effectiveness of the current sepsis nursing education at Hospital X. The survey required quantitative and qualitative responses. Quantitative responses included rating the sepsis
bundle training effectiveness using a Likert scale from 0 to 10 and yes-no closed-ended answers for whether they received the training and if they believed the rapid response process was effective. Qualitative responses allowed for open-ended answers to questions assessing the accessibility of the eCART, challenges for sepsis bundle adherence, and recommendations to increase bundle compliance. The responses from this survey were documented anonymously.

After the execution of the increased education, nursing leadership should administer a post-intervention survey to evaluate the effectiveness of the change. This questionnaire will include inquiries measuring the effectiveness of the increased sepsis training, the confidence in the use of the sepsis bundle, and the challenges of utilizing the unit’s sepsis protocol.

**Ethical Considerations**

This project meets the guidelines for an evidence-based quality improvement project and does not meet the criteria for institutional review board approval.

**Results**

Of the 55 registered nurses on the staff roster in this microsystem, 36 participated in this study. The results revealed that 83.3% (n=30) of nurses received sepsis bundle training. The six nurses who did not receive training stated they did not remember receiving training or did not have formal training on the sepsis bundle. On a Likert scale of 0 to 10, with 0 being no knowledge and 10 being a high level of knowledge, 50% (n=18) of respondents rated their training at an 8 or above, 36.1% (n=13) rated it between 5 and 7, 11.1% (n=4) rated it below 4, and one did not respond. Nurses explained their rating through an open-ended question. Some key responses included “did on them online through Knowledge Center,” “could use refresher courses,” and “it was a long time ago.” Nurses conveyed barriers to sepsis bundle adherence
could be due to “late documentation or labs,” “lack of proper training,” “time confusion,” and “too many steps.”

This microsystem utilized eCART documentation and rapid response as components of early sepsis care. All respondents expressed that eCART was an accessible tool. 88.9% (n=32) of participants regarded the rapid response process as successful at managing sepsis care in their unit. The nurses, who did not agree that rapid response was effective, indicated that there was only one rapid response nurse, and they may not come in time and may individually vary in their care.

The last survey question asked the nurses for recommendations to improve sepsis bundle compliance. Some of the most common responses included utilizing a “badge buddy,” posting visuals (e.g., posters), more frequent refresher courses, in-service training, and simplifying the sepsis protocol. The nurses’ responses and best evidence-based practice will drive the nursing leadership team to implement the appropriate interventions for this change project. After implementation, the team will analyze the responses from a post-intervention survey. This questionnaire will observe if increased sepsis protocol education and resources can expand the use of the sepsis bundle, which can lead to improved septic patient outcomes.

**Discussion**

An increase in sepsis morbidity in Hospital X’s medical-surgical/telemetry unit revealed a sepsis education deficit and a sepsis bundle compliance issue. Evidence has demonstrated that additional sepsis education can increase the usage of the sepsis bundle protocol (Bruce et al., 2015; Taj et al., 2020). Although this project was limited to the pre-intervention questionnaire, the hope is for the nurse leadership team to continue this project to its implementation and post-intervention survey stages. The goal of the intervention would be to increase sepsis protocol
compliance and ultimately reduce the morbidity and mortality rates of sepsis in this microsystem. The pre-intervention questionnaire revealed the challenges nurses face in detecting sepsis early and adequately initiating the sepsis protocol. Utilizing the results from the pre-intervention survey and current evidence-based practice to guide interventions will serve as a starting point for improving sepsis protocol in this unit. Collecting and analyzing data after implementation will provide insight into whether or not such interventions are appropriate for this microsystem, and the leadership team will make adjustments and repeat the PDSA cycle accordingly.

Limitations

Some limitations impacted this study. The participation only included the nurses on the staff roster in this microsystem and excluded float and travel nurses, who are also expected to adhere to the unit’s sepsis protocol and procedures. Also, the delay in obtaining the microsystem's internal data did not allow adequate time to implement the interventions. However, the leadership team received the proposed interventions and analysis of the survey results and will work on the implementation. Despite the delay, this study provided valuable insight into the nurses’ opinions on the microsystem’s sepsis bundle and its training and guided the potential for further investigation into this issue.

Summary

Hospital X's nursing leadership team identified sepsis-related issues in the medical-surgical/telemetry unit and sought a thorough examination of the barriers nurses face with sepsis care. After developing a PICOT question, a comprehensive assessment of the microsystem and a questionnaire were designed to provide awareness of the microsystem’s sepsis education and protocol. The initiation of the PDSA cycle and recommendations were gathered and presented to the leadership team to support the need for change in sepsis bundled care. 50% of registered
nurses felt their sepsis training was adequate, scoring eight or above out of 10. They attributed the lack of proper use of the sepsis protocol to time, accessibility of resources, and infrequent training. While this study was in the pre-intervention stage, the questionnaire administered for this project demonstrated variance in the education and use of the sepsis bundle.

Conclusion

In collaboration with the nursing leadership team to identify and address barriers to sepsis protocol adherence, this study has the potential to reduce morbidity and mortality from sepsis and improve patient outcomes in the medical-surgical/telemetry unit at Hospital X. The implications of this study will provide valuable knowledge on the effects of early sepsis recognition on patient outcomes in medical-surgical units. Repeated PDSA cycles and replications of this study can demonstrate the reliability and validity of increased education to enhance sepsis bundled care. Further research is necessary to better understand the challenges to compliance with institutional sepsis protocol. The expansion of QI projects exploring the effects of enhanced sepsis education and resources on bundle adherence can add to the growing body of evidence-based practice demonstrating its potential for early sepsis detection, prompt treatment, and reduced morbidity and mortality rates.
References


https://doi.org/10.1016/j.jen.2014.12.007


https://doi.org/10.1016/j.ajem.2015.08.039


https://doi.org/10.1097/ccm.0000000000003342


Appendix A

Statement of Determination

Student Project Approval: Statement of Determination

Title of Project

Early Sepsis Recognition: Improving Sepsis Education in a Medical-Surgical/Telemetry Unit

Brief Description of Project:

The aim of this quality improvement project is to improve sepsis bundle compliance to reduce sepsis-related morbidity and mortality rates in the medical-surgical/telemetry unit at Hospital X. Data collected from a pre-intervention questionnaire will reveal the gaps in knowledge for early sepsis recognition. Recommendations from current evidence-based practice and the survey will be presented to the nursing leadership team for implementation.

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). Students may proceed with implementation.

Comments:

Signature of Supervising Faculty ___________________________ (date) __________

Signature of Student ___________________________ (date) 5/15/2023
## Appendix B

### Literature Synthesis Table

<p>| Study Authors                        | Objective &amp; Design                                                                                                                                                                                                 | Sample &amp; Setting                                                                                                                                                                                                 | Results                                                                                                                                                                                                 | Level of Evidence |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Bruce, Maiden, Fedullo, &amp; Kim (2015) | This retrospective study explored patient charts for the consequences of the 3-hour SSC protocol, which included serum lactate measurement and blood cultures before the initiation of antibiotic treatment.             | This study reviewed charts of 195 patients who were diagnosed with severe sepsis or septic shock in the emergency department.                                                                                                         | Compliance with the SSC bundle improved antibiotic administration time. There was no significant difference in the setting’s mortality rate. Treatments that required a multidisciplinary approach complicated the process and led to substandard results. | Level III (Dang et al., 2022) |
| Hayden, Tuuri, Scott, Losek, Blackshaw, Schoenling, Nietert, &amp; Hall (2015) | This retrospective, quasi-experimental study inspected the effect of a sepsis workup and treatment protocol (SWAT) on patients with potential sepsis and septic shock.                                                | This study investigated 238 patients, who were admitted to the adult emergency department in an urban hospital.                                                                                                           | Early recognition of sepsis and septic shock, using an electronic health record triage alert and SWAT, decreased the initiation time of IV fluids and antibiotic treatment. | Level II (Dang et al., 2022) |
| Jacobs (2020)                        | This quasi-experimental study compared the patient readmission rates of those who received proper sepsis protocol and those who did not.                                                                                 | 238 patients admitted to an inpatient rehabilitation facility were studied.                                                                                                                                                                                                 | With the use of the sepsis protocol, 17 patients were detected with sepsis and 14 were missed. Despite implementing the sepsis protocol, not all elements were applied properly. A reduction in acute care readmissions with the compliance of sepsis protocol was exhibited. | Level II (Dang et al., 2022) |
| Semanco, Wright, &amp; Rich (2022)       | This retrospective study evaluated patients with potential                                                                                                                                                           | The sample included 32 patients in an                                                                                                                                                                                                                                     | The application of the sepsis protocol enabled the rapid response team to                                                                                                                                 | Level III (Dang et al., 2022) |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Findings</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taj, Brenner, Sulaiman, &amp; Pandian (2020)</td>
<td>This systematic review investigated optimal sepsis protocols used to improve sepsis mortality rates. The sepsis bundles were evaluated on their components, consistency of use, effect in the microsystem, effect on mortality rate, and challenges to protocol utilization.</td>
<td>Standardized and simplified sepsis protocols can improve compliance in settings where resources may be limited. Increased rates of adherence were demonstrated in sepsis protocol education. Even incomplete sepsis protocol implementation led to improved sepsis-related outcomes.</td>
<td>Level II (Dang et al., 2022)</td>
</tr>
<tr>
<td>Yan, Gustad, &amp; Nytrø (2021)</td>
<td>This systematic review investigated the use of machine learning (ML) and structured clinical data to identify sepsis early.</td>
<td>ML needed to be implemented with the addition of more structured documentation, such as vital signs, laboratory results, and medications. ML used text from clinical notes to identify sepsis, but further research needs to be performed to reach optimal results.</td>
<td>Level III (Dang et al., 2022)</td>
</tr>
</tbody>
</table>
Appendix C

Plan, Do, Study, Act (PDSA) Cycle

**PLAN**
- Collaborated with the leadership team regarding sepsis among multiple medical-surgical units
- Developed a specific aim statement on the unit of choice
- Generated a PICOT question
- Produced a proposal for approval
- Created data collection questionnaires

**DO**
- Assessed the microsystem using the 5 Ps
- Conducted a SWOT analysis
- Ran a root cause analysis
- Collected data passive and active observational data in the microsystem
- Administered questionnaires to the nurses
- Presented evidence-based recommendations to the leadership team on April 17, 2023
- Will implement recommended interventions presented and administer a post-intervention survey

**ACT**
- Will continue implementing suggested interventions
- Will monitor data post-intervention and make adjustments as needed

**STUDY**
- Will analyze data from post-surveys
- Will review data regarding sepsis bundle compliance post-intervention
Appendix D

Root Cause Analysis

ROOT CAUSE ANALYSIS: FISHBONE DIAGRAM
Appendix E

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

**SWOT ANALYSIS**

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sepsis bundles are available as a resource on the unit</td>
<td></td>
</tr>
<tr>
<td>• Implementation of online sepsis education</td>
<td>• Some staff have not received education on the sepsis bundle</td>
</tr>
<tr>
<td>• Easily accessible eCART in EPIC</td>
<td>• Lack of annual sepsis bundle compliance retraining</td>
</tr>
<tr>
<td></td>
<td>• Ineffective communication upon patient transfer</td>
</tr>
<tr>
<td></td>
<td>• Resistance to change among staff nurses</td>
</tr>
<tr>
<td></td>
<td>• Lengthy sepsis bundle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Increased compliance with sepsis protocol</td>
<td>• Time and cost allocated for re-education</td>
</tr>
<tr>
<td>• Reduced long-term hospital costs</td>
<td>• Documentation fatigue</td>
</tr>
<tr>
<td>• Increased infection control</td>
<td>• Staff burdened</td>
</tr>
<tr>
<td>• Increased efficiency and quality of care</td>
<td></td>
</tr>
<tr>
<td>• Decreased sepsis mortality/morbidity rate</td>
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Appendix F

Pre-Intervention Questionnaire

**Sepsis Education Questionnaire**
Hospital X QI Project 2023

- Have you received training on the sepsis bundle?
  - Yes
  - No

- If you answered "no" to receiving training on the sepsis bundle, why not?
  - Your answer

- On a scale of 0-10, how would you rate the effectiveness of the training method? (0 indicating no knowledge, 10 indicating a high level of knowledge).
  - 0 1 2 3 4 5 6 7 8 9 10

- Explain your rating for the effectiveness of the training method.
  - Your answer

- How accessible is the eCART?
  - Your answer
What challenges or barriers prevent nurses from adhering to the sepsis bundle?

Your answer

Do you feel the rapid response process is effective when managing the care of patients admitted with sepsis?

☐ Yes

☐ No

If you answered "no" to effective rapid response process for sepsis, what actions can be implemented to improve the process?

Your answer

What recommendations do you have for improving bundle compliance in your unit?

Your answer

Thank you!
Appendix G

Cost-Benefit Analysis

Estimated Cost of a Badge Reference Card
$300 per year

Estimated Cost of Sepsis Bundle Signage
$20 per year

Estimated Cost of Sepsis Knowledge Center Education Refresher Course (at $70/hr)
$7,700 per year

Total Estimated Cost: $8,020 per year

Compared To:

Total Average Cost of Sepsis Care for an estimated 12 instances of Patients with Sepsis-Related Complications: **$480,000 per year**
Appendix H

Gantt Chart

<table>
<thead>
<tr>
<th>TASK TITLE</th>
<th>START DATE</th>
<th>DUE DATE</th>
</tr>
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<tbody>
<tr>
<td><strong>Project Initiation</strong></td>
<td></td>
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<tr>
<td>Literature Review</td>
<td>2/1/23</td>
<td>3/1/23</td>
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<tr>
<td>Project Initiation Meeting with Leadership</td>
<td>2/9/23</td>
<td>2/9/23</td>
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<tr>
<td><strong>Project Planning</strong></td>
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<tr>
<td>On-Site Walkthrough</td>
<td>2/15/23</td>
<td>2/15/23</td>
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<td>Questionnaire Development</td>
<td>2/15/23</td>
<td>2/23/23</td>
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<tr>
<td>Project Proposal to Leadership</td>
<td>2/23/23</td>
<td>2/23/23</td>
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<tr>
<td>Microsystems Assessment</td>
<td>2/28/23</td>
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<tr>
<td><strong>Project Implementation</strong></td>
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<tr>
<td>Questionnaire Administration</td>
<td>3/1/23</td>
<td>4/8/23</td>
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<tr>
<td>Patient and Active Microsystem Observation</td>
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<tr>
<td><strong>Project Evaluation and Synthesis</strong></td>
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