Summer 2019

Improving Sepsis Bundle Compliance through Comprehensive Education

Stacy Mikel
Jacksonville State University, dmikel@jsu.edu

Improving Sepsis Bundle Compliance through Comprehensive Education

Stacy Mikel

Jacksonville State University

Department of Nursing

Chairs: Dr. Myrna Williamson & Dr. Leigh-Ann Keith

July 1, 2019

Table of Contents

Abstract

Purpose: The purpose of this project was to improve emergency department compliance with sepsis bundles by educating registered nurses and licensed practical nurses on the proper use of sepsis screening tools, make changes to screening tools identified through chart reviews, and finally to evaluate the impact of these changes once initiated. This project sought to increase staff knowledge using an educational module.

Methods: This project began with the delivery of a pre-test questionnaire. The facility's target audience was asked to complete this to determine their current knowledge level regarding sepsis. Once these questionnaires were completed, they were reviewed by the DNP student, and information regarding sepsis knowledge deficits was evaluated as a process evaluation through retrospective chart reviews.

Results: The hospital sites provided summary data of employee results on the Sepsis Questionnaire before and after training. A total of 29 hospital employees took the pre-test, and 20 took the post-test. The pre-test group received an average of 80.1% of the items correct. The post-test group scored an average of 71.4%, a decrease of 8.74%. This decrease is a surprising result, but a t-test showed that the decline was not statistically significant. Chi-square analysis indicated a significant difference between the North and South locations in the degree to which the Sepsis protocol was followed during January and February 2019. (1, N = 42) = 7.9406, p = .005. Although the percentage of cases in which the Sepsis protocol was not followed decreased from 33% to 24% from Quarter 4 of 2018 to the first two months of 2019, chi-square analysis showed that this change was not statistically significant (1, N = 131) = 1.0508, p = .305. The lack of a significant result does not indicate that the intervention was not effective; the small number of cases made a significant result less likely.

Keywords: Sepsis bundle, emergency department, nursing, protocol, SIRS criteria

Improving Sepsis Bundle Compliance through Comprehensive Education

Introduction

Sepsis is a severe and often fatal condition resulting from overwhelming systemic infection. Many different infections can lead to sepsis, which makes it challenging to diagnose. Early recognition and timely treatment of sepsis are integral to the improvement of patient mortality rates.

Background

Sepsis is a life-threatening organ dysfunction caused by an overwhelming systemic infection. Sepsis and septic shock are major healthcare problems that affect millions of people worldwide each year and kill as many as one in four patients (Rhodes et al., 2017). Similar to acute myocardial infarction or stroke, early identification and appropriate management in the first hours after the development of sepsis symptoms improve outcomes (Rhodes et al., 2017).

An estimated 1.7 million adult sepsis cases occur annually in the United States, contributing to 265,000 deaths each year (Dantes & Epstein, 2018). Sepsis presents in many ways. Anyone, from newborn to the elderly, is susceptible to this syndrome of life-threatening organ dysfunction. The clinical data used in identifying sepsis patients was adapted from the Sepsis-3 criteria, which relies on suspicion of infection and associated organ dysfunction, based on the sequential organ failure assessment (SOFA) score (Dantes & Epstein, 2018). Because there is no confirmatory diagnostic test, sepsis diagnosis requires clinical judgment based on evidence of infection and organ dysfunction. A 1991 consensus conference established a clinical definition based on the patient's systemic inflammatory response syndrome (SIRS) to infection. These clinical criteria were expanded in 2001 under the Sepsis-2 criteria. In response to the need for an increased understanding of sepsis, a task force again updated the clinical definitions in

2016. This update is known as Sepsis-3, and it "defined sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection, with clinical guidelines defining organ dysfunction" (Centers for Disease Control [CDC], 2018, p. 3) as an acute change in total Sequential Organ Failure Assessment (SOFA) score ≥2 points related to the infection (CDC, 2018).

If not appropriately treated, sepsis can be a debilitating disease. Therefore, early identification and rapid response are critical in slowing or stopping the progression of the illness. To improve hospitalization outcomes and reduce mortality associated with sepsis, the Surviving Sepsis Campaign (SSC) recommends the utilization of 3-hour and 6-hour bundles. These are elements of care that have demonstrated success in improving sepsis outcomes (Surviving Sepsis Campaign, 2016).

The Surviving Sepsis Campaign (SSC) was developed to provide guidelines for managing the problem of sepsis successfully and ultimately decrease sepsis mortality (Surviving Sepsis Campaign, 2016). The SSC bundle is designed to guide sepsis management, starting in the emergency department (ED) and continuing in the intensive care unit (ICU). Within the bundle are crucial elements that have a more significant effect than if individual orders were initiated when implemented as a set of orders. This order set includes blood collection for lactic acid and blood cultures, broad-spectrum antibiotics, and 30ml/kg crystalloid administered for hypotension or lactic acid greater than 4mmol/L, as well as antibiotics within three hours of the time of presentation.

Sepsis prevention activities led by the Centers for Disease Control (CDC) are focused on five key areas. According to Novosad et al. (2016):

> These areas include 1) increasing sepsis awareness among patients, families, and providers; "2) promoting early recognition of sepsis and aligning antibiotic stewardship efforts with early recognition; 3) identifying at-risk populations for prevention and early recognition efforts; 4) developing better sepsis surveillance methods to measure the impact of interventions; and 5) preventing infections that lead to sepsis, including infections caused by antibiotic-resistant pathogens" (p. 868).

Early signs of sepsis are often subtle. Detection of sepsis requires that a care provider be knowledgeable enough to identify the patient assessment changes, vital signs, and laboratory values. If sepsis goes undetected and is not treated promptly in the early stages, it progresses to septic shock. Early identification and treatment following the Surviving Sepsis Campaign Guidelines protocol have "been shown to significantly improve survival rates." (Vanzant & Schmelzer, 2011, p. 47). Based on data from the last decade, "31.5 million sepsis and 19.4 million severe sepsis cases would be expected to be treated in hospitals globally each year" (Fleischmann et al., 2016, p. 59). If the mortality "rates for sepsis and severe sepsis in the hospital setting from the last decade are applied to the estimated global incidence, sepsis may cause or contribute up to 5.3 million deaths worldwide" (Fleischmann et al., 2016, p. 59).

A thorough understanding of the epidemiology of sepsis is essential to guide the development of organizational strategies for prevention and early recognition. The burden of sepsis has been hard for healthcare organizations to quantify because there is no definitive diagnostic test, and sepsis diagnosis and identification can vary widely among care providers (Dantes & Epstein, 2018). Therefore, efforts must be focused on the education of providers on the risk factors, early warning signs, initial symptoms, and timely treatment of sepsis. Reliable sepsis surveillance is essential given its high burden, the importance of appropriate treatment,

and the new bundle compliance requirements. Identifying sepsis using consistent clinical criteria through electronic health record (EHR) data enhances confidence in sepsis estimates because clinicians under recognize sepsis and vary widely in their knowledge and application of sepsis definitions (Rhee et al., 2017). Because consistent clinical criteria through the EHR is essential, healthcare organizations must develop and maintain appropriate sepsis screening tools.

Problem Statement

Sepsis is a leading cause of critical illness and mortality and has been cited as the cause of more than one-third of all deaths in U.S. hospitals (Makic & Bridges, 2018). Despite being a global healthcare issue that kills more people than cancer, sepsis is still not widely known. Only about half of Americans have heard of sepsis, although approximately 258,000 people in the United States die due to it each year (Rebeaud, 2017). "If sepsis were identified and treated earlier, it has been estimated that there would be 92,000 fewer deaths annually, 1.25 million fewer hospital days annually, and reductions in hospital expenditures of over $1.5 billion" (Rebeaud, 2017, p. 26).

The lack of early identification of sepsis is a problem in facilities across the country. Currently, a rural healthcare organization in the southeast with two locations is experiencing issues with early identification and treatment of sepsis. As a result, their sepsis bundle compliance rates have decreased from 70% to 30% in the past year (Lead Quality Analyst, personal communication, June 2018). This project sought to determine if education on early signs of sepsis, along with instruction regarding the proper use of screening tools, would increase compliance. In a rural facility, did the education of care providers increase screening compliance, detection of patients at risk for or with sepsis, and improve bundle compliance?

This project sought to address the care provider's lack of knowledge of the early signs of sepsis. This lack of knowledge can prevent the timely delivery of care to the sepsis patient. Educational offerings on sepsis were conducted to address the knowledge deficit within the proposed facility. Within this facility, educational sessions were essential because of poor patient outcomes associated with delayed identification and treatment of sepsis patients.

The purpose of this project was to improve compliance with sepsis bundles by educating care providers hospital-wide on early identification, diagnosis, and prompt treatment of sepsis and the proper use of sepsis screening tools and, finally, by evaluating through chart reviews, the impact of these changes once initiated. An analysis of patient charts will be conducted to determine if the current sepsis paper tool is useful, and this information will be used to redesign the current EHR tool. Once the paper tool has been converted into the EHR, users will be trained on its proper use.

A questionnaire was developed to assess the knowledge of the nursing staff on the sepsis bundles. The questionnaire consisted of 25 multiple-choice questions covering all three-hour bundle requirements, time zero, proper antibiotics, fluid bolus questions, and the difference in sepsis, severe sepsis, and septic shock. Following the questionnaire's completion, an educational module was administered during two live sessions at each facility and made available via the hospital intranet. Two additional modules, designed to improve critical thinking related to sepsis, were made available via the hospital intranet. These education modules were required for all licensed practical nurses and registered nurses after completing the initial questionnaire. Participant knowledge level was reassessed following completion of the educational module using the same questions as the post-test. The questionnaire measured the care provider's knowledge level about sepsis, the bundle, and the tool's use. Chart reviews were then performed

comparing the fourth quarter 2018 (October, November, December 2018) to the first quarter of 2019 (January, February, March) to determine if screening tools are being utilized more consistently and if improvement has been made in bundle compliance.

Organizational Description of Project Site

The two facilities chosen for this project are located in the rural southeast and are located on opposite ends of a rural county. One of the facilities is a 150-bed facility located on the south end of the county, and the other facility is a 90-bed facility located on the north end of the county. Both facilities are at least a thirty-minute drive from larger, more technologically advanced healthcare facilities. Therefore, these facilities serve not only their county but other surrounding rural counties. According to facility administrators, both facilities have been struggling to promptly use all components of the SSC bundle (Physician Champion, personal communication, June 2018). Sepsis detection and bundle compliance rates have decreased from 70% to 30% over the last several quarters, according to the facility quality department (Lead Quality Analyst, personal communication, June 2018). The facility's sepsis physician champion has cited the lack of consistent use of the electronic tool and the lack of proper education as reasons for the decrease in bundle compliance (Physician Champion, personal communication, June 2018). The sepsis physician champion has developed and implemented a sepsis paper tool for use in the ED to help combat this problem. This tool replaces or augments the current electronic tool in its existing ED documentation software. The paper tool is not part of the medical record but is completed by ED personnel and then submitted to the quality department to monitor bundle compliance. Currently, the paper tools are only being used by the quality department as a means of flagging charts for bundle compliance review.

Review of Literature

Search Strategy

The DNP student conducted a literature search using EBSC's Cumulative Index to Nursing and Allied Health Literature (CINAHL), The Cochrane Library, Joanna Briggs Institute EBP Database, Google Scholar, and PubMed/MEDLINE databases. Keywords and combinations of words used for the search included sepsis protocol, sepsis, severe sepsis, septic shock, sepsis tool, sepsis education, surviving sepsis campaign, and sepsis bundle. Unless a study was significant to this project, the search was limited to English-language literature published within the last five years. Inclusion criteria consisted of studies conducted in the U.S. that evaluated the effect of implementing sepsis education on care delivery and outcomes of adult patients (age 18 years and older) hospitalized for sepsis. The DNP student reviewed article titles and abstracts to determine their relevance to this review. The full-text article was obtained and assessed for inclusion for studies whose significance could not be determined by evaluating only the title and abstract. Studies were excluded if the authors described the process of implementing a sepsis protocol without reporting its effect on patient care delivery.

Search Results

The purpose of the literature review was to provide support for the early identification of sepsis. Early identification of sepsis symptoms contributes to the timely initiation of the established sepsis bundles for early goal-directed therapy. The Surviving Sepsis Campaign Guidelines were developed and last updated in 2016 to combat the high incidence of sepsis and septic shock in hospitalized patients worldwide (Surviving Sepsis Campaign, 2016). One of the issues with sepsis and septic shock is the delay in identification and timely treatment. Treatment can only be initiated promptly if the care provider identifies the signs of sepsis and appropriately

follows the guidelines. The need for immediate implementation of antibiotics and fluid resuscitation in the initial hours of recognizing sepsis in the patient will influence the outcomes (Dellinger et al., 2013).

The Surviving Sepsis Campaign Guidelines recommend learning models to help educate care providers on pathophysiology related to the signs of early sepsis, which will, in turn, assist with the early identification of sepsis (Surviving Sepsis Campaign, 2016). Management of sepsis requires early goal-directed therapy for improving survival rates (Dellinger et al., 2013). When sepsis is not detected early, and the sepsis bundle is not initiated, the infection begins to overwhelm the body. Recognition of sepsis is one of the vital first steps that is considered a "critical component of reducing mortality" (Dellinger et al., 2013, p. 173). Sepsis bundles focus on early intervention with the one, three, and six-hour bundles that include specific measures to be completed to improve outcomes. The effects of timely recognition and treatment have been studied worldwide (Vilella & Seifert, 2014).

A critical area of research was a retrospective case-control study conducted to determine the patient's clinical outcomes related to the amount of time in the emergency room from diagnosis to initiation of the first intravenous antibiotic treatment (Vilella & Seifert, 2014). The time from diagnosis of sepsis to intravenous antibiotics is often called the "golden hour" (Vilella & Seifert, 2014, p. 7). In this study, the time frame from recognition to treatment was compared to the treatment recommendations for patients that presented with acute myocardial infarction or stroke. Improved outcomes depend on early identification and prompt treatment in sepsis, just as in acute myocardial infarction and stroke (Vilella & Seifert, 2014).

Continuing education, development of established protocols that are consistently implemented, and data collection and measurement are recommended to improve the process for

sepsis identification (Dellinger et al., 2013). Knowledge of the protocols used to detect and treat early sepsis is associated with improved performance by providers. The education process helps change behavior related to sepsis, which improves outcomes for the patient (Dellinger et al., 2013). The research was performed on the implementation of an educational program for sepsis management guidelines in a community hospital. One observational cohort study implemented a quality improvement program based on the Surviving Sepsis Campaign guidelines (Nguyen, Schiavoni, Scott, & Tanios, 2012). The sepsis program provided a consistent protocol to follow when sepsis was detected. Improvement in care was evidenced by the timely intervention and increased survival rates in twenty cases (Nguyen et al., 2012).

The Surviving Sepsis Campaign Guidelines (2016) site offers evidence-based recommendations directly related to the bundles. The three and six-hour bundles include the background, limitations, implications, and grading of the evidence. When implemented as a group, the Surviving Sepsis Campaign bundles have been shown to affect outcomes beyond implementing the individual elements alone (Surviving Sepsis Campaign, 2016). The literature provides the care provider with an understanding of the people at higher risk for sepsis and the need for early detection. The central theme discussed in the literature is early detection and intervention. Clear guidance for implementing the Surviving Sepsis Campaign bundles was provided to help the nurse follow the established protocols.

According to Li, Xi, Luo, Li, and Li (2013), the mortality rate decreased dramatically as more bundle elements were achieved. The study noted that the mortality rate dropped to 25% with full bundle compliance, whereas the mortality rate soared to greater than 34% when four or fewer elements were completed. A quality improvement program launched by the SSC committee and the Institute for Healthcare Improvement extended SSC guidelines into

bundles of care aimed to improve sepsis patient outcomes (Levy et al., 2010). According to Levy et al. (2010), participating facilities with developed protocols were associated with increased bundle compliance, better patient outcomes, and reported a mortality reduction from 37% to 30.8%.

Evidence-Based Practice: Verification of Chosen Option

A review of the literature demonstrates the importance of early detection of sepsis. According to research, early recognition and prompt treatment improve the survival rate for the sepsis patient (Vazant & Schmelzer, 2011). A literature review has shown that the implementation of a mandatory program designed to educate providers on the signs of sepsis can contribute to higher survival rates (Nguyen, Schiavoni, Scott, & Tanios, 2012). An educational module was presented via the hospital intranet and in live sessions to assist the chosen facilities in increasing bundle compliance. This multi-session program provided education on the importance of early identification and timely treatment of sepsis. Bundle elements were addressed within the program to allow participants to understand the driving factors of the facility's sepsis protocols. The effectiveness of the current sepsis paper tool was evaluated as well, and those results were used to redesign the existing EMR tool. Participants' knowledge level was assessed pre and post completion of the educational module using the same 25-question multiple-choice questionnaire.

Theoretical Framework/Evidence-Based Practice Model

One of the most well-known and widely used evaluation models for educational programs is the four-level evaluation model by Donald Kirkpatrick (Reio, Rocco, Smith, & Chang, 2017). This theoretical framework is Kirkpatrick's learning evaluation theory (Appendix A). It was used in this project as a basis for developing and assessing the effectiveness of the

educational offering. The Kirkpatrick model focuses on evaluating how participants react to an educational offering, what they are learning, and how this newly acquired knowledge changes their behavior related to clinical practice. Finally, the model focuses on the results that educational offerings have on desired outcomes (Simpson & Scheer, 2016). Educational offerings must begin with desired results in mind, and then the educator must determine what behavior is needed to accomplish them. Educators are responsible for determining the attitudes, knowledge, and skills necessary to achieve the educational offering's desired results. The challenge is to present educational offerings in a way that enables the participants not only to learn what they need to know but also to react favorably to the program (Kirkpatrick & Kirkpatrick, 2009). Kirkpatrick defined four levels related to the evaluation of learning: reaction, learning, behavior, and results (Kurt, n.d.).

Level 1 focuses on the learner's reaction to the program. At this level, comments about the training content, materials, instructors, facilities, delivery methods, etc. are solicited to measure how participants react to the training (Reio et al., 2017). Kirkpatrick's Level 2 is dedicated to the content evaluation, the examination of what employees learned as a result of participating in the educational offering. Kirkpatrick defined learning "as the extent to which participants change attitudes, improve knowledge," and increase skill as a result of attending the program (Reio et al., 2017, p. 2). Learning occurs when training is understood and if there was an increase in knowledge, skills, or experience. Level 3 measures participants' job performance by determining the extent to which they apply their newly acquired knowledge and skills on the job (Reio et al., 2017). Behavior demonstrates whether the learned information is being utilized. At Level 4, organizations seek measurable results for their training efforts. At this level,

organizations attempt to measure actual changes due to educational offerings and place a value on those changes (Reio et al., 2017).

Results establish whether the educational material had a positive impact on the organization. Reactions can be measured by using anonymous forms that encourage comments and are based on learning outcomes. The response to a program by participants can be used to improve subsequent sessions. Learning can be measured statistically through testing. Behavior evaluation may include a post-program appraisal. Results can be evaluated by questionnaires, participant data collection and analysis, and productivity measurement after completion of the program.

Level 1 of Kirkpatrick's model was assessed during the educational offerings using anonymous feedback from participants. The results of this feedback were used to guide future educational offerings. Within this project, the pre and post questionnaire measured the second step of Kirkpatrick's learning evaluation theory: learning through an increase in knowledge score after educational activity. The third and the fourth steps in Kirkpatrick's learning evaluation theory were evaluated by assessing changes in speed and accuracy when managing patients presenting with sepsis and were measured by collecting data on bundle compliance (Kurt, n.d.).

Goals, Objectives, and Expected Outcomes

This project's overarching goal was to improve bundle compliance through the early identification of patients with or at risk for sepsis after a mandatory education offering. This project aimed to increase knowledge of early signs of sepsis and the treatment protocols outlined by the SSC bundle through an educational offering directed towards licensed practical nurses and registered nurses in a rural healthcare facility. The education-related to sepsis was designed to improve care providers' expertise in detecting subtle changes early during sepsis and then

implementing the evidence-based interventions recommended by the 2016 Surviving Sepsis Campaign guidelines.

Sepsis and septic shock are medical emergencies, and the best practice recommendation of the 2016 SSC guideline is that treatment and resuscitation begin immediately to reduce sepsis mortality (Rhodes et al., 2017). Despite the availability of evidence-based guidelines for the management of sepsis and their association with improved patient outcomes, mortality remains high, and implementation and adherence to the guidelines have not yet become routine practice (Dellinger et al., 2013). The SSC bundle recommends training and skills development to increase the incidence of early detection of sepsis. Continuing education regarding the importance of early detection and timely treatment of sepsis is paramount. For this reason, within this and other facilities, educational offerings are needed to increase bundle compliance and ultimately reduce sepsis mortality rates.

This project was designed and implemented by the DNP student, with assistance from the physician champion, quality analysts, education directors, and the information technology (IT) department at the facilities. The DNP student developed educational materials based on the 2016 Surviving Sepsis Campaign regarding the early indications of sepsis. In conjunction with the physician champion, The DNP student provided education on the proper use of the facility's current sepsis paper tool. With assistance from the education directors and IT department, the DNP student implemented the use, via hospital intranet, of Septris, an interactive game to promote critical thinking related to the identification and treatment of sepsis ("Septris," 2014). The DNP student also presented case studies via the hospital intranet to educate licensed practical nurses and registered nurses about sepsis. Following the completion of this eight-week educational offering, the DNP student, with the assistance of a statistician, evaluated pre- and

post-educational results related to the identification of sepsis with the assistance of the facility quality analysts.

The proposed objectives of this project were: 1) increase the consistent use of the sepsis tool following completion of the educational offering, 2) increase sepsis recognition by participants following completion of the educational offering, 3) increase sepsis bundle compliance following the conclusion of the educational offerings, and 4) implement a long-term sepsis educational offering which can be sustained by the facility's education department.

The educational offering sought to answer the following questions:

Does the licensed practical nurse, registered nurse, nurse practitioner, or physician identify early laboratory changes related to sepsis following an educational offering?

Does the licensed practical nurse, registered nurse, nurse practitioner, or physician identify early clinical signs related to sepsis following an educational offering?

Does the licensed practical nurse, registered nurse, nurse practitioner, or physician identify Surviving Sepsis Campaign Guidelines following an educational offering?

The expected outcomes of the project were increased early recognition of sepsis and increased bundle compliance. The outcomes were measured through concurrent and retrospective chart reviews and were monitored over three months with the assistance of the facility's quality analysts.

Project Design

The purpose of this project was to improve bundle compliance through the early identification of patients with or at risk for sepsis after a mandatory educational offering. This project aimed to increase knowledge of early signs of sepsis and the treatment protocols outlined

by the SSC bundle through an educational offering directed towards licensed practical nurses and registered nurses in two rural healthcare facilities.

Because SSC recommends the initiation of sepsis bundles by the healthcare teams (Rhodes et al., 2017), it is imperative that facilities provide extensive education to staff on their use. The sepsis bundle is a set of evidence-based elements of care designed to be implemented together to improve patient outcomes. The recommended sepsis bundle includes the collection of blood cultures before the administration of intravenous broad-spectrum antibiotics, early fluid resuscitation, and the collection of a lactate level (Smith & Zolotorofe, 2018). Facility compliance with these bundles has been shown to improve patient outcomes and decrease mortality in patients with sepsis (Smith & Zolotorofe, 2018).

Because "approximately every third patient with severe sepsis is admitted through the ED, recognizing these cases and initiating appropriate treatment is of utmost importance" (Morr, Lukasz, Rubig, Pavenstadt, & Kumpers, 2017, p. 2). Sepsis continues to be under-recognized in the chosen facility’s ED (Physician Champion, personal communication, June 2018). The facility recognized the need to incorporate process improvement plans to screen for patients in the ED. Therefore, administrators agreed to the addition of a comprehensive educational offering for their staff.

Current evidence from the 2016 SSC guidelines, webinars, and literature review guided the development of the educational materials needed to accomplish this project. Input from the facility's physician champion, quality analyst, and the ED medical director helped to narrow the focus of this project and provide education related to the facility's specific needs. Data for this project was obtained using a quantitative, longitudinal study research methodology over three months.

Project Site and Population

The facilities chosen for this project are in the rural southeast. The healthcare organization has two facilities located on opposite ends of a rural county. While each of the two facilities has a larger, more technologically advanced healthcare facility within thirty minutes of their location, the county is large, and these two facilities service the majority of the population, as well as those in the surrounding rural counties. One of the facilities is a 150-bed facility located on the south end of the county, and the other facility is a 90-bed facility located on the north end of the county. Both facilities offer moderate-sized emergency departments, intensive care units (ICU), surgical services, cath labs, obstetric units, and a psychiatric unit in the facility on the county's north end. For the most part, the facilities can meet the needs of their population, but generally transfer critical patients to the more comprehensive facilities nearby (Physician Champion, personal communication, June 2018).

Implementation Plan/Procedures

"Based on data from the Joint Commission Center for Transforming Healthcare (JCCTH), sepsis has an estimated mortality rate of 25% to 50% and costs patients, health care facilities, and insurance companies an estimated $17 billion per year combined. Research suggests that with early screening, recognition, and treatments, outcomes related to sepsis can be improved" (Walters, 2018, p. 224). The facilities were chosen for this project because they have recognized a need for increased education about sepsis to increase bundle compliance (Physician Champion, personal communication, June 2018).

During the planning phase of this project, the facility's physician champion, quality analyst, and ED medical director were heavily involved with streamlining the educational offering to meet the specific needs of the facility. The target audience for the educational

offerings were the licensed practical nurses and registered nurses working in the ED of each facility. The educational offerings were delivered via the hospital intranet along with two live sessions at each facility. The sessions were implemented with the assistance of the facility's education directors and IT department. Following the completion of the educational offerings, the facility quality analysts were instrumental in assisting the DNP student with chart reviews to determine sepsis bundle compliance.

Setting Facilitators and Barriers

A joint effort by the Society of Critical Care Medicine and European Society of Intensive Care was started in 2004 to reduce sepsis mortality by launching SSC, which established a set of clinical practice guidelines for the management of severe sepsis and septic shock based on evidence-based studies (Dellinger et al., 2013). The goal of the SSC is to increase health care providers' awareness and improve the outcomes of patients with sepsis, and the SSC states that hospitals benefit from programs to identify sepsis. SSC improvement projects have been historically aimed at early recognition of sepsis using screening tools based on the sepsis care bundles. Research has shown that delays in screening delay the identification of sepsis and, therefore, essential, life-saving treatment is postponed (Walters, 2018).

A 2017 study states that potential barriers to sepsis education programs include insufficient resources to implement training, inadequate training, poor communication, teamwork, and a lack of feedback on performance (Roberts, Hooper, Lorencatto, Storr, & Spivey, 2017). Potential facilitators include participants' confidence in their knowledge and skills when performing the bundle and their belief that the bundle will improve patient outcomes (Roberts et al., 2017).

Employee participation was one potential barrier to the success of this project. Although the educational offerings were mandatory, education directors have cited difficulty ensuring that all employees complete required learning modules due to different work schedules (Facility N Education Director, personal communication, June 2018). To ensure maximum participation, the ED medical director and charge nurse scheduled mandatory education sessions for employees (ED Medical Director, personal communication, June 2018). During these education sessions, employees were expected to complete the compulsory educational offerings. By requiring these sessions, the DNP student sought to ensure 100% participation; however, not all employees participated in the offerings (Facility N Education Director, personal communication, March 2019). After completion of the post-test questionnaire, the facility education director reviewed the results and reported that historically staff within the facility did not take learning management system requirements seriously and often took the associated tests quickly, without preparation, to remove them from their requirements (Facility N Education Director, personal communication, March 2019).

Implementation Plan/Procedures

This project began with the delivery of a pre-test questionnaire, which a facility's target audience was asked to complete to determine their current sepsis knowledge level. Once questionnaires were completed, they were reviewed, and information regarding sepsis knowledge deficits within the facility was used to further guide the educational offering.

The educational materials were developed based on the 2016 Surviving Sepsis Campaign regarding the early indications of sepsis. The materials included education on the proper use of the facility's current sepsis paper tool, Septris, an interactive game to promote critical thinking related to the identification and treatment of sepsis ("Septris," 2014), and sepsis case studies.

These were delivered via the hospital intranet in four modules to educate licensed practical nurses and registered nurses about sepsis. The timeline for participant completion of the three modules was eight-weeks and was a mandatory requirement within the hospital learning management system. Following the educational offering's completion, the same questionnaire was administered to participants and then reviewed to determine if an increase in sepsis knowledge had occurred. After review of the post-test questionnaires, additional education may be provided if requested by the facility. Following the completion of the educational offerings, chart reviews were performed with the assistance of the quality analysts to determine if there has been any effect on bundle compliance.

Measurement Instruments

The following instruments were used to measure the outcomes of the DNP project: 1) pre-test questionnaire, 2) the same questionnaire administered as a post-test (Appendix B), and 3) current and retrospective chart reviews.

A sepsis-specific abstraction tool (Appendix C) provided by the quality department was used to gather results before and after the implementation of the sepsis educational offerings. The abstraction tool downloaded from the quality department abstraction site analyzed three-hour bundles results based on CMS guidelines for sepsis guideline compliance (Care Discovery Quality Measures, n.d.). The three-hour sepsis early intervention bundles include the following:

- Measure lactate level,
- Obtain two blood cultures before administration of antibiotics,
- Administer broad-spectrum antibiotics, and

- Administer 30ml/kg of crystalloid fluids for hypotension (systolic blood pressure less than 90) or lactate level greater than or equal to 4 mmo/L (Surviving Sepsis Campaign, 2016).

Completed chart reviews were used to determine if educational offerings had an impact on sepsis bundle compliance.

Data Collection Procedures

Approval for this project was obtained from facility administrators before the beginning of the educational offerings. Participation by ED nursing staff was mandatory, and no control groups were utilized for the project. Pre and post-test questionnaires were completed anonymously via the hospital intranet to maintain participant confidentiality. Staff members were educated on the purpose of the questionnaire and how results will guide educational offerings. Completed questionnaires were secured within password-protected learning management, accessible only by the facility's education directors. The staff had approximately four weeks to complete the pre-test questionnaire. This time frame was decided upon with the assistance of the facility education director to allow adequate time for all to finish.

The educational offering was available via the hospital intranet over an eight-week time frame to allow the staff to participate and minimize the barriers associated with completing the requirements. The educational sessions were administered in four parts, and each section had to be completed before progression to the next session. The first session was a comprehensive sepsis module based on SSC guidelines. The second session outlined the proper use of the facility’s current sepsis paper tool. The third session included sepsis case studies designed to foster understanding of sepsis and promote critical thinking skills. The last session involved the

use of the interactive game, Septris ("Septris," 2014). In addition to the learning management system modules, two live sessions at each facility were conducted by the DNP student at the request of the ED Medical director (ED Medical Director, personal communication, June 2018).

Following the completion of the educational offerings, the staff was required to take the post-test questionnaire. With the assistance of a statistician, the DNP student compared the sepsis knowledge level before and after educational offering to determine if the basic knowledge of sepsis increased. The DNP student and preceptors agreed that a 50% knowledge increase would be considered acceptable. Analysis of the results of these questionnaires was used to determine if any additional education was needed based on the pre-determined percentages of a 50% increase in knowledge level.

Following the completion of the educational offerings, concurrent and retrospective chart reviews were performed. These chart reviews compared the fourth quarter (4Q) 2018 sepsis bundle compliance to the first quarter (1Q) 2019 and sought to determine if education affected an increase in sepsis bundle compliance. Indicators of compliance which were reviewed included initial measurement of lactate level; obtainment of a blood culture before antibiotic administration; administration of broad-spectrum antibiotics; fluid resuscitation with 30 ml/kg of a crystalloid solution for hypotension or lactic acid level greater than or equal to 36 mg/dL if applicable. Administration of vasopressors for hypotension with a Mean Arterial Pressure (MAP) less than or equal to 65 mmHg despite fluid resuscitation efforts, if applicable; and measurement of Central Venous Pressure (CVP) for persistent arterial hypotension were also evaluated.

Charts with a diagnosis of sepsis at any stage of stay were reviewed. Selected charts were evaluated for the proper use of the current sepsis screening tool. The next area for review was to determine if a lactate level was drawn within the time frame outlined in the SSC guidelines. If

this was not drawn, then the chart did not meet bundle compliance. Two sets of blood cultures must be drawn before antibiotic administration; if they are not, the chart did not meet bundle compliance. If a broad-spectrum antibiotic was not administered within three hours of recognition of possible sepsis, bundle compliance was not met. If the patient had either a lactate level greater than 4 mmol/L or hypotension with systolic blood pressure less than 90 mmHg and a fluid bolus of 30 ml/kg was not administered within the first three hours of recognition of two or more SIRS criteria, then bundle compliance was not met. If all interventions were met during the three-hour time frame, the chart was considered to have met sepsis bundle requirements (Surviving Sepsis Campaign, 2016).

Data Analysis

A paired-samples t-test is a statistical test used to compare the mean scores for the same group of people on two different occasions. The two requirements for a paired t-test is one categorical independent variable (before education and after education) and one continuous, dependent variable (knowledge of sepsis bundles) measured on two different occasions (Sylvia & Terhaar, 2014). The t-test was used to determine if there is an increase in sepsis knowledge as a result of the educational offering.

Chart abstractions based on Centers for Medicare and Medicaid Services (CMS) sepsis guidelines for three-hour bundles were performed to determine if the educational offering and the resulting increased knowledge of sepsis affected bundle compliance. Each variable of the three-hour bundle (lactate level, blood cultures, fluid administration, and antibiotic administration) was analyzed individually within the abstracted chart. The results of the abstractions were tracked with a spreadsheet. A yes or no response was denoted, based on whether the sepsis bundle interventions were completed per CMS sepsis guidelines.

A questionnaire was used to assess participant knowledge of sepsis and bundle compliance guidelines before and after the educational offering. The questionnaire was developed by the DNP student based on knowledge gained through the SSC guidelines. The questionnaire was administered to licensed practical nurses and registered nurses to assess their general knowledge of sepsis, the sepsis screening tool, and the three-hour sepsis bundles. This questionnaire was placed on the hospital's learning management system. This learning management system is the method used for all online clinical education within the facilities. The questionnaire consisted of twenty-five multiple-choice questions covering information on the three-hour bundle requirements, time zero, proper antibiotics, fluid bolus questions, and the difference in sepsis, severe sepsis, and septic shock.

Studies have shown that the utilization of educational programs regarding sepsis, sepsis toolkits, and sepsis bundle compliance improve facility processes and lead to desired patient outcomes (Barochia et al., 2010). A four-module education presentation developed by the DNP student, based on SSC guidelines, was made available to staff in the learning management system. This eight-week educational offering was available after the completion of the pre-test questionnaire. The same staff members who initially took the pre-test questionnaire were assigned the same questionnaire as a post-test to be completed after the education. The questionnaire results were analyzed to determine if the current sepsis educational offering was effective in increasing the knowledge level of participants.

The specific data examined was the compliance with the three-hour bundle early sepsis interventions for the fourth quarter (4Q) 2018 and the first quarter (1Q) 2019. This data was examined to determine if the educational offering positively impacted the staff's knowledge level and the sepsis three-hour bundle compliance rate.

According to an article published by Venkatesh et al. (2018), the mean hospital sepsis bundle compliance rate was 54 %. The site chosen for this project has a compliance rate of 30% as of 1Q data 2018 compiled by the quality department (Lead Quality Analyst, personal communication, June 2018). This project sought to improve facility bundle compliance to a minimum of 54% as determined by the physician champion.

Cost-Benefit Analysis/Budget

There were no costs associated with this project. The DNP student developed all materials for the educational offering and administered their dissemination via the learning management system with the facility's education directors' assistance.

The implementation of a comprehensive sepsis educational offering based on the evidence-based recommendations of the Surviving Sepsis Campaign guidelines may lead to better delivery of care to patients with sepsis and improved patient outcomes. Implementation of a sepsis education program may also increase the frequency, timeliness, and appropriateness of diagnostic and therapeutic interventions for patients presenting with sepsis.

Timeline

The pre-test questionnaire was administered to staff over two weeks before the beginning of the educational offering. This period began in January 2019. The post-test questionnaire was administered over two weeks following the completion date of the educational offering. This period ended in March 2019. The four-part educational offering was available via the hospital learning management system for eight weeks.

Ethical Considerations/Protection of Human Subjects

Before the DNP project was initiated, approval was obtained from the Jacksonville State University Institutional Review Board (IRB). The project was designed as a quality improvement

initiative for the facilities involved. The information collected from patient charts was abstraction data related to CMS sepsis bundle compliance. This project required no direct contact with patients being treated within the facilities. No actual patients or family members were interviewed. Health Insurance Portability and Accountability Act (HIPAA) compliance was maintained per facility protocol during the abstraction of data from patient charts, and no patient identifiers were collected. For these reasons, the project was eligible for expedited review and exempt status from the IRB.

Conclusion

The hospital sites provided summary data of employee results on the Sepsis Questionnaire before and after training. Online statistical tools were used rather than SPSS to analyze because only summary data, not raw data, was available. Chi-square analysis was conducted on the overall pass/fail rate for the instrument and each question. The results are summarized below.

There were significant limitations in the data. The small pre-test group at the north location and the small post-test group at the south location made comparing the two sites impossible. The two pre-test groups were combined for analysis, as were the two post-test groups.

A total of 29 hospital employees took the pre-test, and 20 took the post-test. The pre-test group got an average of 80.1% of the items correct. The post-test group scored an average of 71.4%, a decrease of 8.74%. This decrease is a surprising result, but a t-test showed that the decline was not statistically significant.

What accounts for the widespread decrease in scores and the significant changes in three items? It could be that the training was not sufficient and needs to be improved. However, there

are other possible reasons for the score decrease. One is the small sample size. For a small study such as this one, a change of just a few responses changes the percentages by a significant amount. A second possibility is that of type I errors or false positives. With a significance level of $p = .05$, it would be expected that false positives are the reason for the score decrease. A third possibility is that the pre-test and post-test samples were different. The data show that most of the pre-test respondents worked at the south location. A majority of the post-test respondents worked at the north location; there could be other differences in the pre-test and post-test groups that might account for the decrease (years of experience, for example). Unfortunately, the available data did not allow for demographic comparison between the pre- and post-test groups.

Further data analysis was conducted comparing bundle compliance for the fourth quarter of 2018 and the first two months of the first quarter of 2019. Unfortunately, upon completion of the project, due to coding delays, data was unavailable for the last month of the first quarter of 2019.

Chi-square analysis indicated a significant difference between the north location and the south location in the degree to which the Sepsis protocol was followed during the last quarter of 2018. $X^2(1, N = 89) = 8.3262$, $p = .004$. Chi-square analysis also indicated a significant difference between the north location and south location in the degree to which the Sepsis protocol was followed during January and February 2019. $X^2(1, N = 42) = 7.9406$, $p = .005$.

Although the percentage of cases in which the Sepsis protocol was not followed decreased from 33% to 24% from Q4 of 2018 to the first two months of 2019, chi-square analysis showed that this change was not statistically significant $X^2(1, N = 131) = 1.0508$, $p = .305$. The lack of a significant result does not indicate that the intervention was not effective; the small number of cases made a significant result less likely.

Implications for Nursing Practice

Upon completion of the project, the DNP student was able to participate in sepsis chart review round-table discussions with the sepsis physician champion and ED nurses from each facility. These round-table discussions were the results of suggestions obtained during face-to-face educational sessions. During these sessions, the charts in which the sepsis bundle was not followed were reviewed and discussed with the nurses involved. These sessions were productive, with many nurses stating that they understood more about sepsis as a result.

The sepsis physician champion plans to continue these round-table discussions quarterly to increase sepsis bundle compliance. The facility's education directors have expressed interest in using the DNP student's educational modules in their annual facility educational requirements. Approval of the addition of these materials is pending.

Nurses are the first line of defense when dealing with sepsis. If adequately educated to follow sepsis guidelines consistently, nurses will be able to promptly identify sepsis, notify the doctors, and promptly implement sepsis interventions. The application of a comprehensive educational program can support and guide nurses in early identification of sepsis care and may ultimately decrease sepsis mortality rates.

References

Barochia, A. V., Cui, X., Vitberg, D., Suffredeni, F., O'Grady, N. P., Banks, S. M., ... Eichacker, P. Q. (2010). Bundled care for septic shock: an analysis of clinical trials. *Critical Care Medicine, 38*(2), 668-678. http://dx.doi.org/10.1097/CCM.0b013e3181cb0ddf.

Care Discovery Quality Measures. (n.d.). https://cdqualitymeasures.truvenhealth.com

Centers for Disease Control. (2018, March). *Hospital toolkit for adult sepsis surveillance* [Press release]. Retrieved from https://www.cdc.gov/sepsis/pdfs/Sepsis-Surveillance-Toolkit-Mar-2018_508.pdf

Dantes, R. B., & Epstein, L. (2018). Combatting sepsis: A public health perspective. *Clinical Infectious Diseases*. http://dx.doi.org/10.1093/cid/ciy342

Dellinger, R. P., Levy, M. M., Rhode, A., Annane, D., Gerlach, H., Opal, S. M., ... Moreno, R. (2013). Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. *Critical Care Medicine, 4*(2), 580-637. http://dx.doi.org/10.1097/CCM.0b013e31827e83af

Fleischmann, C., Scherag, A., Adhikari, N. K., Hartog, C. S., Tsaganos, T., Schlattmann, P., ... Reinhart, K. (2016, February 1). Assessment of global incidence and mortality of hospital-treated sepsis: Current estimates and limitations. *American Journal of Respiratory and Critical Care Medicine, 193*(3), 259-272. http://dx.doi.org/10.1164/rccm.201504-0781OC

Kirkpatrick, J., & Kirkpatrick, W. K. (2009). *The Kirkpatrick four levels: A fresh look after 50 years 1959 - 2009* [White paper]. Retrieved from Kirkpatrick Partners: https://www.kirkpatrickpartners.com/Portals/0/Storage/Kirkpatrick%20Four%20Levels%20white%20paper%20updated%2010%2009.pdf?ver=2017-03-17-073928-257

Kurt, S. (n.d.). Kirkpatrick Model: Four levels of learning evaluation. Retrieved from https://educationaltechnology.net/kirkpatrick-model-four-levels-learning-evaluation/

Levy, M. M., Dellinger, R. P., Townsend, S. R., Linde-Zwirble, W. T., Marshall, J. C., Bion, J., ... Angus, D. C. (2010). The Surviving Sepsis Campaign: results of an international guideline-based performance improvement program targeting severe sepsis. *Critical Care Medicine*, *38*(2), 367-374. http://dx.doi.org/10.1097/CCM.0b013e3181cb0cdc

Li, Z. Q., Xi, X. M., Luo, X., Li, J., & Jiang, L. (2013). Implementing surviving sepsis campaign bundles in China: a prospective cohort study. *Chinese Medical Journal*, *126*(10), 1819-1825. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed

Makic, M. F., & Bridges, E. (2018). CE: Managing sepsis and septic shock: Current guidelines and definitions. *American Journal of Nursing*, *118*(2), 34-39. http://dx.doi.org/10.1097/01.NAJ.0000530223.33211.f5

Morr, M., Lukasz, A., Rubig, E., Pavenstadt, H., & Kumpers, P. (2017). Sepsis recognition in the emergency department: Impact on quality of care and outcome? *BMC Emergency Medicine*, *17*(11), 2-8. http://dx.doi.org/10.1186/s12873-017-0122-9

Nguyen, H. M., Schiavoni, A., Scott, K. D., & Tanios, M. A. (2012, July). Implementation of sepsis management guideline in a community-based teaching hospital: Can education be potentially beneficial for septic patients? *International Journal of Clinical Practice*, *66*(7), 705-710. http://dx.doi.org/10.1111/j.1742-1241.2012.02939.x

Nguyen, H., Schiavoni, A., Scott, K., & Tanios, M. (2012). Implementation of sepsis management guidelines in a community-based teaching hospital-can education be potentially beneficial for septic patients? *International Journal of Clinical Practice, 66*(7), 705-710. http://dx.doi.org/10.1111/j.1742-1241.2012.02939.x

Novosad, S. A., Sapiano, M. R., Grigg, C., Lake, J., Robyn, M., Dumyati, G., ... Epstein, L. (2016). *Vital signs: Epidemiology of sepsis: prevalence of health care factors and opportunities for prevention*. Retrieved from MMWR: Morbidity and Mortality Weekly Report: https://www.cdc.gov/mmwr

Rebeaud, F. (2017). Timely identification of sepsis: Has the time (finally) come? *Medical Laboratory Observer*, *49*(8), 26-28. http://dx.doi.org/10.1002/nha3.20178

Reio, T. J., Rocco, T. S., Smith, D. H., & Chang, E. (2017). A critique of Kirkpatrick's evaluation model. *New Horizons In Adult Education & Human Resource Development*, *29*(2), 35-53. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1139075&site=eds-live

Rhee, C., Dantes, R., Epstein, L., Murphy, D. J., Seymour, C. W., Iwashyna, T. J., ... Klompas, M. (2017, October 3). Incidence and trends of sepsis in US hospitals using clinical vs. claims data, 2009-2014. *JAMA*, *318*(13), 1241-1249. http://dx.doi.org/10.1001/jama.2017.13836

Rhodes, A., Evans, L. E., Alhazzani, W., Levy, M. M., Antonelli, M., Ferrer, R., ... Gerlach, H. (2017). Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock: 2016. *Intensive Care Medicine*, *43*(3), 304-377. http://dx.doi.org/10.1007/s00134-017-4683-6

Roberts, N., Hooper, G., Lorencatto, F., Storr, W., & Spivey, M. (2017). Barriers and facilitators towards implementing the Sepsis Six care bundle (BLISS-1): a mixed methods investigation using the theoretical domains framework. *Scandinavian Journal of Traum, Resuscitation, and Emergency Medicine*, *25*(96). http://dx.doi.org/10.1186%2Fs13049-017-0437-2

Septris. (2014). Retrieved July 9, 2018, from http://med.stanford.edu/septris/

Simpson, J. S., & Scheer, A. S. (2016). A review of the effectiveness of breast surgical oncology fellowship programs utilizing Kirkpatrick's evaluation model. *Journal of Cancer Education*, *31*(3), 466-471. http://dx.doi.org/10.1007/s13187-015-0866-4

Smith, S., & Zolotorofe, I. (2018). Sepsis screening for ambulatory care nursing. *AAACN Viewpoint*, *40*(3), 3-7. Retrieved from http://web.b.ebscohost.com.lib-proxy.jsu.edu

Surviving Sepsis Campaign. (2016). http://www.survivingsepsis.org

Sylvia, M. L., & Terhaar, M. F. (2014). *Clinical analytics and data management for the DNP*. New York, NY: Springer Publishing Company.

Vanzant, A., & Schmelzer, M. (2011). Detecting and treating sepsis in the emergency department. *Journal of Emergency Nursing*, *37*(1), 47-54. http://dx.doi.org/10.1016/j.jen.2010.06.020

Venkatesh, A. K., Slesinger, T., Whittle, J., Osborn, T., Aaronson, E., Rothenberg, C., ... Schuur, J. D. (2018). Preliminary performance on the new CMS Sepsis-1 national quality measure: Early insights from the Emergency Quality Network (E-QUAL). *Annals of emergency medicine*, *71*(1), 110-15. http://dx.doi.org/10.1016/j.annemergmed.2017.06.032

Vilella, A. L., & Seifert, C. F. (2014, January). Timing and appropriateness of initial antibiotic therapy in newly presenting septic patients. *The American Journal of Emergency Medicine*, *1*(7), 7-13. http://dx.doi.org/10.1016/j.ajem.2013.09.008

Walters, E. (2018). Raising awareness for sepsis, sepsis screening, early recognition, and treatment in the emergency department. *Journal of Emergency Nursing*, *40*(3), 224-227. http://dx.doi.org/10.1016/j.jen.2017.10.008

Wang, H. E., Shapiro, N. I., Safford, M. M., Judd, S., & Howard, G. (2012, October 31). Chronic medical conditions and risk of sepsis. *PLoSOne, 7*(70). http://dx.doi.org/10.1371/journal.pone.0048307

Appendix A: Kirkpatrick Learning Theory

Appendix B: Pre/Post Test Questionnaire

Sepsis Pre-& Post-Questionnaire

1)The acronym SIRS is short for Systemic Inflammatory Response Syndrome.

a) True

b) False

2) What criteria determine that fluid resuscitation is required for a patient with sepsis?

a) Systolic BP < 90

b) Lactate > 4

c) Lactate < 4

d) Both A and B

3) What is the normal lactate level?

a) 0.4-2.0

b) 0.1-1.0

c) 3.0-5.1

d) 2.0-4.0

4) If a patient whose weight is 163 pounds requires a fluid bolus for septic shock, what amount of fluid would be infused?

a) 1 liter

b) 600 ml

c) 2,200 ml

d) 4,400 ml

5) At what point should blood cultures be drawn on a patient with possible sepsis?

a) After administration of antibiotics

b) Upon admission to the hospital

c) After lactate is completed

d) Before administration of antibiotic

6) Broad-spectrum antibiotics should be administered with the first three hours after recognition of sepsis, preferably within the first hour.

a) True

b) False

7) What is the recommended time frame for the administration of antibiotics from time zero?

a) 3 hours

b) 6 hours

c) 2 hours

d) 1 hour

8) When does the clock start for time zero in measuring sepsis three and six-hour bundles on the Med/Surg unit?

a) one hour after 2 SIRS are identified

b) when the patient is admitted

c) after antibiotics are administered

9) If the initial lactate level is elevated, what time should the second lactate level be drawn?

a) 2 hours after the first lactate level is > 2

b) 1 hour after first lactate level is > 4

c) 4 hours after first lactate level is > 2

d) 3 hours after first lactate level is > 4

10) When should a vasopressor be administered in the treatment of a patient in septic shock?

a) When the systolic BP falls below 90

b) When the systolic BP drops below 50

c) When the systolic BP falls below 90 after the patient has received a fluid bolus requirement

d) When a patient has a lactate level > 2

11) What is the recommended vasopressor for persistent hypotension in septic patients?

a) Dobutamine

b) Levophed

c) Dopamine

d) Epinephrine

12) Which temperature qualifies as SIRS criteria?

a) 102.4 F

b) 98.6

c) 96.4

d) Both A & C

13) What heart rate qualifies as SIRS criteria?

a) 68

b) 92

c) 74

d) 89

14) What respiratory rate qualifies as SIRS criteria?

a) 16

b) 18

c) 8

d) 26

15) What WBC levels qualify as SIRS criteria?

a) 13,000

b) 3,000

c) 6,000

d) Both A & B

e) Both B & C

16) What are the indicators of septic shock?

a) Systolic BP > 90 after fluid resuscitation

b) Temperature of 100.8

c) Lactate > 4

d) Both A & C

17) What is the mortality rate of patients with sepsis?

a) 50%

b) 28%

c) 8%

d) 19%

18) What are the first signs of sepsis in most cases?

a) Fever

b) Hypotension

c) Tachycardia

d) Both A and B

19) Which populations of patients are at a higher risk of developing sepsis?

a) Elderly

b) Infants

c) Pediatrics

d) Immunocompromised patients

e) All the above

20) What are two common findings associated with sepsis?

a) Infection

b) Hypotension

c) Both A & B

d) None of the above

21) What are the two most common etiologies of sepsis?

a) Pneumonia and UTI

b) H pylori and colitis

c) Cellulitis and otitis media

d) Strep throat and influenza

22) Sepsis, combined with associated sepsis-induced organ dysfunction, is called:

a) Septic shock

b) Severe sepsis

c) Both A & B

d) None of the above

23) Which of the following is NOT part of the conventional approach to all patients with sepsis?

a) Antibiotics

b) Fluids

c) Steroids

d) Measuring lactate

24) Which of the following interventions most commonly is missed or delayed in the sepsis core measure?

a) Antibiotic administration

b) Drawing blood cultures x 2

c) Measuring lactate

d) Fluid resuscitation

25) What is the proper fluid requirement for patients with septic shock?

a) 20 ml/kg of crystalloid fluid

b) 30 ml/kg of crystalloid fluid

c) 30 ml/kg of colloid fluid

d) 40 ml/kg of colloid fluid

Answer Key

1) A

2) D

3) A

4) C

5) D

6) A

7) D

8) A

9) C

10) C

11) B

12) D

13) B

14) D

15) D

16) D

17) B

18) D

19) E

20) C

21) A

22) B

23) C

24) D

25) B

Appendix C: Abstraction Tool

Measure case criteria

Was the patient received as a transfer from an inpatient, outpatient or emergency/observation department of an outside hospital or an ambulatory surgery center?

Y N

During this hospital stay, was the patient enrolled in a clinical trial in which patients with the same condition as the measure set were being studied (i.e., SEP, STK, VTE)?

Y N

What time was the patient discharged?

UTD

Presentation of Severe Sepsis

Was severe sepsis present?

1 - Yes

2 - No

What was the date on which the last criterion was met to establish the presence of severe sepsis?

UTD

What was the time at which the last criterion was met to establish the presence of severe sepsis?

UTD

Is there documentation that the patient or coreviized patient advocate refused either a blood draw, IV fluid administration, or IV antibiotic

administration prior to or within 6 hours following the Severe Sepsis Presentation Time?

1 - Yes documentation by MD/APN/PA or nurse that Pt. or authorized patient advocate refused either blood draw, IV fluid admin, or IV

antibiotic admin prior to or within 6 hrs following the presentation of severe sepsis

2 - No MD/APN/PA or nurse doc or witnessed consent that Pt. or authorized patient advocate refused either blood draw, IV fluid admin, or IV

antibiotic admin prior to or w/in 6 hrs following the presentation of severe sepsis

Did physician/APN/PA documentation of comfort measures only or palliative care occur?

1 - Yes

2 - No

Severe Sepsis Antibiotics

Was a broad spectrum or other antibiotic administered in the time window 24 hours prior to or 3 hours after Severe Sepsis Presentation Date and

Time?

1 - Yes

2 - No

What was the earliest date on which an antibiotic was started in the time window of 24 hours preceding or 3 hours after Severe Sepsis

Presentation Date and Time?

UTD

What was the earliest time at which an antibiotic was started in the time window of 24 hours preceding or 3 hours after Severe Sepsis

Presentation Date and Time?

UTD

Was the antibiotic administered within 3 hours after the Severe Sepsis Presentation Date and Time consistent with antibiotic selection guidelines

detailed in the Notes for Abstraction?

1 - Yes

2 - No

Severe Sepsis Blood Cultures

Was a blood culture collected in the appropriate time window?

1 - Yes

2 - No

What date was the blood culture collected on?

UTD

What time was the blood culture collected?

UTD

Is there documentation supporting an acceptable delay in collecting a blood culture?

1 - Yes

2 - No

Severe Sepsis Lactate Level

Was an initial lactate level drawn between 6 hours prior to and 3 hours following the presentation of severe sepsis?

1 - Yes

2 - No

What was the date on which the initial lactate level was drawn?

UTD

Severe Sepsis Lactate Level

What was the time at which the initial lactate level was drawn?

UTD

What was the initial lactate level result?

1 - (<= 2) Initial lactate level was less than or equal to 2 mmol/L, or no result in the chart, or UTD result

2 - (> 2 and < 4) Initial lactate level was greater than 2 mmol/L and less than 4 mmol/L

3 - (>= 4) Initial lactate level was 4 mmol/L or more

Severe Sepsis Repeat Lactate Level

Was a repeat lactate level drawn in the time window beginning at severe sepsis presentation date and time and ending 6 hours thereafter?

1 - Yes

2 - No

What was the earliest date on which the repeat lactate level was drawn in the time window beginning at severe sepsis presentation date and time

and ending 6 hours thereafter?

UTD

What was the earliest time at which a repeat lactate level was drawn in the time window beginning at severe sepsis presentation date and time

and ending 6 hours thereafter?

UTD

Fluid Administration

Was initial hypotension present 6 hours prior to or within 6 hours following Severe Sepsis Presentation Date and Time?

1 - Yes

2 - No

On which date was initial hypotension present 6 hours prior to or within 6 hours following Severe Sepsis Presentation Date and Time?

UTD

At which time was initial hypotension present 6 hours prior to or within 6 hours following Severe Sepsis Presentation Date and Time?

UTD

Was physician/APN/PA documentation of septic shock within 6 hours following the presentation of severe sepsis present in the medical record?

1 - Yes

2 - No

Were crystalloid fluids inititated prior to, at the time of, or after the presentation of Initial Hypotension, Initial Lactate Level Result >=4 mmol/L, or

physician/APN/PA Documentation of Septic Shock?

1 - Yes - Target ordered volume of crystalloid fluids ordered, initiated, and infused prior to, at time of, or after the presentation of Initial

Hypotension, Initial Lactate >=4, or Documentation of Septic Shock

2 - No - Less than target ordered volume of crystalloid fluids were ordered, initiated, or infused prior to, at time of, or after the presentation of Initial

Hypotension, Initial Lactate >=4, or Documentation of Septic Shock, or UTD volume ordered

3 - No - Crystalloid fluids were not initiated prior to, at time of, or after the presentation of Initial Hypotension, Initial Lactate >=4, or Documentation

of Septic Shock, or UTD fluids infused

4 - No - Documentation patient has an implanted Ventricular Assist Device (VAD) or patient or authorized pt advocate refusal of IV fluids

Optional Fluid Calculator

Weight in lbs

Weight in kgs

Patient weight in

Weight in kgs (divide by 2.2):

Weight in kgs times 30: to mLs

What was the earliest date on which crystalloid fluids were initiated for Initial Hypotension, Initial Lactate Level Result >=4 mmol/L, or

physician/APN/PA Documentation of Septic Shock?

UTD

What was the earliest time at which crystalloid fluids were initiated for Initial Hypotension, Initial Lactate Level Result >=4 mmol/L, or

physician/APN/PA Documentation of Septic Shock?

UTD

Presentation of Septic Shock

Is there documentation of the presence of septic shock?

1 - Yes

2 - No

What was the date on which the last criterion was met to establish the presence of septic shock?

UTD

What was the time at which the last criterion was met to establish the presence of septic shock?

UTD

Presentation of Septic Shock

Is there documentation that the patient or authorized patient advocate refused either a blood draw, IV fluid administration, or vasopressor

administration prior to or within 6 hours following the Septic Shock Presentation Time?

1 - Yes documentation by MD/APN/PA or nurse that Pt. or authorized patient advocate refused either blood draw, IV fluid admin, or

vasopressor admin prior to or within 6 hrs following the presentation of septic shock

2 - No MD/APN/PA or nurse doc or witnessed consent that Pt. or authorized patient advocate refused either blood draw, IV fluid admin, or

vasopressor admin prior to or w/in 6 hrs following the presentation of septic shock

Did physician/APN/PA documentation of comfort measures only or palliative care occur?

1 - Yes

2 - No

Septic Shock - Vasopressor Administration

Was persistent hypotension or new onset of hypotension present within one hour of the conclusion of crystalloid fluid administration?

1 - Yes - Persistent hypotension or new onset of hypotension was present within one hour of the conclusion of crystalloid fluid administration at

the target ordered volume

2 - No - Persistent hypotension or new onset of hypotension was not present within one hour of the conclusion of crystalloid fluid administration at

the target ordered volume

3 - No or UTD - Patient was not assessed for persistent hypotension or new onset of hypotension within the one hour after the conclusion of

crystalloid fluid administration at the target ordered volume, or UTD

4 - Not applicable - Crystalloid fluids were administered but not at a volume less than the target ordered volume

Was an intravenous or intraosseous vasopressor administered in the time window beginning at septic shock presentation and ending 6 hours after

The presentation of septic shock, demonstrated by persistent hypotension after crystalloid fluid administration?

1 - Yes

2 - No

What was the date on which an intravenous or intraosseous vasopressor was administered within 6 hours following the presentation of septic

shock, demonstrated by persistent hypotension after crystalloid fluid administration?

UTD

The time at which an intravenous or intraosseous vasopressor was administered within 6 hours following the presentation of septic shock,

demonstrated by persistent hypotension after crystalloid fluid administration.

UTD

Repeat Volume - Tissue Perfusion

Was a repeat volume status and tissue perfusion assessment documented in the appropriate time window?

1 - Yes

2 - No

On what date were a repeat volume status and tissue perfusion assessment documented by a physician/APN/PA?

UTD

At what time were a repeat volume status and tissue perfusion assessment documented by a physician/APN/PA?

UTD

Appendix D: Project Timeline

Table X

Project Timeline

	September	October	November	December	January	February	March	April	May	June	July
IRB submission	X										
Intranet module development		X	X								
Introduction to module				X							
Pre-test questionnaire					X						
Educational module						X	X				
Post-test questionnaire							X				
Data collection								X	X	X	
Evaluation and summation										X	X