

2020

Development and Validation of a Sepsis Course for Burn Intensive Care Unit Nurses

Colleen Melisa Reid
Walden University

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Walden University

College of Health Sciences

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Colleen Reid

has been found to be complete and satisfactory in all respects,
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Walden University

2020

Abstract

Development and Validation of a Sepsis Course for Burn Intensive Care Unit Nurses

by

Colleen M. J. Reid

MS, Duke University, 2012

BS, Rutgers University, 1994

Project Submitted in Fulfillment
of the Requirements for the Degree of
Doctor of Nursing Practice

Walden University

August 2020

Abstract

Sepsis is the most common cause of death in burn patients. Optimal recovery from sepsis requires early recognition and prompt treatment. When sepsis is suspected or detected, the 2016 Surviving Sepsis Campaign guidelines endorse immediate initiation of the Hour-1 Sepsis Bundle. Unfortunately, a random audit of hospital system compliance with the Centers for Medicare and Medicaid Services sepsis core measure was less than 50%. A 2019 performance improvement project uncovered delays in antibiotic administration, and a search of scientific and burn center literature did not elucidate a course that educated burn intensive care nurses about sepsis. The purpose of this project was to develop and validate a sepsis course for burn intensive care unit nurses. The American Burn Association's 2007 sepsis consensus, the 2016 Surviving Sepsis Campaign guidelines, the 2018 Hour-1 Sepsis Bundle, organization policies, and current research contributed to the development of the sepsis course. Theoretical foundations for the course included the ADDIE approach and adult learning theory. A panel of experts evaluated and validated instructional materials using 2 surveys: a modified survey validated rubric for expert panel and a course evaluation survey. An aggregate mean of 3.92 and a median of 4 on the validated rubric for expert panel (a 4-point Likert scale) validated the post-course test. A thematic analysis of panelist responses helped validate course content. These results demonstrated that current research and experiential knowledge might be combined to create a burn-specific sepsis course. The sepsis course may improve staff compliance with the Hour-1 Sepsis Bundle and create positive social change for nursing staff and burn patients.

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Dedication

I dedicated this DNP project to my mother, Nesta, and my daughters Cara, Kayanna, and Vanessa, who supported me tirelessly throughout this journey. Thank you for your continual love and support. We did it, y'all!

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Section 1: Nature of the Project

Introduction

Every year at least 1.7 million Americans develop sepsis (Centers for Disease Control and Prevention [CDC], 2020). Sepsis is life-threatening organ dysfunction caused by an invasion of microorganisms (Tridente, 2018). Sepsis is the leading cause of multiple organ failure and death in burn patients (Greenhalgh, 2017; Tridente, 2018). Hospital-associated infections, such as pneumonia, urinary tract infection, and cellulitis or wound infection, are the most common causes of sepsis-related death in burn populations (Lopez, Cambiaso-Daniel, Branski, Norbury, and Herndon, 2017). Burn patients are susceptible to infection because their primary barrier against invasive microorganisms, the skin, is damaged. While the burn wound is open, burn intensive care unit (BICU) patients, particularly those with extensive thermal burns or greater than 20% total body surface area (TBSA), are at high risk for sepsis.

Burn wounds are categorized according to the size, type, and depth of tissue injury. Superficial burns (first-degree burns) are confined to the epidermis and do not require surgery. Partial and deep partial-thickness (second- or third-degree burns) penetrate the dermal surface damaging skin and dermal structures such as hair follicles, nails, sweat, sebaceous glands, and blood vessels. These burns cause pain, erythema, and blistering of the skin. Partial-thickness injuries may take 10 days or up to 3 weeks to heal. Full-thickness burns (fourth degree) penetrate the dermis, hypodermis, and damage muscles and tendons below the skin. These burns are painless, leathery, and do not heal without surgery (Herndon, 2017). Patients with extensive (> 20% TBSA) and full-

thickness burns undergo multiple surgeries to repair and heal their burn wounds. Early excision and grafting of the burn wound are the primary surgical treatment for full-thickness injuries.

Each year over 40,000 burn-injured persons are admitted to the hospital in the United States (American Burn Association [ABA], 2016). During the initial injury, microorganisms from the patient's normal flora or the environment penetrate the burn wound through damaged skin, blood vessels, and skin appendages (Greenhalgh, 2017). These microorganisms colonize the burn wound and later contribute to cellulitis or wound infections. While hospitalized, more than 3,400 burn patients develop infections from exposure to microbes in the clinical environment, their gut, oropharynx, and indwelling devices (Norbury, Herndon, Tanksley, Jeschke, & Finnerty, 2016). Early identification and prompt treatment of infection decreases morbidity and mortality from a severe burn injury (Greenhalgh, 2017; Lopez et al., 2017). Prudent application of infection prevention bundles and timely management of organ dysfunction is vital to reducing the incidence and risk of infectious complications. Burn intensive care unit (BICU) nurses are in a unique position to detect and rapidly treat sepsis.

Nurse education improves compliance with sepsis bundles and infection prevention measures (Fee, Hartigan, McAuliffe, & Higgins, 2017; Delaney, Friedman, & Fitzpatrick, 2015). The American Association of Critical-Care Nurses (AACN), the Society of Critical Care Medicine (SCCM), and the Sepsis Alliance recommend sepsis education for all members of the patient care team. Online or e-learning sepsis courses are popular methods for instruction because they are accessible, convenient, easy to

dispense, and cost-effective to manage (Davis, Henderson, & Langmack, 2016; Schilinski, Hellier, & Cline, 2019). Many healthcare facilities prefer online educational platforms because content can be standardized to meet the regulatory of healthcare systems and the learning needs large groups of staff. Online sepsis courses are associated with increased nursing knowledge and enhanced self-confidence in the application of goal-directed, time-targeted therapies (Delaney et al., 2015).

Unfortunately, a review of current literature and study site (Burn Center) educational materials did not elucidate a course that educates burn nurses about the nuances of sepsis and the criteria for early recognition and treatment of sepsis in burn populations. Therefore, the purpose of this project was to develop and validate a sepsis course for BICU nurses. The sepsis course aims to improve BICU nursing knowledge of the pathophysiology of burn sepsis, signs and symptoms of infection, early recognition and treatment of sepsis, and sepsis-related multiple organ failure in burn patients. The sepsis course may create a positive social change for nursing staff and patients through a reduction in morbidity and mortality, a decrease in length of hospital stay, a reduction in antibiotic delays, and improved compliance with Centers for Medicare and Medicaid Services (CMS) sepsis core measures and infection prevention bundles. In this section, I introduce the problem statement and present the purpose, nature, significance, and a summary of the doctoral project.

Problem Statement

Sepsis is a medical emergency that threatens populations all around the world. Burn injury increases an individual's vulnerability to sepsis. Despite aggressive

treatment, sepsis is a significant cause of morbidity and mortality in burn populations (Rech et al., 2017). Sepsis is the chief cause of death in 51% of patients who die after sustaining a burn injury (Norbury et al., 2016). A 2009 retrospective analysis of 74 autopsies conducted between 2004 and 2007 revealed that infection was the top cause of death in Burn Center patients. The Burn Center's study demonstrated that gram-negative bacteria, such as *Klebsiella pneumonia* and *Pseudomonas aeruginosa*, were the principal cause of infection in burn-injured patients (Gomez et al., 2009).

Patients with severe burn injuries typically have a prolonged hospital stay. This extended hospital stay increases a burn patient's risk and incidence of infection. Hospital-associated infections from such as pneumonia, urinary tract infection, wounds, and other indwelling devices contribute to the death and disability of hospitalized burn patients (Lopez et al., 2017). Burn patients with extensive injury, concomitant trauma, multiple comorbidities, inhalation injury, substance overuse, or age extremes like children or the elderly, are particularly vulnerable to sepsis, septic shock, and sepsis-related multiorgan dysfunction syndrome (Lopez et al., 2017; Tridente, 2018).

During hospitalization, patients with extensive burn injury undergo several surgeries and experience multiple bouts of sepsis (Tridente, 2018). Detecting sepsis in this population is challenging because burn injury creates an exaggerated inflammatory and catabolic response known as hypermetabolism. Hypermetabolism is an exaggerated catabolic response to burn injury that makes it challenging to distinguish sepsis-related organ dysfunction in burn patients (Greenhalgh, 2017). The hypermetabolism may persist for up to 3 years after the initial injury. Given the problem of recognizing symptoms of

burn-sepsis and the incidence of infection of the Burn Center, BICU nurses must have current, evidence-based knowledge that empowers them to identify and treat complex physiologic responses to an infection rapidly.

Caring for a burn-injured patient is a complicated process. The 2017 ABA burn nurse competencies require burn nurses to be competent in rapid detection and prudent management of sepsis, septic shock, and organ dysfunction (ABA, 2017). Nurses employed in the Burn Center must attain and sustain a unique catalog of nursing knowledge and skills. For example, a critically ill burn patient with septic shock and multiorgan failure may require one to two nurses to manage advanced technologies and complex wounds. A paired staff assignment for this type of patient may include a licensed practice nurse (LPN) and a registered nurse (RN). This nursing team may collaboratively manage complex physiologic disorders and advanced technologies such as continuous renal replacement therapy, roto prone beds, and extracorporeal membrane oxygenation (ECMO).

In 2007, experts from the ABA issued a consensus statement and a list of criteria for diagnosing sepsis in burn patients (see Appendix A). Unfortunately, the ABA experts have not updated their 2007 sepsis consensus. In 2013, Mann-Salinas et al. (2013) attempted to diversify the ABA's sepsis criteria by developing a vital sign-based, burn-specific sepsis protocol. However, there are few follow-up clinical trials that assessed the validity of Mann-Salinas's model (Yan et al., 2018). The lack of current consensus of sepsis in burn patients made it difficult to discern a body of evidence-based literature unique to the care of septic burn patients.

Despite the gap in current burn sepsis evidence, strategies for early identification and treatment of sepsis are discussed on multidisciplinary rounds each day in the Burn Center. Burn Center staff is familiar with the 2016 Surviving Sepsis Campaign (SSC) guidelines and the SSC's 2018 update—the Hour-1 Sepsis Bundle. Even though it was developed more than 15 years ago, the ABA's 2007 consensus on sepsis remains the foundation for many of the Burn Center's sepsis-related protocols and policies. The tendency to prefer the ABA's 2007 Sepsis Consensus instead of the 2016 SSC's criteria may be a contributing factor in staff management of antimicrobials. For example, current scientific literature and the 2018 SSC strongly recommends the administration of antibiotics within one hour of suspicion or detection of sepsis. Despite this recommendation, a September 2019 a performance improvement (PI) project uncovered numerous delays—up to 5 hours—in initial antibiotic administration. The PI project also revealed that 40% of nursing staff lacked knowledge of the urgency of time-sensitive antimicrobial treatments for sepsis. Further analysis of the contributing factors for antibiotic delays is needed to determine strategies to improve antibiotic administration in the Burn Center.

Random chart audits are a way to measure competency and compliance with established standards and protocols. In October 2019, the hospital system adopted the CMS sepsis core measure, Severe Sepsis and Septic Shock: Management Bundle. The CMS's sepsis core measure is a bundle of evidence-based therapies for adults with the diagnosis of sepsis or septic shock. The 2016 SSC's guidelines is basis for the core measure (CMS, 2020). The CMS's sepsis core measure is a publicly reported standard

that strives to decrease morbidity, mortality, and the cost of care for Medicare and Medicaid beneficiaries. CMS mandates that hospitals report their compliance with the sepsis core measure (CMS, 2020). Unfortunately, a random electronic medical record audits of 45 inpatients in the hospital system that houses the Burn Center demonstrated less than 50% compliance with this standard. To date, the facility has not established a process to determine the causation of poor compliance with the CMS bundle.

Research from Davis et al. (2016), Delaney et al. (2015), and Foss and Frost (2019), Gyang, Shieh, Forsey, & Maggio (2015), Kleinpell (2017), suggested that sepsis education modules improve staff compliance with CMS's Sepsis Core Measures and the 2016 SCC's guidelines. Studies by Davis et al. (2016), Delaney et al. (2015), and Schilinski et al. (2019) also demonstrated that an e-learning course increased nursing competence and compliance with time-targeted, goal-directed sepsis treatment plans. In their 2019 sepsis education booklet, the SCCM advised healthcare organization to develop nurse education that includes the epidemiology, signs and symptoms, and the effect of early identification and rapid treatment of sepsis. The SCCM also urges organizations to ensure that nurse education inspires staff to routinely screen every patient for sepsis (SCCM, 2019).

Unfortunately, an evaluation of current literature and the Burn Center's educational materials did not elucidate a standardized process for educating and evaluating nursing knowledge of sepsis. Therefore, I developed and validated a sepsis module for BICU nurses. This sepsis course explores the nuances and criteria for early recognition and treatment of sepsis. A panel of experts in burns, infection, wound care,

and critical care reviewed and validated instructional content and materials using two surveys: a modified VREP (Survey Validation for Expert Panel) and a 10-item course evaluation questionnaire. High cumulative mean (3.92) and median (4) scores on the modified VREP—a four-point Likert scale evaluation tool—validated content of the 15-item postcourse test. Panelists used the 10-item course evaluation to validate course content. Course evaluation consisted of four open-ended questions with free text answers, four yes/no satisfaction questions, and two five-point Likert scale questions. Four “yes” satisfaction responses and comments on course content and design guided revisions of instructional materials.

Feedback from the expert panel demonstrated that the ABA’s 2007 sepsis criteria, the 2016 SSC, and the 2018 Hour-1 Sepsis Bundle might be used to create a burn sepsis course for the Burn Center. This Doctor of Nursing Practice (DNP) project may influence the development of other population-specific sepsis courses within the hospital system. Additional population-specific sepsis courses may improve hospital-wide compliance with CMS’s Sepsis Core Measure. Findings from this DNP project indicate that the ADDIE approach, adult learning theory, current research, experiential knowledge, and organizational policies may be used to develop and validate an educational course for nurses in other unique specialties.

Purpose Statement

Amongst hospitalized burn patients, 96.8% survive their burn injury (ABA, 2016). Early detection and prompt treatment of sepsis, septic shock, and multiple organ dysfunction are associated with improved survival from burn injury (Lopez, 2017).

Among adult nonsurvivors, sepsis contributes to 50%–84% of deaths from burn injury (Lopez, 2017). To reduce morbidity and mortality from sepsis, the CDC advises healthcare providers to become familiar with the signs and symptoms of sepsis and their facility's guidance for sepsis management. The CDC (2019) also recommends that healthcare facilities integrate infection prevention bundles and goal-directed interventions whenever sepsis is suspected or detected.

Despite the incidence and prevalence of sepsis in burn populations, there is no evidence of a burn-specific sepsis course in Burn Center educational materials or current literature. Therefore, the goal of this DNP project was to develop and validate a sepsis course for BICU nurses. This course seeks to enhance nursing knowledge of the nuances and criteria for early recognition and treatment of sepsis in burn populations. Current research demonstrates that instruction about the 2016 SSC's sepsis guidelines improves nurse knowledge of the nuances and criteria for early identification and treatment of sepsis (Davis et al., 2016; Drahnak, Hravnak, Ren, Haines, & Tuite, 2016; Schilinski, Hellier, & Cline, 2019). Therefore, the PICO (participants, intervention, comparison, outcome) question was, "What is the process for developing and validating an online sepsis course for BICU nurses?" Key literature for the course included ABA's 2007 consensus definition of sepsis, the Surviving Sepsis Campaign's (SSC) 2016 Guidelines (Sepsis-3), and the SSC's 2018 Update; the Hour-1 Sepsis Bundle.

The ABA's 2007 consensus on sepsis, the SSC's 2016 guidelines, and the Hour-1 Sepsis Bundle are algorithms used for detection and treatment of sepsis in a variety of acute and critically ill patients (Ladhani et al., 2017; Rech et al., 2017; Yan et al., 2018;

Yoon et al., 2018). Yoon et al. (2018) found that a combination of the SSC's 2016 guidelines and ABA's 2007 sepsis criteria (see Appendix A) had the best predictive value for suspicion and diagnosis of sepsis in burn patients. Scientific literature also suggests that initiation of the SSC's Hour-1 Sepsis Bundle (see Appendix B), along with source control, is essential to managing sepsis in burn patients (Greenhalgh, 2017; Lopez et al., 2017).

Because there are no burn-specific sepsis courses for BICU nurses, I used the SSC's 2016 guidelines, ABA consensus, current scientific evidence, experiential knowledge from a variety of sources, classic burn literature, and organizational policies to develop the burn sepsis course. The course seeks to enhance nursing knowledge by merging definitions of sepsis, septic shock, and sepsis-related multiple organ failure with burn sepsis information. The sepsis course highlighted evidence-based, goal-directed treatment such as vasopressor therapy, dynamic fluid management, and patient-centered antimicrobial and antifungal treatment. Course content prompts BICU nurses to use validated tools like the sequential organ failure (SOFA) score (see Appendix C) to screen and collaboratively measure sepsis. If selected for use in the facility, the e-learning course may augment the Burn Center's continuing professional education, annual training, or nursing orientation materials.

Nature of the Doctoral Project

The goal of this DNP project was to develop and validate a sepsis course for BICU nurses. When designing an educational product, Jeffery, Longo, and Nienaber (2016) recommended that nurse educators consider the learning concepts and domains

that augment an educational need or gap in nursing knowledge and practice. Any idea or thought that facilitates learning is a learning concept (Jeffery et al., 2016). Nursing domains are an area of focus unique to nursing practice. Course validation is a collaborative process that assesses the usability and quality of an educational product (Balaban, Bubas, & Pipan, 2011)

Key learning concepts in the sepsis course were individualized learning, feedback, and reinforcement. Personalized education or a learning experience that adjusts to the pace of the student may influence BICU nursing practice. Exposure to current research, clinical expertise, organizational knowledge, and patient values inform evidence-based nursing practice (Peterson et al., 2014). The nursing domain in this project was the care of the patient with burn injury and sepsis. Therefore, enhancing BICU nursing knowledge began with a search for a body of literature that improves nursing knowledge of the criteria for early recognition and treatment of sepsis in burn populations. I searched multiple databases (Medline, CINAHL, Google Scholar, and Thoreau) for English language literature published between January 2015 and March 2020. I used the keywords *sepsis*, *septic shock*, *burn injury*, *wound infection*, *multiple organ dysfunction/failure*, and *infection prevention*. My search produced current scientific studies and classic literature. I also gathered information on these topics from reputable databases, professional websites, and organizational policies. Research selected included clinical practice guidelines and best practice protocols from highly regarded organizations such as the CDC, ABA's Burn Research Network (ABuRN), the Sepsis Alliance, the Society of Critical Care Medicine, and International Society for Burn

Injuries. A focused search of the ABA's Journal of Burn Care and Research elicited several cohort studies and editorials on sepsis and sepsis-related organ failure in burn patients.

I searched the Burn Center's intranet to select organization policies that detailed strategies for detecting and treating sepsis, septic shock, and sepsis-related multiple organ failure in burn and critically ill patients. The Burn Center policies selected were updated in 2019, and the multidisciplinary team use this information to care for burn and nonburned patients. The policies contained vital information, such as the local antibiogram, facility guidance on the administration of antimicrobials and antifungal mediations, environmental hygiene practices, and infection prevention bundles. Patient-centered regimens for vancomycin and amikacin, basic burn wound care, as well as procedures for obtaining a wound biopsy were examined. Facility guidance on infection prevention bundles such as the ventilator associated pneumonia (VAP), catheter associated urinary tract infection (UTI), and central line associated blood stream infection (CLABSI) bundles contributed to the body of literature for the sepsis course. After a body of literature was selected, I used the 6S pyramid and the GRADE (grading of recommendations, assessment, development, and evaluation) system to appraise studies and select literature for inclusion or exclusion in the DNP project.

The 6S pyramid is a hierarchical tool that ranks evidence-based research in six levels from lowest to highest (see Appendix D). Background resources, such as narrative reviews, expert opinion, and mobile applications like Micromedex, are considered foundational resources. Original studies, such as single-center retrospective cohort

studies, are the lowest and most abundant source of clinical evidence. Evidence then moves upward in rank from synopses (summaries) of studies, syntheses (systematic reviews or meta-analysis), synopses of syntheses, and summaries (clinical practice guidelines) to systems (computerized decision support system studies). Systems studies are the most robust form of evidence and exist at the apex of the pyramid (Peterson et al., 2014).

The GRADE system ranks the quality of evidence generated by studies as strong or weak recommendations. Healthcare committees, policy writers, and other professional organizations use the GRADE system to develop evidence-based recommendations for clinical practice guidelines and other best practice protocols (Goldet & Howick, 2013). The GRADE system helped develop proposals for the clinical questions posed by the SSC's guideline committee. Both the SSC's 2016 guidelines and the 2018 update committees used the GRADE system to identify interventions that improve outcomes for septic patients.

Walden University's Staff Education Manual, the ADDIE (analysis, design, development, implementation, and evaluation) approach, and adult learning principles helped me to design instructional materials for the course. The ADDIE approach guided the development of instructional conditions, procedures, and products. Walden University's preapproved education model guided instructional design and format. Andragogy (adult learning principles) guided the structure, composition, and content of the post course test and course survey.

A panel of experts in burns, infection, critical care, wound care, perioperative nursing, and nursing administration provided feedback about the quality of the course materials and validated instructional content. Course validation is a vital peer-review process that ensures the quality of a new or revised education module (MacCormick & Cheater, 1995). According to Balaban et al. (2011), evaluation and validation of course materials are associated with student satisfaction and success in e-learning. There are two types of validation: internal and external. Internal validation is performed by faculty or team implementing the course. External validation may be conducted by non-nurses or staff who are not affiliated with the institution (MacCormick & Cheater, 1995). Since burn care is unique to one unit in the hospital, members of the expert panelists selected to participate in the DNP project were Burn Center employees. Panelists used their knowledge and expertise in nursing, education, preceptorship, and leadership to assess and validate instructional materials.

The Burn Center employs nurses with a range of clinical knowledge and professional experience. Novice LPNs and experienced RNs often collaborate to provide care for critically ill burn patients with sepsis-related multiorgan failure. These staff members are in a pivotal position to recognize subtle signs and symptoms of sepsis. Unfortunately, early detection of sepsis is challenging in burn populations because hypermetabolism mimics early signs of sepsis. Therefore, enhancing BICU nursing knowledge of the nuances of sepsis in burn populations may improve early detection and treatment of sepsis. The sepsis course also highlighted evidence-based strategies vital to the care of critically ill burn patients with multiorgan failure. Finally, the course explored

interventions that prevent and reduce infections amongst in burn patients hospitalized in the intensive care unit. Feedback from the expert panel provided ensured the sepsis course succinctly combined current evidence, experiential knowledge, and classic literature into an educational product that may improve BICU nursing knowledge. Individualized learning and reinforcement of essential burn and sepsis concepts may also promote positive social change by increasing compliance with sepsis and infection prevention bundles.

Significance

The Burn Center has a robust, formal nursing preceptorship program that develops and validates essential burn nurse competencies. Crucial competencies for burn nurses include the application of infection prevention strategies, treatment of complex wounds, identification of sepsis, and management of unique burn injury ailments such as hypermetabolism (ABA, 2017). The Burn Center has many resources to educate staff about illnesses that afflict burn patients. However, it does not have a standardized continuing education program to support and enhance nursing ability to distinguish and manage burn sepsis. Sepsis is the number-one cause for morbidity and mortality in hospitalized patients (Greenhalgh, 2017). Sepsis education provided by the course has the potential to affect the care provided by critical stakeholders in the Burn Center. Educating burn nurses about the nuances of sepsis may improve patient care team knowledge of infection, increase multidisciplinary collaboration, and enhance compliance with sepsis and infection prevention bundles.

BICU nurses must be empowered to recognize and treat complex physiologic responses to burn injury, surgery, and critical illness. Hypermetabolism is a sophisticated but classic physiologic finding in burn patients, particularly in persons with severe burn injury (Jeschke, 2016). It is a catabolic response that produces profound alterations in a patient's protein and fat metabolism. The hypermetabolic response contributes to a dynamic interaction between stress hormones and inflammatory mediators used to respond to and heal from injury. This response begins after the initial burn injury and may last up to three years postburn (Jeschke, 2016). Symptoms of hypermetabolism include muscle wasting, poor wound healing, tachycardia, hyperglycemia, temperature instability, and multiple organ dysfunction (Jeschke, 2016). These immunologic changes increase a burn patient's risk for infection from multidrug resistant organisms and mask the signs and symptoms of sepsis. Hypermetabolism's exaggerated catabolic response also weakens the burn patient's response to surgery, comorbid diseases, and critical illness. More importantly, the manifestations of hypermetabolism make it difficult to delineate the signs and symptoms of infection and organ dysfunction in critically ill burn patients.

Competency in delineation and management of hypermetabolism, wound infection, and other illnesses such as VAP is essential for BICU nurses (ABA, 2017). The BICU's eighty-eight nursing staff with mixed licensure must demonstrate knowledge and competency in 11 nursing domains. In August 2019, a survey of nursing experience showed that approximately 40% of the BICU nursing staff had less than two years of burn experience. These novice nurses lack the depth of expertise in the recognition and

management of complex burn injuries and illnesses possessed by senior nursing staff. So, this project intends to develop an educational module that establishes a baseline or standard for BICU nursing knowledge of burn sepsis. This module may ensure that, regardless of their scope of practice or clinical experience, BICU staff attain and sustain fundamental knowledge in the care of patients with burn sepsis.

The Burn Center is a regional trauma facility that operates within the confines of an urban, academic hospital system. From 2011 to 2018, the center cared for more than 6,051 patients, ages 18 to 90. Stakeholders in the sepsis education project include patients, family members, nursing staff, general medical education residents, burn surgeons, intensivists, rehabilitation staff, a nutritionist, infection control nurses, and a team of operating room staff. Each stakeholder benefits from enhanced nursing knowledge in early recognition and treatment of burn sepsis. For example, the Burn Center multidisciplinary rounds are initiated by the bedside nurse. During daily rounds, BICU nurses who are competent in the early identification of sepsis confidently present their suspicions of infection during daily rounds. These nurses effortlessly articulate collaborative strategies to identify and manage infection. However, novice LPNs or critical care nurses who are new to burns struggle with quantifying and presenting their suspicion of sepsis.

An increase in confidence in sepsis knowledge and multidisciplinary team collaboration is a critical to the success of nurse-led rounds and interventions (Gyang et al., 2015; Kleinpell, 2017; Ruhumuliza, Popkin, & Sprague, n.d.). For example, Advent Health in Shawnee Mission, Kansas, successfully implemented a nurse-led sepsis

program by focusing on nurse education. Foss and Frost (2019) attributed program success to hospitalists' confidence in nurse-led management of sepsis patients in the progressive care unit (PCU). Results from Foss and Frost's (2019) hospital system's evidence-based practice performance improvement (PI) project demonstrated that the facility's online module and their nursing-driven sepsis protocol improved nursing knowledge, self-confidence, and patient care team collaboration. The researchers found that leadership empowerment of nurse-led collaborative discussions and interactions inspired patients, family, and providers to have more respect for nursing's ability to identify and manage sepsis (Foss and Frost, 2019). Based on these findings, the intent of the DNP project was to develop and validate a course that met the learning needs of novice and experienced BICU nurses.

BICU nurses' staff the Burn Center's rapid response team. Sepsis is a common finding amongst the patients in the Center's progressive care unit (PCU). In 2018, at least 60% of the 45 rapid response team calls were sepsis related. Therefore, educating BICU nurses about early recognition and treatment of sepsis may be an opportunity to refocus PCU nurse attention on the intricacies of caring for an acute or seriously ill burn patients with sepsis. This evidence-based practice project may stimulate interest in the development of a burn-specific sepsis screening tool for BICU nurses. The course may also inspire the BICU's nurse educator to create multidisciplinary simulation training that improves the ability of the entire patient care team's ability to rapidly recognize and treat sepsis. The project may also prompt the facility to develop population-specific sepsis courses for other specialty services within the hospital system.

The results of this DNP project may inspire a positive social change for patients and staff in the Burn Center. Leicht (2018, paragraph 1) defined social change as a “significant alteration in social structure and cultural patterns” over time. The sepsis course may influence social change by inspiring new habits and customs amongst staff who care for burn populations. For example, education about how early and on-time antibiotics improves patient outcomes may encourage BICU staff to improve compliance with the Burn Center’s policy and SSC guidelines on the administration of antimicrobials. In turn, timely antibiotic administration may enhance burn patient outcomes by reducing sepsis-related inpatient morbidity and mortality. The sepsis course may also inspire BICU nurses to enhance compliance with the CMS’s Sepsis Core Measure, national infection prevention bundles, and daily environmental hygiene regimens. Renewed focus on teamwork and efficient performance of goal-directed therapies may enhance professional relationships and promote a positive collegial atmosphere among all staff. Finally, this project may also affect social change by bridging the gap between current research, experiential information, nursing knowledge, and clinical practice.

Summary

Sepsis is a severe life-threatening problem for hospitalized burn patients. The absence of skin, exposure to invasive pathogens, presence of indwelling devices, and prolonged hospital stay place burn patients at high risk for sepsis. Pneumonia, urinary tract infections, and wound infections are common causes for sepsis in burn patients (Lopez et al., 2017). BICU nurses have a unique opportunity to identify and rapidly

coordinate the collaborative treatment of burn sepsis. Unfortunately, hypermetabolism—a routine but exaggerated catabolic response to burn injury—can confound early identification and treatment of sepsis in burn populations (Tridente, 2018). Studies by Davis et al. (2016) and Delaney et al. (2015) demonstrated that population-specific education may improve the detection of sepsis by burn nurses. Because there was no evidence of a sepsis course for BICU nurses, I designed and used current research, experiential knowledge, classic burn literature, and organization policies to develop instructional materials. Results from this DNP project may inspire the Burn Center to develop sepsis education strategies that further enhance nursing knowledge and create positive social change within the Burn Center.

Section 2: Background and Context

Introduction

Sepsis has a tremendous impact on the mortality and morbidity of burn patients (Tridente, 2018). BICU nurses play an essential role in early detection and collaborative management of burn sepsis. The ABA (2017) requires burn nurses to be competent in the management of complex illnesses such as sepsis, septic shock, and multiorgan failure. BICU nurses must routinely screen and promptly intervene when there is a suspicion or diagnosis of sepsis. Unfortunately, there is no distinct definition of burn sepsis, and the Burn Center does not have a formal process for educating staff about early recognition and treatment of sepsis. Therefore, the purpose of this DNP project was to develop and validate a sepsis course for BICU nurses. This educational module aims to improve BICU nursing knowledge of the nuances of sepsis as well as current strategies for early identification, treatment, and prevention of sepsis in burn populations.

In Section 2, I discuss how adult learning theory (ALT), the ADDIE approach, and the theory of reasoned action (TRA) influenced instructional design and selection of course materials. I explore local findings pertinent to BICU nursing knowledge of sepsis. I also examine the role of the DNP student and the expert panel in the DNP project. Then, I describe how andragogy principles, TRA, and the ADDIE approach may be combined to bridge the knowledge gap for BICU nurses.

Concepts, Models, and Theories

The SSC's 2016 guidelines and the Hour-1 Sepsis Bundle are goal-directed, time-sensitive therapies that require collaboration between nurses and various members of a

healthcare team. The 2016 SSC guidelines also provide an algorithm to care for critically ill patients with multiorgan dysfunction or failure. The Hour-1 Sepsis Bundle consists of five time-sensitive tasks pertinent to the care of a variety of septic patients. Nurses confident in early recognition and treatment of sepsis are more likely to facilitate the Hour-1 Bundle because they are aware of how or why the tasks improve outcomes for septic patients (Delaney et al., 2015). Application of the sepsis bundle and 2016 SSG guidelines in the Burn Center hinges on BICU nurses embracing a confident, collaborative attitude towards identifying and treating sepsis. Therefore, Fishbein and Ajzen's TRA, a behavioral theory, served as the theoretical framework for this project. Adult learning principles and the ADDIE approach were vital to the design and revision of instructional materials for the burn sepsis course.

Researchers use the ADDIE approach as an instructional design paradigm to improve competencies for medical students and professional nurses (Cheung, 2016; Hsu, Lee-Hsieh, Turton, & Cheng, 2014; Jeffery et al., 2016). The ADDIE system aims to promote intentional individual and group learning by guiding students through a three-step process: input, process, and output (Branch, 2009). Large healthcare facilities use the ADDIE approach to develop online, simulation, and performance-based courses that align corporate, organizational, and individual educational objectives (Branch, 2009). Jeffery et al. (2016) recommended that nurse educators use the ADDIE approach to create content that fills the gap between current practice, evolving science, and regulatory requirements.

The ADDIE approach is a five-step process for designing instruction (see Appendix F). Analysis is the first phase of the ADDIE paradigm. During the analysis stage, the organization must validate that the most probable cause for the gap in performance is knowledge (Branch, 2009). When presented with an educational problem by an organization, educators must examine the knowledge gap, determine instructional goals, identify organizational resources, consider the delivery format, and compose a plan or timeline for the educational project (Branch, 2009). After validating that an instructional product may diminish the knowledge gap, instructors must design an educational program that meets learner and organization needs.

Identifying performance tasks and testing strategies are critical components of the design phase. For example, Cheung (2016) recognized that medical residents rotating through the radiology department were not competent in reading chest films. Cheung concluded that previous attempts at instruction failed because there was no coordinated strategy to improve resident knowledge and performance. After collecting qualitative data from medical residents and faculty, a team of radiologists created a list of essential competencies in chest radiographic interpretation. Then, the group collaborated with an education expert to identify and prioritize critical radiographic interpretation tasks. Armed with information from medical residents, instructors, educators, and a content expert, the team developed a performance-based curriculum of eight 1-hour classes. Each class included learning objectives, standardized content, and a task-oriented performance checklist.

The development of instructional content is the third step of the ADDIE approach. During the development phase, Branch (2009) encourages educators to create a shared learning space that fosters ingenuity, creativity, and interdependence between the instructor, individual student, and peers in the classroom. Hsu et al. (2014, paragraph 2) identified that nurses in their hospital lacked knowledge in the organization's SHARE philosophy, which is, "Sense people's needs before they ask. Help each other out. Acknowledge people's feelings. Respect the dignity and privacy of others and explain what's happening." The philosophy was designed to influence caring behaviors among Taiwanese nurses (Hsu et al., 2016). To create a shared learning environment, Hsu et al. (2016) incorporated patient and nurse comments into their online caring curriculum. Nurses in the facility lacked the time and energy to complete 150 continuing annual education credits required by the Taiwanese Health and Welfare Ministry; therefore, Hsu et al. (2014) developed 72 instructional videos and five short live-action movies that were viewed by nurses at their convenience (Hsu et al., 2014).

Preparing the learning environment, implementing the instruction, and evaluating student performance are essential components of the fourth and fifth steps of the ADDIE approach. Staff in Cheung's (2016) study bought a computer monitor that rotated between landscape and portrait orientation. The group also restructured their 4-week residency program by facilitating individual and group discussion into each educational session. During each lesson, instructors promoted self and group learning by selecting a medical resident to interpret a chest film. Then, group discussion provided feedback to the resident about their interpretation. At the end of the experience, the radiologist, who

facilitated the session, summarized pertinent disease and radiology concepts. Faculty surveys from Cheung's (2016) program lauded the ADDIE approach for enhancing the delivery and comprehension of instruction. Satisfaction surveys from residents extolled the benefits of guided chest radiograph education. An end-of-month analysis of the course's performance checklists demonstrated that 86 residents attained competency in reading chest radiographs. Hsu et al. (2014) also used formative and summative evaluation strategies to evaluate their course about the facility's SHARE philosophy. Even though results from pre- and postcourse questionnaires were not significant, quantitative analysis of data from 14 obstetrics-gynecology nurses demonstrated that the online course was an appropriate educational platform for their unit.

Adult learners, like the medical residents and nurses in Cheung (2016)'s and Hsu et al.'s (2014) studies, are self-directed individuals capable of independent learning behavior (Spies, Seale, & Botma, 2015). There are five principles of adult learning. These principles include drawing on previous experiences to influence new knowledge. Social norms and problem-centered learning inspire adult learning strategies. Adult learners are motivated by internal forces, and they want to understand why they must learn a concept before participating in educational activities (Spies et al., 2015).

Malcolm Knowles popularized andragogy (adult learning theory) in the 1980s (Adult Institute for Research, 2011). Andragogy proposes that adults are self-directed learners who grasp concepts by performing a task or solving real-life problems (Adult Institute for Research, 2011). The premise for adult learning principles is that adults learn differently than children. Spies et al. (2015) used adult learning principles to develop a

high-fidelity simulation exercise for 18 mature, post-graduate nursing students in South Africa. During “life-like” clinical scenarios, students drew on previous experience to perform a variety of skills within 45 – 60 minutes. Results from Spies et al. ‘s (2015) study suggested that educators must assess a group’s “self-directedness” before a learning exercise. The authors’ results suggested that nurse educators should introduce new concepts through collaborative discussion and reflection at regular intervals in the nursing curriculum.

TRA (see Appendix G) was developed by Fishbein and Ajzen in the 1980s. It is a behavioral theory that elucidates how individual beliefs, social attitudes, group norms, and perceived behavioral control influence intent and behavior. The model is commonly used by the community and public health agencies to study health promotion activities such as cervical cancer screening, smoking cessation, and safe sex practice. According to Fishbein and Ajzen (2010), an individual’s personality, mood, emotion, stereotypes, values, perceived risk, general attitudes, and past behavior influence an individual’s behavioral, control, and normative beliefs. Societal factors such as education, age, gender, income, religion, race, ethnicity, and culture play an essential role in the formation of individual and group beliefs. Fishbein and Ajzen (2010) proposed that communication outlets such as social media, and television also influence personal and societal knowledge, attitudes, intent, and actions.

Mullan and Westwood (2010) used TRA to assess “attitude, subjective norm, intent, and self-reported behavior” towards sexual health education amongst 46 British school nurses. The nurses, all women, were asked to describe how London’s Department

of Health directive, “The School Nurse Practice and Development Resource Pack,” influenced their nursing practice. Using qualitative analysis, the researchers determined that even though school nurses were aware of the resource packet, individual knowledge and attitude had a significant effect on a nurse’s intent to implement the Department of Health’s sex education policies. Results from this study demonstrated that providing a single educational resource is not enough to motivate school nurses to diversify their attitude toward educating students about sexual health practices. Findings from this study inferred that educators should consider individual and collective attitudes about a topic when they design instruction.

Relevance to Nursing Practice

BICU nursing knowledge of the criteria, signs and symptoms, and treatment of sepsis may be influenced by their attitudes and perceived ability to influence early recognition and prompt treatment of sepsis. Multidisciplinary treatment of sepsis requires collaborative communication and interaction between nursing staff and members of the patient care team (Foss and Frost., 2019). In the daily rounds, the multidisciplinary team reviews overnight events and plans interdisciplinary care at least once per shift. Burn Center leaders are avid advocates for the application of collaborative practice principles such as shared mental model, mutual trust, and team-focused commitment to accuracy, flexibility, safety, and efficiency. Given this environment and the results from studies by Cheung (2016), Hsu et al. ‘s (2014), and Spies et al. (2015), TRA, andragogy, and the ADDIE paradigm were appropriate theoretical frameworks for designing an educational module on burn-sepsis for BICU nurses.

Nurses must possess the knowledge and ability to conduct tasks and duties they were hired to perform (Jeffery et al., 2016). To practice in the Burn Center, BICU staff must be competent in knowledge of interventions that prevent and reduce the impact of burn injury, infection, surgery, critical illness, and pre-existing ailments. Given ABA's 2017 burn nurse knowledge and competency requirements, the application of the ADDIE approach, TRA theory, and adult learning principles was fundamental strategies to increasing BICU nursing knowledge about early recognition and treatment of sepsis.

Previous attempts at enhancing nursing knowledge about sepsis were not sustained the Burn Center. The nursing department attempted to educate nurses about sepsis in 2013. This project used an automated screening tool to detect sepsis. Unfortunately, when the contract for the electronic database expired, the organization opted to discontinue the product because upgrades were costly. A burn surgeon led the second sepsis education project. He was passionate about early identification and treatment for sepsis. However, he devised a cumbersome, paper-based, and screening tool. Nurses failed to embrace the project because the tool was complex, and they felt the physician was condescending towards nurses, especially novice staff. The sepsis course in this DNP project was designed for all BICU nurses and centers around multidisciplinary tasks that they perform each day. The success of this education project will depend on the department leader and Nurse Educators' ability or willingness to support follow on training for staff. Dissemination of sepsis concepts amongst nursing staff and the multidisciplinary team may improve Burn Center staff compliance with sepsis and infection prevention bundles. For example, the burn sepsis pocket card that

compliments course instruction could be shared with nursing staff and posted around the unit. During team huddles, BICU nursing leadership could promote knowledge uptake by acknowledging nurses who are compliant with sepsis and infection prevention bundles.

Local Background and Context

Nurses in the Burn Center are socialized to prioritize wound care. During nursing orientation, BICU nurses receive a minimum of 80 hours of education in assessment, documentation, and management of burn wounds. Each nurse orientee receives a booklet on different types of wound treatments and dressings. At the end of their nine-week orientation, novice BICU nurses pass a written test on basic burn wound care. Orientees documentation of wound care and treatment of infected burn wounds are heavily scrutinized. Patient acuity and the “effort” required to manage burn wounds determine patient care assignments the duration of a novice burn nurse’s orientation to the BICU.

The wound care committee is the largest and most active nursing group in the unit. These committee members hold a privileged status on the unit. They are recognized by leadership and their peers as clinical experts in burn care. These staffs are intimately involved in teaching, coaching, and mentoring nurses in the unit. The active promotion of excellence in wound care to the exclusion of other infection prevention and treatment actions further denigrates the vital importance of nursing actions such as on-time antibiotic delivery that improve early recognition and treatment of sepsis in burn populations.

A burn patient’s risk for sepsis correlates with their length of stay, percent and type of injury, and the presence of inhalation injury or other co-morbidities. For example,

a patient with 40% TBSA thermal burn and inhalation injury (smoke and heat damage to the bronchial airways and parenchyma) typically spends 40 to 50 inpatient days in the Burn Center. Burn patients are uniquely susceptible to multi-drug resistant infections from invasive devices and the hospital environment (Yan et al., 2018). VAP is a top source of hospital-acquired infection in Burn Center patients (Gomez et al., 2009). In their 2009 study, Gomez et al. (2009) found that 55% of the 74 Burn Center patients autopsied between January 2004 to December 2007 died from pneumonia. Elderly burn patients and those with inhalation injury, concomitant trauma, substance abuse, or other medical diseases are at higher risk for sepsis-related demise (Tridente, 2018). Results from the Gomez et al.'s (2009) study demonstrated that patients in the Burn Center are at high risk for sepsis from pneumonia, burn wounds, and indwelling devices.

The Burn Center is one of six verified burn units in the state. It has a 16-bed ICU, 26-bed PCU, two burn-specific operating rooms, a burn clinic, and a rehabilitation center that cares for burn injured inpatients and outpatients. Seventeen percent of the Center's admissions between 2011 to 2018 were males, 60 years of age and older. The Burn Center accepts all military patients with a burn, blast, and trauma injury. The Center also cares adult burn patients from 49 surrounding counties with skin diseases such as Steven's Johnson Syndrome, calciphylaxis, and purpura fulminans. Like burn patients, this unique population is at high risk for sepsis and septic shock from open and infected wounds. Therefore, enhanced nursing knowledge about the nuances, signs and symptoms, and treatment of sepsis may improve care provided to Burn Center populations with skin diseases and other nonburn illness.

Military patients with battle-related injuries experience prolonged evacuation to the United States from the operational theaters in Iraq, Afghanistan, and other nations around the world. It takes several hours or days for a military patient to arrive at the Burn Center for definitive care. During transport, these patients encounter an array of bacteria from a variety of environments. Burn Center studies in 2009 and 2018 demonstrated that military patients are younger and have fewer comorbidities than their civilian counterparts. Battle-field injuries during this period contributed to a higher percentage of full-thickness burns, inhalation injuries, and multiple organ dysfunction. Sadly, infections, namely fungus, *Pseudomonas*, and *Klebsiella*, contributed to a higher incidence of severe disability amongst military patients (Gomez et al., 2009; Rizzo et al., 2019). On the other hand, the presence of comorbidities such as respiratory and cardiovascular failure, inhalation injury, sepsis, gastrointestinal and renal dysfunction, and advanced age contributed to a higher incidence of sepsis-related death amongst burn injured civilian patients (Rizzo et al., 2019).

Seventy-five percent of the Burn Center's admissions arrive during nights and weekends. During these hours, graduate medical education residents, who rotate every month, direct care with guidance from an attending burn surgeon or intensivist. Since these residents are not experts in burn care, BICU nurses must be knowledgeable, confident, and competent in the care of acute and critically ill burn patients. Given the high incidence and risk for sepsis, septic shock, and multiorgan failure amongst Burn Center populations, the BICU nursing staff must be proficient in early recognition and treatment of sepsis. BICU nurses are a vital member of the patient care team. These staff

collaboratively facilitate complex treatment regimens for acute and critically ill burn patients. An evidence-based sepsis course that improves nursing knowledge of strategies to rapidly detect and treat sepsis may benefit all the populations who receive from Burn Center staff.

“Burn injury is one of the leading causes of unintentional death and injury in the United States” (ABA, 2018). Young adults age 20 – 29 have 1.5 times the risk of sustaining a burn injury. The Burn Center is in an urban community, and most patients who receive care in this specialty hospital are young Hispanic and African American males who are injured in an occupational accident or incident. Hispanic and African American males in the county have the highest age-adjusted mortality compared to other races. 16.4% of deaths in the county are due to sepsis (Freeman, 2019). Therefore, educating BICU nurses about sepsis may reduce death and disability from infection for young burn injured civilian and military patients.

Role of the DNP Student

DNP prepared nurses are essential to the translation of evidence into clinical practice. As a leader in advance practice nursing, DNP nurses must seek to improve nursing knowledge and competencies. Essential tenets of DNP practice include translation of evidence, promotion of evidence-based patient-centered care, and facilitation of goal-directed inter-professional team collaborations (Walker and Polancich, 2015). I am passionate about evidence-based nursing practice, educating staff about new knowledge, and improving patient outcomes. As a Clinical nurse specialist (CNS) with more than 25 years of critical care experience, I believe that patients should

receive evidence-based care, goal-directed care. This DNP project motivated me to be part of a system-wide process that improves burn patient outcomes. It also helped me learn how to gather, analyze, and synthesize evidence-based literature, nursing knowledge, and multidisciplinary expertise that guide the care of septic patients.

My role in the DNP project included gathering and analyzing literature, developing instructional materials, and revising the educational module after it was reviewed and validated by a panel of experts. Since I do not have an extensive background in burn nursing, feedback from experts in burns, infection control, wound care, critical care, and leadership sepsis guided and validated instructional materials. I delivered course materials to the BICU's Nurse Educator during a 30-minute meeting. She will brief the BICU's nursing leadership. If the Burn Center elects to use the sepsis course, they will retain authority on the implementation and management of instructional materials.

Role of the Project Team

There is no evidence of a course that educates burn nurses about the nuances of burn sepsis and early identification and management of sepsis in burn populations. Given this void in the literature, the burn sepsis module was evaluated and validated by a panel of clinical experts. This team ensured that course materials were accurate, relevant, and pertinent to the BICU nursing practice. There were six members of the expert panel. Panelists included four clinical nurse specialists (CNS) who are experts burns, wound care, perioperative, burn injury research, and burn nurse preceptorship. A critical care nurse with eight years of leadership and burn nursing experience and the Chief of

Infection Control, who is also a nurse, also served on the panel. Recommendations helped guide revisions of instructional design and educational materials.

Simon and Goes (2016) defined an expert as an individual with significant training in, and knowledge of, a distinct topic. For example, the Chief of Infection Control has more than 30 years of experience in leadership, critical care, and infection prevention. The nurse leader who served on the panel had 8 years of critical care and leadership experience. She serves as the Assistant Chief Nurse of the Burn Center and directs clinical operations for nursing staff throughout the facility. The perioperative CNS is the Chief of Perioperative Nursing Services and has more than 20 years of nursing experience. She excels in leadership, infection prevention, and burn wound care. The perioperative Chief nurse recently implemented a PI project that improved the wound biopsy processes in the operating room. One of the CNS's had over 35 years of experience in critical care and animal research. His research focused on burn resuscitation, mechanisms of burn injury, and physiologic manifestations of organ dysfunction in burn-injured animals. The other Burn CNS has ten years of experience in burn nursing. Her interests and peer-reviewed publications include development of nursing orientation and preceptorship programs, education and mentorship of burn nurses, and performance improvement projects. This diverse group of panelists represented nursing knowledge and experience from a variety of burn, critical care, and leadership perspectives. Their contributions ensured that the course was relevant to BICU staff and burn nursing.

After an initial in-person meeting with the DNP student, members of the expert panel received two emails. One email contained four items the sepsis course, a 12-item post course test, 3-item course survey, and the modified VREP. The VREP is a tool used by experts to measure face, construct, and content validity of the post course test (see Appendix H). Permission to use this tool was granted by the author, Dr. Marylin K. Simon. The VREP evaluated clarity, wordiness, negative wording, overlapping responses, the balance of concepts, and the absence of jargon in the post course test and survey. A second email was delivered to panelists via Survey Monkey. Survey Monkey is a cloud-based company that provides a suite of survey services for individuals and businesses. Panelist used the 10-item Survey Monkey tool to assess and validate course content. Course content validated include Part I, II, and III of the burn sepsis course. A packet of literature was available to address panelist concerns about the source of burn, sepsis, and infection prevention concepts. Experts were encouraged to meet with the student and request additional assistance with evidence presented in the course. Panelists had 2 weeks to evaluate and provide feedback on instructional materials. Feedback from both surveys validated that burn sepsis content was accurate, pertinent, congruent with BICU nursing practice, and clinically relevant to the care of burn patients. The panel also confirmed that instructional materials were evidence-based, nonbiased, and applicable to multidisciplinary care of septic burn patients. After completing their review of the course materials, the experts submitted their recommendations to the DNP student via email. Two experts met with the student in-person to clarify findings and discuss concerns about educational materials. Their recommendations ensured that instructional materials met

the learning needs of the nursing staff and the organization. For example, the wound care CNS contributed photos of infected wounds and advised the alteration of course materials into a format that may improve nursing's ability to identify the progression of wound infections. The wound CNS provides on the spot training during daily rounds. She also teaches classes to new Burn Center staff and conducts training during staff development day. Given her role, the wound care CNS's recommendations were vital to improvements in instructional design and course content.

Summary

Sepsis is associated with multisystem organ failure, delayed wound healing, prolonged hospital-stay, severe disability, and death, particularly in battle-injured military patients (Gomez et al., 2009; Rizzo et al., 2019). When sepsis is identified or suspected, the ABA's 2007 Sepsis Consensus and the 2016 SSC Guidelines advise clinicians to search for a source of infection, initiate antibiotic treatment, and expeditiously manage the manifestations of sepsis, septic shock, and organ dysfunction. Regular screening with criteria from the 2016 Sepsis guidelines and ABA's 2007 Sepsis Consensus may contribute to prompt recognition and treatment of sepsis (Tridente, 2018; Lopez et al., 2017). Unfortunately, there is no evidence of a burn-specific sepsis course in the literature. In addition, the Burn Center does not have a standardized format to improve nursing knowledge of sepsis in burn patients. So, the DNP project intended to create and validate a sepsis course for BICU nurses. This course may enhance nursing knowledge of the nuances of sepsis and the criteria for early recognition and treatment of sepsis in burn populations. Section two of this paper explored how adult learning theory, the ADDIE

approach, and TRA influenced DNP project development. It also explored how these conceptual models and theories intersect with BICU nursing knowledge and burn nurse competency. Finally, this section described the role of the DNP student and expert panel and explored how a sepsis course may bridge the knowledge gap for BICU nurses.

Section 3: Collection and Analysis of Evidence

Introduction

Throughout the United States, hospital systems are developing comprehensive education programs that improve early identification and treatment of sepsis (CDC, 2018; Delaney et al., 2015). Research by Delaney et al. (2015), Gyang et al. (2015), and Kleinpell (2017) demonstrated that online education modules enhance nursing knowledge and self-assessed competency in early recognition and treatment of sepsis. Current literature suggests that burn nurse knowledge about early identification and rapid treatment of sepsis requires familiarization with the ABA's 2007 consensus definition of sepsis, the 2016 Surviving Sepsis Campaign's guidelines, and the Hour-1 Sepsis Bundle. However, a search of Thoreau (a database in Walden University's library) and Google and Bing (public search engines) did not elicit evidence of formal or informal courses that educate burn nurses about sepsis. Therefore, the purpose of this evidence-based project was to develop and validate a sepsis course for BICU nurses. This education module may improve BICU nursing knowledge of the nuances of burn sepsis and the criteria for early recognition and treatment of sepsis in burn patients. In Section 3, I explore the practice-focused question, expound on sources of evidence, and describe the process of gathering literature for the sepsis course. In this section, I also analyze the systems used to organize and analyze evidence.

Practice-Focused Question

After initial resuscitation, sepsis is the principal cause of morbidity and mortality (Greenhalgh, 2017). Sepsis-related illness such as acute kidney injury affects up to 65%

of burn patients (Mann-Salinas et al., 2013). BICU nurses are in a unique position to influence collaborative care provided to septic burn patients. Recognition of the signs and symptoms of sepsis and managing septic shock are core competencies for burn nurses (ABA, 2017). The ABA expects burn nurses to employ interventions that mitigate and prevent complications from an infection. However, there is no current definition of burn sepsis, and the Burn Center does not have a standardized platform to educate BICU nurses about burn sepsis. Given these findings, this evidence-based practice project's practice-focused question was, "What is the process for developing and validating a sepsis course for BICU nurses?" Key literature for the course included ABA's 2007 Consensus definition of sepsis, the SSC's 2016 guidelines (Sepsis-3), and the SSC's 2018 update - the Hour-1 Sepsis Bundle.

The ADDIE approach influenced the design of the sepsis course. The five phases of ADDIE helped create a streamlined process that provided continual feedback on the quality of instructional design, materials, and resources. This process ensured that the learning needs of the individual BICU nurses and the organization were met throughout the course (see Figure 1). A panel of experts validated instructional materials using the modified VREP and a 10-item survey on Survey Monkey. Panelists helped inform course design, structure, and alignment with learning needs of BICU nurses and the organization. The expert panel examined constructs, such as quality of course content, the utility of knowledge assessment tools, the relevance of instructional materials to Burn Center nursing practice, general characteristics of burn sepsis concepts, and the application of sepsis, burn, and critical care concepts to the care of burn patients.

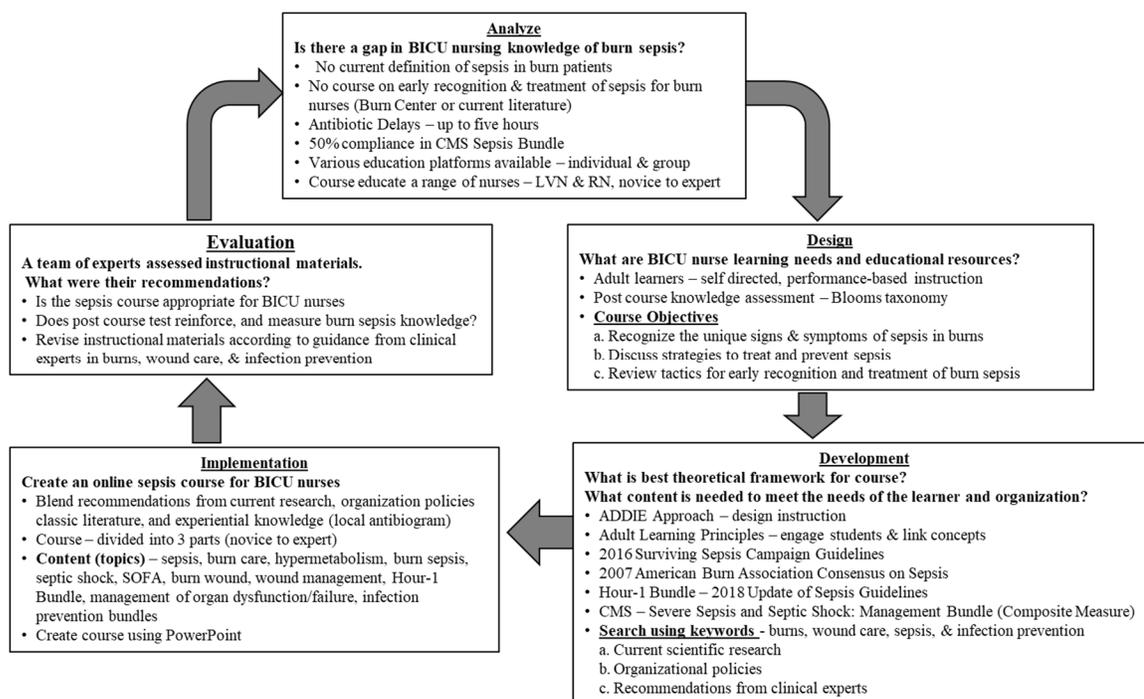


Figure 1. The ADDIE approach: Development of a sepsis course for BICU nurses.

Sources of Evidence

According to the CDC (2018), healthcare staff must be knowledgeable of the rationale for initiating time-sensitive, goal-directed therapies in septic populations. Schilinski et al. (2019) urged instructors to ensure that educational materials are innovative, interactive, and pertinent to a nurse's specialty or clinical environment. When designing educational materials, Jeffery et al. (2016) advised nurse educators to engage internal and external resources to help meet the perceived knowledge gap or need. Jeffery et al. (2016) also called on educators to leverage subject matter experts who can ensure that course content meets learning objectives. Jeffery et al. (2016) advised educators should focus their search on information that supports the three domains of learning.

There are three domains of learning: affective, cognitive, and psychomotor. The affective domain “focuses on emotions, feelings, beliefs, and values of an individual” (Jeffery et al. 2016, pg. 62). The psychomotor domain is hands-on knowledge obtained through the completion of a task or skill. The affective domain aims to explore “emotions, feelings, beliefs, and values” of the student (Jeffery et al. 2016, pg. 62). The cognitive domain includes “knowledge-based information about remembering, reasoning, and prioritizing (Jeffery et al. 2016, pg. 62). Because the goal of the project was to develop and validate a course that may improve nursing knowledge, I focused on cognitive domain of learning. Instructional materials included photos of infected burn wound, visual mnemonics of sepsis treatment interventions, and checklists that highlighted infection prevention concepts.

External sources of information were obtained from national and local library databases, reputable professional websites, and organizational policies. These sites contained peer-reviewed literature about sepsis, burn sepsis, septic shock, hypermetabolism, burn injury, wound care, wound infection, sepsis education, and infection prevention practices in ICUs. While there was an abundance of scientific information about sepsis, sepsis education, and burn injury in Google Scholar, CINAHL, Medline, Ovid, PubMed, and Thoreau, there was no evidence of a sepsis education course for burn nurses.

Total Burn Care (2018) is the preeminent text for burn-specific pathophysiology, physical findings, and treatment protocols. This text, the ABA’s 2017 burn nurse competencies, and the 2007 ABA consensus on sepsis helped me identify essential

nursing knowledge for the collaborative treatment of sepsis, infected burn wounds, and multiorgan failure. There are few studies and no current validated tools that were sensitive and specific to the detection of sepsis and the measurement of sepsis-related multiorgan failure in burn populations. Therefore, key search terms for the project included *sepsis, burn sepsis, septic shock, sepsis guidelines, sepsis education, nurse-led sepsis protocols, hypermetabolism, management of critically ill burn patients, and infection prevention bundles in ICU*. Additional terms used in database searches were *burn nurse competency, the ADDIE Approach, the Theory of Reasoned Action, and adult learning principles*. Websites for the Society of Critical Care Medicine, the CDC, Sepsis Alliance, ABA, and the International Society of Burn Injury contained peer-reviewed articles and cutting-edge research on sepsis and sepsis education projects. In my literature review, I focused on the collection of full-text, English-language publications, as well as classic burn and sepsis research published within the last 5 years.

The primary focus of the literature search was to find a body of peer-reviewed literature that informed evidence-based knowledge about the management of sepsis in burn populations. The 6S pyramid of evidence served as the theoretical framework for analyzing the body of literature. Evidence-based interventions gathered from summaries, primary research, and systematic reviews elucidated strategies for managing sepsis and septic shock. Evidence from textbooks, expert opinion, and reputable websites, such as the CMS Center for Clinical Standards and Quality, helped guide course design and content.

When developing a body of literature, I analyzed studies that explored the concepts sepsis, burn sepsis, hypermetabolism, septic shock, the Hour-1 Bundle, the SOFA score, multisystem organ dysfunction/failure, and infection prevention in depth. Systemic inflammatory response syndrome (SIRS) is the body's global response to an invading organism. A sustained immunologic response to infection is measured by quantifying multisystem dysfunction. SIRS criteria are a list of symptoms that quantify organ dysfunction. The criteria include a temperature greater than 38 °C or less than 36 °C, heart rate greater than 90 beats per minute, respiratory rate greater than 20 breaths per minute, carbon dioxide less than 4.kPa, and white count greater than 12,000/mm³ or less than 4000/mm³ or greater than 10% immature neutrophils (bands) (Tridente, 2018). Sepsis is a "life-threatening organ dysfunction caused by a dysregulated host response to infection" (Rhodes et al., 2016, pg. 488). Burn sepsis refers to the presence of three or more signs of SIRS and documentation or suspicion of infection in a burn patient (Tridente, 2018). In 2007, the ABA quantified burn sepsis criteria a a temperature higher than 39⁰ or less than 36.5⁰ Celsius, progressive tachycardia and tachypnea, thrombocytopenia, hyperglycemia (in the absence of pre-existing diabetes), and an inability to tolerate feedings. Suspicion or confirmation of burn sepsis is determined by the presence systemic inflammatory response syndrome (see Appendix I) and at least one of the following: a positive culture from pathologic tissue source or clinical response to antimicrobials (Yan et al., 2018). It is important to note that while burn sepsis and the sepsis criteria are similar, symptoms of burn sepsis were expanded to include gastrointestinal and splenic function. Evaluation of these organ systems were included in

the ABA's 2007 Sepsis Consensus because the burn experts who developed the burn sepsis felt that the definition of SIRS and sepsis was nonspecific and inconclusive in burn populations (Greenhalgh et al., 2007).

The 2016 Surviving Sepsis Campaign's guidelines, commonly known as Sepsis-3, lists 21 systemic inflammatory response syndrome findings that should be considered when determining the presence of infection. Interestingly, the identification and diagnosis of sepsis is easier because the 2016 only require the presence of two or more signs of organ dysfunction. SSC directs clinicians to measure the severity of organ dysfunction using 6-item sequential organ failure assessment (SOFA) score. SOFA variables include partial pressure of oxygen (PaO_2) and fraction of inspired oxygen (FiO_2) ratio, Glasgow Coma Scale, Mean Arterial Pressure (MAP), vasopressor requirements, serum creatine or urine output, bilirubin, and platelet count. The SOFA score measurement zero to 24 and may be used to assess an acute or critically ill patient's risk for severe illness and death from multiple organ failure. In critically ill patients, a SOFA Score equal to or greater than 2 points or more indicates in hospital mortality of more than 10% (Tridente, 2018).

Septic shock is an extreme response to infection. The 2016 SSC guidelines define septic shock as persistent hypotension with lactate greater than 2 mmol/L despite fluid resuscitation. In the absence of hypovolemia, patients with septic shock and elevated serum lactate need vasopressors to maintain a MAP greater than 65 mmHg (Rhodes et al., 2016). The Hour-1 bundle is the cornerstone of treatment for sepsis and septic shock (Levy, Evans, & Rhodes, 2018). Upon suspicion or confirmation of sepsis, the 2018 update of SSC guidelines recommends the following: measurement of lactate and follow

up testing of lactate if the initial finding is greater than 2 mmol/L; obtain blood cultures before antibiotic administration; administer broad-spectrum antibiotics within one hour; rapid delivery of 30 ml/kg of crystalloid for hypotension or lactate greater than 4 mmol/L; and application of vasopressors within 1 hour of fluid administration or in the presence of hypotension (defined as a mean arterial pressure or MAP less than 65mmHg) (Levy et al., 2018).

Current research demonstrates that nursing education about sepsis, the SOFA score, septic shock, and multiorgan failure is associated with improved survival of hospitalized patients (CDC, 2018; Davis et al., 2016; Levy et al., 2018). Since the sepsis course may be incorporated into Burn Center nursing orientation, annual training, or continuing education platforms for BICU nurses, a panel of experts reviewed and validated instructional materials. Feedback from panelists, who are subject matter experts in their field, ensured that course content met learning objectives and bridged the nursing knowledge gap. Panelists validated that course content was accurate, applicable, and pertinent to the knowledge, skills, and behaviors of BICU nurses. For example, panelists used the ten-item Survey Monkey tool to assess course content. This survey consisted of four yes/no questions, two Likert scale questions, and four open-ended questions. The four “Yes/No” questions assessed course design, consistency of course content with learning objectives, and relevance of content to burn nursing (see Table 1. Comparison of ABA Burn Nurse Competencies and Sepsis Course Objectives). Two Likert scale questions evaluated course quality and usability for BICU nurses. Four open-ended questions empowered panelists to share concerns about the general characteristics of burn

sepsis concepts and course design. The panelist also used the 10-item modified VREP to validate the utility of knowledge assessment tools and application of sepsis concepts to the care of critically ill burn patients. Individual and aggregate subject matter expert data from the VREP was evaluated using descriptive statistics such as the mean, median, and mode. Responses to open-ended questions and in-person interviews added to the data used to validate instructional materials. Since the ABA's 2007 Consensus contained similar but distinctly different information than the SSC's guidelines, feedback from the experts was essential to aligning instructional materials with the learning needs of nursing staff and the Burn Center.

Table 1

Comparison of 2017 ABA Burn Nurse Competencies and Sepsis Course Objectives

Domain name	General burn nurse competency statement	Essential performance criteria
Physiologic support	Recognizes the unique signs and symptoms of sepsis in the burn patient	Explains the pathophysiology and unique signs/symptoms of burn sepsis Assesses routinely for development of burn sepsis Engages prompt interventions when sepsis symptoms arise
	Employs interventions to reduce secondary complications associated with burn injury	Describes common secondary complications by body systems Initiates interventions to prevent or mitigate complications
	Employs appropriate infection prevention practices	Explains the significance of infection prevention measures for the burn patient Identifies reasons for increased infection risk Outlines infection prevention guidelines per institutional and American Burn Association (ABA) protocols Considers the role of the patient's gastrointestinal, skin, and burn wound microbes and burn center microbes
Learning objectives of sepsis course		
Sepsis Course Objectives	Part I: Recognize the unique signs & symptoms of sepsis in burn patients	Examine the pathophysiology and signs and symptoms of burn sepsis Identify three causes for increased infection risk in burns Discuss the role of micro-organisms in the development of sepsis & septic shock in burn patients List two signs & symptoms of sepsis
	Part II: Discuss strategies to treat and prevent sepsis and sepsis-related multiorgan failure	Identify six interventions used to treat sepsis promptly Discuss three strategies to manage sepsis-related organ failure List two infection prevention protocols Identify three infection prevention bundles and policies
	Part III: Clinical scenario: Review strategies for early recognition and treatment of sepsis in burn patients	List the risk factors, signs and symptoms, and treatment of sepsis Identify strategies used to manage sepsis-related organ failure in burn-injured patients

2017 ABA burn nurse competencies source: <http://ameriburn.org/wp-content/uploads/2017/05/bnci-competency-document-february-2017-final.pdf>. DNP student created the learning objectives for the sepsis course.

Analysis and Synthesis

When developing a course, Jeffery et al. (2016) advised nurse educators to incorporate the meta paradigms of person, health, environment, and nursing. The application of these nursing meta paradigms is vital to providing nurses with a consistent framework to make decisions about nursing care (Jeffery et al., 2016). The body of literature gathered, analyzed, and applied to the course were pertinent to nursing meta paradigms explored in the sepsis course. The person (a BICU nurse) must understand, rapidly treat, and prevent sepsis in burn populations. Health is the change in patient outcomes that occur after the BICU nurses apply their knowledge of sepsis concepts and treatment interventions. The environment includes physical concepts such as infection prevention principles that must be considered during the care of a burn patient. Burn nursing is the care performed by the BICU nurses in the Burn Center.

The first step in the development of the sepsis course was to conduct an extensive search of evidence-based literature. This search attempted to find evidence that bridged the gap in burn and sepsis instruction. The 6S Pyramid of Evidence and the GRADE system was used to classify, organize, and analyze current and classic literature. Items were retrieved from reputable professional websites, organization resources, and national databases included international burn and sepsis guidelines, sepsis treatment protocols, infection prevention bundles, as well as sepsis and professional education resources (see Figure 2). Articles included in the body of literature explored data from adult burn and sepsis populations. Pediatrics, pregnancy, and nonburn critical illness such as burn resuscitation were excluded from course content.

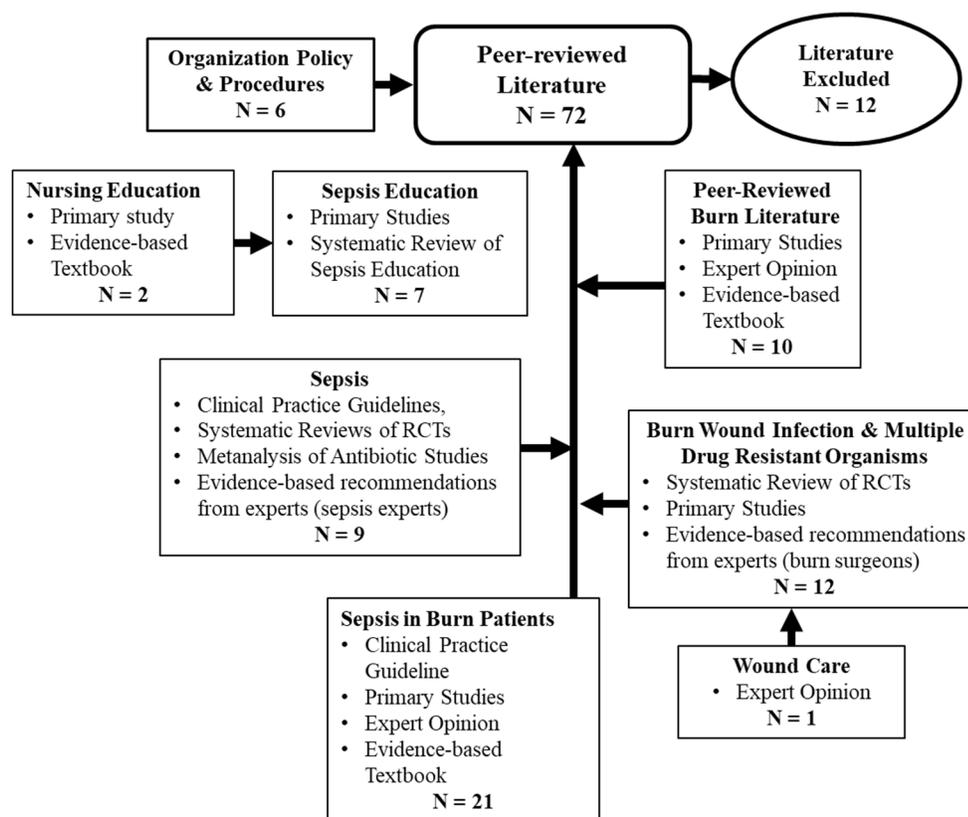


Figure 2. Literature search for burn sepsis course.

The ABA has not updated its guidance on sepsis in burn populations since 2007. However, their Sepsis Consensus serves as the primary source for defining burn sepsis in Burn Center and throughout the burn community. A search of Semantic Scholar (a search engine for peer-reviewed literature) revealed that the ABA's 2007 Consensus on sepsis was cited 253 times. This conference report influenced 11 papers and it was cited 41 times in the background section, 26 times in the methods section, and 4 times in the results section of burn abstracts. Conversely, the SSC's 2016 guidelines were cited in the abstracts of 1667 studies and the SSC's 2018 was cited 155 times in abstracts. A focused search of websites sponsored by nationally recognized professional bodies such as the ABA, Society of Critical Care Medicine (SCCM), American Association of Critical Care

Nurses (AACN), CDC, and Sepsis Alliance elucidated a host of current evidence-based resources for patients, providers, and health educators. Seventy-two sources of information were selected and 12 of these articles were rejected. In total, the 60 sources of information selected included evidence-based guidelines and protocols that improved patient outcomes and nurse compliance with sepsis and infection prevention bundles.

When creating educational materials, Branch (2009) advised educators to use evidence-based strategies and content that motivate, inspire, and reinforce learning. Jeffery et al. (2016) encouraged educators to organize instructional materials so that learners can quickly and easily perceive essential concepts. Current evidence-based strategies for sepsis instruction in the literature include traditional didactic lectures, online self-study modules, pocket cards, and posters, simulation exercises, focused instruction by sepsis champions, and collaborative case study review by sepsis teams (Fee et al., 2017). Online modules were the most popular mode of instruction for sepsis education because they can be tailored to a variety of healthcare providers, particularly in hospital systems with large numbers of staff.

When developing a sepsis course for nurses, Davis et al., (2016), Kleinpell (2017), and the SCCM (2019) urge educators to empower bedside nurses with knowledge and tools that inspire them to autonomously screen “every patient; every shift; every day” (SCCM, 2019, pg.16). To inspire BICU nurses to rapidly identify and collaboratively treat sepsis, recommendations from Davis et al. (2016), Kleinpell (2017), and the SCCM (2019) such as incorporating local policy and practice in sepsis education informed the development of burn sepsis course. The SCCM encourages educators to prepare courses

that engage critical thinking and motivate nurses to understand the rationale for new tasks. Davis et al. (2016) found that nursing compliance with the sepsis bundle improved after online education about the six elements of the Hour-1 Bundle. Given ABA requirements, Davis et al. (2016) findings, and the SCCM's (2019) recommendations, contents of the sepsis course included epidemiology, risk factors, pathophysiology, and the signs and symptoms of sepsis. Course content also included a modified Hour-1 Sepsis Bundle, a list of strategies to improve management of sepsis-related multiorgan failure, three infection prevention bundles, and two clinical scenarios. The modified Hour-1 Sepsis Bundle instruction highlighted evidence-based burn-specific tasks garnered from current literature (see Appendix J). For example, hospitalized burn patients are at high risk for infection from pneumonia, urinary tract, and burn wound infection. So, the course's modified Hour-1 Bundle graphic included burn-specific concepts such as obtain a tracheal aspirate, evaluate the burn wound, consider colloids during fluid resuscitation, and consider antifungals when administering antimicrobials. Patients with large burn wound are at high risk for death from fungemia (Stuck and Guile, 2013). 28 out of 74 patients autopsied in the Burn Center's 2009 study were diagnosed with fungemia. Current burn literature encouraged clinicians to consider fungemia when diagnosing sepsis in patients with large burns (Norbury et al., 2016). Therefore, instructional materials included photos of burn wounds infected with fungus, tips to improve recognition of the signs and symptoms of fungal infection, and a list of antifungals commonly used to treat fungemia amongst Burn Center populations. The course also included two realistic clinical scenarios that encouraged BICU nurses to critically

examine the risk factors, signs and symptoms, and treatment of early and late sepsis.

These scenarios attempted to engage the affective domain of learning. Data provided in the scenarios were extrapolated from clinical findings of Burn Center patients who were diagnosed or died from sepsis.

Course content also included information from six Burn Center policies. Information from these internal resources helped align nursing practice with current research and experiential knowledge. For example, vancomycin is an essential antimicrobial in the burn community. This medication is commonly used to treat skin and soft tissue infection, especially methicillin-resistant staphylococcus infection (MRSA) (Norbury et al., 2016). The course examined the Burn Center's protocol on administration and monitoring of vancomycin. Instructional materials sought to educate all BICU nurses about vancomycin by including drug administration and monitoring strategies in the course content and the post course test (see Appendix K for a sample of the post course test).

Finally, Blooms Taxonomy and adult learning principles informed development of the post course test. Learning strategies such as recall, apply, analyze, and evaluate formed the basis for the 13-item post course test. The post course test prompted BICU nurses to reflect on clinical data, identify signs and symptoms of sepsis, and recall strategies to manage sepsis. Infection prevention bundles highlighted strategies to reduce the risk of sepsis in burn populations and encouraged nurses to critically think about their role in reducing the incidence and prevalence of hospital-associated infections in burn patients.

Jeffery et al. (2016) advised educators to design education activities that fit into an existing curriculum or educational platform. Approximately 90% of the Burn Center's annual training, nursing orientation, and professional continuing education materials are administered via online instruction. The facility's staff education platform is compatible with Power Point and Microsoft Word. Web and cloud-based application are not approved for use on the organization's intranet. Therefore, course development focused on a product that was easy to implement and compatible with online or paper-based instruction. The BICU's nurse educator and preceptor coordinator will play a key role in implementing the course and analyzing results from nursing staff. Given Branch's (2009) and Jeffery et al. (2016) recommendations and current scientific evidence from Davis et al. (2016) and others, a self-directed eLearning module that used Power Point to highlight the nuances and criteria of sepsis in burn population was the most suitable educational platform for the course.

The student approached panelists about participation in the DNP project. After a short discussion and receipt of the Walden University's Consent Form for Anonymous Questionnaires, the student email panelists the instructional materials and supporting literature about sepsis. The first survey, a 10-item modified VREP, was adapted from the Simon, White, and Goes' (2019) validated survey for expert panels. This questionnaire assessed and validated the 12-item post course test. Panelist received a 10-item course evaluation survey via email from Survey Monkey. Survey questions were modified from SurveyMonkey's bank of course evaluation questions. The revised questions aligned with the constructs of the sepsis course. For example, Survey Monkey's question "Did the

course cover the content you expected?” became “Did the sepsis course cover the content you expected?” Each panelist had two weeks to complete the surveys. Expert emailed their feedback to the student and completed the survey on Survey Monkey.

Recommendations for panelists were stored in a password-protected folder on the student’s computer. In-person discussion with two members of the panel occurred at the site on three separate occasions. Information gathered from experts during the DNP project remain confidential and contributed solely to the development of the sepsis course.

Summary

Section 3 of this paper introduced the DNP project and summarized content from section 2. It highlighted the practice-focused question and reviewed strategies for gathering the body of literature on burn sepsis. Sources of evidence included scientific research, experiential knowledge, and organizational policies. The 6S Pyramid Level of Evidence and GRADE system helped to categorize, analyze, and synthesize current evidence and classic burn literature. Recognizing and treating sepsis is challenging in burn populations, particularly amongst patients with severe burns. This DNP project may improve the BICU nurse’s ability to discern and treat sepsis because it exposes nursing staff to current research, experiential knowledge, and emerging science in the care of septic and burn-injured patients.

Section 4: Findings and Recommendations

Introduction

Optimal treatment for sepsis hinges on early recognition and prompt administration of fluids, antibiotics, and hemodynamic support. Sepsis education courses improve nursing knowledge of early identification and treatment of sepsis (Davis et al., 2016). However, a review of current literature did not elucidate a course about sepsis for burn nurses. Therefore, with this DNP project, I developed and validated a sepsis course for BICU nurses. This course may enhance nursing knowledge of the nuances and criteria for early recognition and treatment of sepsis in burn populations. I examined the body of evidence selected for the development of instructional materials using the 6S pyramid of evidence and the GRADE system. Descriptive statistics and qualitative measures were applied to feedback from members of the expert panel. Recommendations from panelists helped validate course revise and validate instructional materials.

Findings and Implications

When developing and validating a sepsis course, it is essential to match learner and organization needs with a body of evidence that bridges the knowledge gap. Learning theories, such as the ADDIE Approach, adult learning theory, and TRA, were the framework for designing a course that integrates new sepsis knowledge into burn nursing practice. An in-depth analysis of literature informed course design and content, and feedback from a panel of experts validated instructional materials.

Table 2

Analysis of the Level of Evidence in Burn, Sepsis, and Education Literature

	Sepsis	Burn	Education
Systems			
Computerized decision support software electronic health Records	4	1	0
Summaries			
Evidence-based textbooks, clinical practice guidelines	5	2	3
Organization policy	0	6	0
Synopses			
Pre-appraised abstracts of studies and syntheses, journal club review	3	0	1
Syntheses			
Systemic reviews & meta-analyses	4	1	0
Studies - primary research			
Randomized control studies, cohort studies, case-control studies, case report/series	2	17	5
Foundational resources			
Expert opinion, narrative reviews, drug reviews, and the UpToDate website	3	10	5
Totals	21	37	14

Note. The totals indicate a cumulative total of literature in the sepsis course.

An analysis of the literature selected for the education module demonstrated that there is a distinct difference in the volume and quality of evidence about sepsis in burn and nonburn injured populations (see Table 2). Most of the burn literature included expert opinion, narrative reviews, retrospective cohort studies, and case reports of burn specific interventions. The sepsis literature included a diverse sample of high level or strong support for clinical findings. For example, there were a few studies that used artificial intelligence to collect and analyze data from large populations of patients with sepsis. Sepsis literature included several highly regarded systematic reviews and meta-analysis of randomized studies with large populations of patients. The recommendations from the

2016 and 2018 SSC guidelines were derived from primary studies that underwent rigorous evaluation by a team of experts and other stakeholders. Sepsis education research included several primary studies and a handful of systematic reviews about the most effective course of instruction for nurses and other healthcare staff. Given the discord between burn and nonburn sepsis literature, I used a mix of experiential knowledge, classic literature, organizational policies, and current research for the content for this sepsis course.

Examples of current burn sepsis research are Yoon et al.'s (2018) single cohort study of adult burn patients, which is one of the most extensive burn sepsis studies within the past 5 years. Yoon et al. (2018) conducted a retrospective study of 1,185 patients admitted to the BICU in Seoul, Korea, between September 1, 2009, and December 31, 2015. The intent of Yoon et al.'s (2018) study was to examine the sensitivity and specificity of the 2016 surviving sepsis campaign's sepsis criteria in critically ill burn populations. After reviewing results from survivors and non-survivors, Yoon et al. determined that the 2016 surviving sepsis campaign's sepsis criteria and the SOFA score are sensitive (84.8%) but nonspecific (61.8%) for detecting sepsis in burn populations. Yoon et al.'s (2018) results are clinically relevant and pertinent to the identification of sepsis in burn patients. However, given the low specificity Yoon et al.'s (2018) findings, it was essential to evaluate sepsis literature that examined the use of the 2016 surviving sepsis campaign's sepsis criteria and the SOFA score in nonburn adult ICU populations.

Lembke, Parashar, and Simpson (2017) conducted a retrospective cohort study of 15,708 adult ICU patients and is an example of current sepsis research in nonburned

patients. Study participants received care at the University of Kansas Health System's emergency rooms between March 2007 and May 2016. In the study, the 2016 surviving sepsis campaign's sepsis criteria and the SOFA score were sensitive and specific for sepsis (64.7% and 74.0%, respectively; Lembke et al., 2017). Yoon et al.'s (2018) and Lembke et al.'s (2017) studies were well-designed retrospective cohort studies that adhered to Level 4 criteria of evidence. Yoon et al.'s (2018) participants were predominately Korean men who received public healthcare in a national healthcare system. A comparison of the methodology of both studies suggested that Lembke et al.'s (2017) findings may have less bias than Yoon et al.'s (2018) results because of the diversity, size, and ethnicity of the population sampled. The Burn Center is part of an urban academic healthcare system. Lembke et al.'s (2017) sepsis study was selected for inclusion in the DNP project because 40% of the Burn Center population is African American and Hispanic males who reside in ethnically diverse urban and rural communities. Therefore, results from Lembke et al.'s (2017) larger sample of minority patients may be analogous to the characteristics of the Burn Center's population.

The 2007 ABA sepsis consensus and the Burn Centers' policies on antimicrobial administration are examples of experiential knowledge and classic literature. Twenty-three experts in the field of burn care and research experts developed the ABA's sepsis criteria during a 2007 conference in Tuscan, Arizona. The experts met to discuss burn sepsis and elected to use a series of clinical questions to develop the criteria for sepsis in burn-injured populations. These experts reviewed evidence-based literature, shared their findings among attendees, selected seven criteria for determining sepsis, and developed a

special report on sepsis in burn populations. This manuscript continues to serve as the standard for care in burn centers around the world.

Unfortunately, the ABA's consensus on sepsis has not been updated since 2007. Unlike the 2016 SSC guideline, authors of the 2007 sepsis consensus did not offer information about the studies used to create their guidelines. Several studies listed in the sepsis consensus's references were conducted in the late 1970s and the early 2000s. Fortunately, the six organization policies used to create the sepsis course were updated by facility leaders in 2019. The Burn Center's medical director, who is an author, burn surgeon, and expert in burn care and research evaluated and validated each study prior to its inclusion in organization policies. Studies used to develop the policies were no more than five to 10 years old. Organizational protocols, such as the facility's antimicrobial antibiogram, are a prime example of the application of current research and local knowledge and experience in burn sepsis. An antibiogram is a list of antimicrobial drugs commonly used to treat infections in a population of patients. The Center's antimicrobial protocol provides recommendations on treatment for infections common in the local region and Burn Center patients. Evidence from this policy informed treatment interventions detailed in the burn sepsis course. For example, vancomycin is at the top of the list of antimicrobials commonly used in the Burn Center to treat cellulitis or burn wound infection and multidrug resistant organisms such as MRSA. So, this information was highlighted several times throughout the course.

Validation of instructional content and materials is vital to the design and development of any educational product (MacCormick & Cheater, 1995). The expert

panel used two questionnaires to evaluate and validate the sepsis course: the VREP and a 10-item course evaluation survey. Panelists used the VREP to assess the post-course test questions for clarity, wordiness, negative wording, overlapping, balance, use of jargon, appropriateness of responses listed, use of technical language, application to praxis or theory, and relationship to the problem. VREP criteria were ranked one to four. Number one is unacceptable, two below expectations, three meets expectations, and four exceeds expectations. The high mean (3.92), median (4), and mode (4) scores indicated that the panelists determined that the post-course test appropriately measured BICU nursing knowledge of sepsis. (see Table 3).

Table 3

Results from Expert Panel

Criteria	Panelist 1	Panelist 2	Panelist 3	Panelist 4	Panelist 5	Panelist 6	Mean	Median	Mode
Clarity	4	4	4	4	4	3	3.83	4	4
Wordiness	4	4	4	4	4	3	3.83	4	4
Negative wording	4	4	4	4	4	3	3.83	4	4
Overlapping responses	4	4	4	4	4	4	4	4	4
Balance	4	4	4	4	4	4	4	4	4
Use of jargon	4	4	4	4	4	4	4	4	4
Appropriateness of responses listed	4	4	4	4	4	3	3.83	4	4
Use of technical language	4	4	4	4	4	3	3.83	4	4
Application to praxis	4	4	4	4	4	4	4	4	4
Relationship to problem	4	4	4	4	4	4	4	4	4
Aggregate data from panelists	4	4	4	4	4	3.5	3.92	4	4

The expert panel evaluated and validated course content using a 10-item survey on Survey Monkey (see Appendix L). This survey contained four open-ended questions, four “yes/no” questions, and two Likert-like questions. The average time spent completing the survey from Survey Monkey was 4 minutes 9 seconds. Descriptive statistics and thematic analysis measures quantified and qualified feedback from the expert panel.

The panelists used the “yes/no” questions to examine course design and structure, alignment of course objectives and content, and applicability of sepsis content to nursing practice in the Burn Center. A cumulative score of 4 out of 4 or 100% indicated that the course met basic tenets for educating burn nurses about sepsis. Two Likert questions assessed the quality of instruction and appropriateness of educating BICU nurses about sepsis. Likert questions ranked responses from one to five. One was the lowest score, and five was the highest score in both questions. High mean (4.83 and 5) and median (5 and 5) scores from these questions demonstrate that course instruction was appropriate, thorough, and pertinent to the BICU nursing knowledge of burn sepsis (see Table 4. Course Content Validation: Analysis of Responses from Expert Panelist).

Table 4

Course Content Validation: Analysis of Responses from Expert Panelists

Question 1. Is course content consistent with course objectives?					Yes (1)
Question 2. Was the content arranged clearly and logically?					Yes (1)
Question 3. Was course content appropriate for educating BICU nurses about sepsis?					
5	4	3	2	1	
Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree	Mean = 4.83 Median = 5.0
Question 4. Is the content relevant to nursing care in the Burn Center?					Yes (1)
Question 5. Were sepsis concepts adequately explained?					
5	4	3	2	1	Mean = 5 Median = 5
A great deal	A lot	A moderate amount	A little	None at all	
Question 6. Did the sepsis course cover content you expected?					Yes (1)
Aggregate score for questions 1, 2, 4, 6 = 4/4 = 100%					Yes (1) / No (0)

The panelists used four open-ended questions to evaluate and validate course content and design. Panelists provided free-text answers to these questions. Thematic analysis of their collective responses helped to assess the usefulness of course information, examined concepts missing from the course, explored notions vital to sepsis instruction, and highlighted revisions that may improve the course content. One theme consistently identified by panelists was antibiotic stewardship is vital to BICU nursing knowledge and practice. Additional themes that emerged during analysis of panelist responses include visual aids demystify complex concepts, sepsis content should be thorough and meet a variety of learner needs, and course content should be concise and easy to follow.

Individual responses from panelists also guided course revisions. For example, the question “What areas of the course (or section) need to be improved?” elicited comments such as “a lot of content on slides,” and the “number of slides should be limited.” These responses resulted in a reduction of slide content, reorganizing of topics into distinct categories, and a change in the color of titles in the slide deck. Course revisions highlighted and simplified key concepts such as the process for managing sepsis-related acute respiratory failure. Novice and experience BICU nurse knowledge of fundamental sepsis concepts such as antibiotic treatment regimens and wound biopsy procedures were stripped down to their essential tasks.

Members of the expert panel were encouraged to meet with the DNP student to discuss instructional materials. One of the panelists verbalized a concern that the course did not stress the importance of early and on-time antibiotics. Therefore, course revisions highlighted the impact of antibiotics delays and streamlined the timeline for infection in burn patients. Another panelist expressed suggested that some slides were too dense contained advanced concepts that may confuse novice nurses. These recommendations led to the DNP student trimming several slides. Then, a summary of sepsis content was condensed into two slides and inserted into part III of the course. One slide summarized the signs and symptoms of sepsis (see Appendix M). The other slide was a checklist of the six elements of the Hour-1 Sepsis Bundle (see Appendix N). These slides simplified and burn-specific sepsis concepts and tasks. These revisions attempted to encourage BICU nurses to review ideas presented earlier in the sepsis course.

Results from the expert panel surveys suggest that current research, experiential knowledge, and organizational policies may be used to develop and validate a sepsis course for BICU nurses. Expert panel review and validation of instructional materials suggest that the ADDIE approach, adult learning theory, and TRA may be used as a theoretical framework for other population-specific sepsis courses. Adult learning theory principles helped design the clinical scenario and post-course test. TRA influenced the design of instructional materials and the 12-item post course test and 3-item post course survey. ADDIE instructional principles enhanced course construction and improved the quality of instruction throughout the course.

Results from Davis et al. (2016) and Delaney et al. (2015) studies demonstrated that current evidence and experiential-based instruction creates a positive social change within organizations. Social changes associated with this education module may include an improvement in on-time antibiotic delivery, a reduction in morbidity, mortality, and a decline in the burn patient's length of hospital stay. The module may also foster a collaborative climate that promotes nursing compliance with organization policies and national clinical guidelines. For example, each month, the unit's Infection Prevention Committee monitors handwashing, environmental hygiene, VAP, CLABSI, and CAUTI bundles. This education module may result in a reduction of CLABSI, VAP, and CAUTI rates because novice BICU nurses understand why these protocols are essential critical care tasks for burn patient care. Staff who view the education module may be encouraged to embrace organization and hygiene standards such as handwashing and daily environmental cleaning. Improved compliance with infection prevention measures may

contribute to an increase in hand hygiene compliance and greater compliance with the daily cleansing of the patient and staff environment.

The Burn Center is a mecca for military, trauma, and burn research. Therefore, improved compliance with sepsis and infection prevention bundles may have a downstream impact on the quality of research developed at the Burn Center. For example, the VAP Bundle is a multidisciplinary sepsis and infection prevention strategy. The VAP bundle is an essential element in the care of mechanically ventilated patients all around the world. Current research demonstrates that the VAP Bundle reduces the incidence of ventilator-associated pneumonia, days of mechanical ventilation, and length of ICU stay (AHA/HRET HEN, n.d.). In 2016, the Burn Center published a survey of the mechanical ventilation practices of 129 burn centers in the United States. This study found significant variation in clinical practice between individual burn centers (Chung et al., 2016). Improved BICU nursing compliance with the VAP Bundle may impact future multisite Burn Center research on mechanical ventilation practices. Applying a standard approach to the care of mechanically ventilated burn in the BICU may also demonstrate throughout the burn community that nursing practice infused with current science improves patient outcomes.

Recommendations

The dichotomy between burn and nonburn sepsis literature made it difficult to create a burn-specific education module. However, results from this DNP project demonstrate that the ADDIE Approach and adult learning theory was appropriate for creating a course that blended current research, classic literature, and experiential

knowledge about sepsis in burn populations. When developing and validating an educational product, it is crucial to consider the needs of individual learners and the organization. An expert panel evaluated and validated instructional materials. Quantitative and thematic analysis of their responses suggests that nurse educators should consider strategies to simplify sepsis concepts and make this information relevant for nurses who care for unique populations. Findings from the thematic analysis of panelists responses may be helpful to nurse educators developing a sepsis course for nurses in other specialties. For example, surgical clinic staff care for outpatients who present for care after their procedure. Recommendations about photos that adeptly describe wound infections may be vital to nurse educators who instruct staff in a surgical clinic.

Collective themes from panelist's responses may help nurse educators in a variety of disciplines develop sepsis courses that are relevant and effective for a unique specialty. For example, one of the panelists expressed concern that the sepsis course may too advance for novice LPNs who are new to nursing practice and the Burn Center. Based on this feedback, the sepsis course was divided into three parts to meet the needs of different learners. Part one of the course educates novice BICU nurses about essential burn nursing concepts such as the definition and criteria of sepsis and septic shock. This section of the course also explored the epidemiology, pathophysiology, risk factors, and common signs and symptoms of burn sepsis were introduced and explored. Since novice BICU nurses receive a wealth of wound care information during nursing orientation, part one of the sepsis course offers these staff an opportunity to identify the difference between wound colonization, wound infection, and an invasive migration of harmful microorganisms in

the burn wound. Hypermetabolism is a dynamic process unique to burn injury and it confounds early recognition sepsis (Lopez et al., 2017). Since this concept is new to novice burn nurses, part one of the course briefly examines hypermetabolism's role in mystifying the diagnosis of burn sepsis.

Teasing the signs and symptoms of sepsis from hypermetabolism is essential for all burn nurses. So, part two of the sepsis course aims to educate all BICU nurses about strategies to rapidly recognize and treat sepsis. This section encourages experienced BICU nurses to apply evidence-based strategies to the management and prevention of sepsis-related organ failure. For example, optimizing fluids is a vital skill for burn nurses (ABA, 2017). The SSC's Hour-1 Bundle recommends the administration of 30 ml/kg within one hour of detection or suspicion of sepsis (Rhodes et al., 2016). However, rapidly administering balanced crystalloid is not recommended for critically ill burn patients. Burn patients have diffuse capillary leak syndrome, and this pathophysiology does not respond well to rapid fluid boluses (Sheridan, 2015). Experienced BICU nurses are well versed in the use of dynamic fluid resuscitation measures. So, the sepsis course reviewed dynamic fluid management measures such as a cardiac preload, fluid challenges, stroke volume variation, and colloid-based resuscitation. Reviewing these core concepts may improve nursing practice by educating all BICU nurses about the use of dynamic fluid measures in septic burn patients.

To enhance the learning needs of experienced nurses, part two of the course also examines evidence-based strategies to manage critically ill septic patients with a complicated illness such as acute respiratory distress syndrome (ARDS), Clostridium

difficile infection, fungemia, and multidrug-resistant infection. Local practice habits and environmental hygiene practices like changing mattress covers every Monday, daily cleaning of the patient and staff environment, and personnel protective equipment (PPE) required for patient care reinforced the rationale for aggressive infection prevention strategies. Finally, the VAP, CLABSI, and CAUTI bundles are vital components of the Burn Center's and national critical care infection prevention programs. Exposure to these bundles may reinvigorate nursing support for unit compliance with fundamental infection prevention measures.

The third portion of the course used adult learning theory to introduce and enhance BICU nursing knowledge of sepsis, septic shock, multiple organ failure, and infection prevention. It contains a summary of the Hour-1 Sepsis Bundle, a pocket card to aid early recognition of burn sepsis, two clinical scenarios, 13 questions about sepsis, and a two-item post course survey. These instructional materials may stimulate self-reflection on the risk factors, signs and symptoms, and treatment of sepsis in hospitalized burn patients. Post-course test questions include fill-in-the-blank and multiple-choice questions. These questions may help all BICU nurses to recall, analyze, and synthesize sepsis concepts. The test questions seek to encourage novice LPNs to apply new burn sepsis concepts to a real-life scenario. Seasoned RN may analyze the clinical scenario, reflect on previous knowledge, and evaluate their current practice. There is no time limit on answering post-course questions. The absence of a time limit allows maximal time for individual learning and self-reflection.

Nurse educators seeking to develop a sepsis course should consider resources to deliver their instructional materials. For example, if the Burn Center chooses to implement the sepsis course, the BICU's Nurse Educator and Preceptor Coordinator may be responsible for administering the course and analyzing results. These staff should consider using individual and aggregate post-course test scores, such as the means and median, to determine the individual and collective nursing knowledge of burn sepsis. The student offered the Burn Center two versions of the course: a slide deck with voice-over PowerPoint and a slide deck without voice-over. One limitation of this instructional format is that Burn Center leaders will have to assign a staff member to update instructional materials every two years in accordance with revisions of the SSC's Sepsis Guidelines.

Nurse educators should consider adapting their sepsis course to meet the needs of a variety of learners. For example, Nursing leaders in the burn community are in the process of developing certification for burn nurses. The sepsis course may be used as a refresher for experienced BICU nurses seeking certification in burn nursing. Instructional materials could be modified so that the information is relevant to burn nurses in other specialty areas. For example, in the burn operating room, perioperative nurses assist with assessment and monitoring of wounds. A modified course may improve perioperative nursing knowledge of the signs of wound colonization, infection, and microbial invasion. Nurses in the Burn clinic care for outpatients who occasionally present with signs and symptoms of sepsis. With a few adjustments, the course could be modified to help these staff decipher between the signs of hypermetabolism and sepsis in outpatients who are

beyond the initial diagnosis and treatment phase. Caring for the seriously ill burn patient requires collaboration between various disciplines. Rehabilitation therapists who care for burn patients may benefit from a modified course that highlights the pathophysiology, signs, and symptoms of sepsis in burn populations. Finally, graduate medical residents who rotate through Burn Center each month may benefit from in-depth instruction about comprehensive care of the burn patient with sepsis.

Contribution of the Doctoral Project Team

The goal of this DNP project was to develop and validate a sepsis course for BICU nurses. This educational module aims to enhance nursing knowledge of the nuances of early recognition and treatment of sepsis in burn patients. Therefore, the DNP student collaborated with a team of experts to develop instructional materials that were evidence-based, pertinent, and relevant to the BICU nursing practice. Panelists were tasked with critically evaluating and validating instructional materials to ensure that critical concepts were sufficiently explored and succinctly discussed.

There were six members of the expert panel. Each panelist used their clinical knowledge and expertise to determine if instructional materials were appropriate for BICU nurses. Each panelist critically evaluated course materials according to their area of expertise. For example, the facility's Chief of Infection Control was selected to become a member of the expert panel because she is intimately familiar with Burn Center and national VAP, CAUTI, and CLABSI rates, guidelines, policies, and procedures. She develops infection reports and oversees infection prevention activities in the Burn Center. She critically evaluated the infection prevention content. Her responses ensured that

instructional materials were compliant with evidence-based sepsis and infection prevention strategies. The Infection Control Chief's recommendations helped guide the presentation of instructional content such as the VAP, CAUTI, and CLABSI checklist. Advice from the critical care nurse leader, wound care CNS, and burn nurse CNS were vital to ensuring that sepsis, critical care, and wound care concepts were adequately explored throughout the sepsis course. For example, the burn nurse researcher's contributions confirmed that burn knowledge conveyed in the sepsis course met basic scientific standards. The other burn CNS and critical care leader reviewed the course to ensure that it met basic learning needs of BICU nurses and the Burn Center.

Currently, there are no plans to expand the DNP project. However, the Burn Center may choose to present the course to PCU nurses. Future options for the DNP project include the development of a multidisciplinary simulation exercise that reinforces the six steps of the Hour-1 Bundle. The organization could consider recording the simulation exercise and showing snippets of this training on the hospital's closed-circuit television. These video vignettes may enhance patient and staff knowledge of their role in reducing the impact of sepsis. The DNP project may stimulate interest in the development of an automated sepsis screen tool. This sepsis tool may use smart technology to flag burn patients with early signs of sepsis. It may also result in the creation of automated tools that assess organization compliance with the CMS's Sepsis Core Measure. A retrospective cohort study that compares sepsis-related mortality before and after implementation of the burn sepsis course may demonstrate the value of comprehensive instruction in early recognition and treatment of sepsis.

Strengths and Limitations of the Project

There are several strengths and limitations to designing an education module that uses a defined body of literature to target a unique population of patients and staff. The advantages of the DNP project include a robust collection of sepsis literature and a wide variety of evidence-based strategies to develop and deliver sepsis education. For example, sepsis researchers used the highest level of evidence (systems, syntheses, and randomized control studies) to create the 2016 and 2018 SSC guidelines. No less than twenty-five professional organizations and key stakeholders such as patients influenced development of the SSC guidelines. The SSC guidelines are revised every two years, using the highest level of evidence. There is a growing body of evidence-based literature that demonstrates that the SSC guidelines may be pertinent to the care of unique populations such as burn patients. Studies from Yoon et al, 2018 demonstrate that current sepsis data may be applied to burn sepsis interventions. Education in the course is compliant with ABA's 2017 list of burn nurse knowledge and competencies. The sepsis course may be customized into a platform that fits the needs of other stakeholders in the organization. A team of six experts in the burn, infection, and critical care nursing validated the educational concepts and content. Each of these source of evidence and recommendations from the panel of experts ensured that the course met the learning needs of BICU nursing staff.

The absence of a current consensus on the identification and treatment of sepsis in the burn population limits the ability of this DNP project to educate nurses about a variety of manifestations of sepsis-related organ failure in burn populations. There is no

validated burn-specific tool that is sensitive and specific to sepsis-related multiorgan dysfunction in burn-injured patients. The International Burn Society 2016 Guidelines for Burn Care does include recommendations for rapid identification and treatment of sepsis. However, most of the interventions recommended in the guideline are based on studies conducted before 2014. The low volume of randomized control trials in burn populations limits burn-specific recommendations for managing sepsis.

This DNP project focuses on improving nursing knowledge in a single institution with a unique population. Organizational policies and local practice patterns discussed in this course may not be applicable in other burn centers. Since this the 2018 Hour-1 Bundle as the epicenter for treatment of infection and sepsis-related organ dysfunction, the module will need to be updated whenever there are new or more robust sepsis recommendations. The education module is a self-directed, adult learning course created with PowerPoint. This educational format may not meet the needs of nurses with different learning styles. Experienced BICU nurses who are competent in the identification and treatment of sepsis may choose to skip part one and two of the course to complete part three – the clinical scenario and post-course test. Skipping these sections may limit nursing exposure to new knowledge. It also decreases the opportunity for experienced to BICU nurses to refresh nursing knowledge of sepsis.

Sepsis education is a continual process. Therefore, educators who seek to develop sepsis education modules like this DNP project must limit bias by conducting an extensive search of the literature. Sources of evidence-based research should include Medline Plus, PubMed, OVID, EBSCO, Google Scholar, and CINAHL Plus. Literature

searches should also include clinical guidelines, conference proceedings, literature reviews from professional organizations, and reports from state and national disease surveillance systems such as the CDC's National Notifiable Infectious Disease Conditions, United States: Annual Tables.

Future sepsis education projects should balance the strengths and limits of current evidence with the learning needs of individuals and their organizations. Sepsis is a complex, multifaceted disease. So, educators must also be prepared to incorporate population or disease-specific nuances into their presentation. Educational initiatives should also allow for different learning styles. Fee et al.'s (2017) systematic review on sepsis educational initiatives demonstrated that a combination of lectures, bedside teaching, and protocol simulations reduced morbidity, mortality, and improved compliance with sepsis bundles. In the future, the BICU Nurse Educator may consider augmenting their sepsis courses with multidisciplinary simulation training that includes respiratory therapists, general medical education residents, and rapid response team nurses.

Section 5: Dissemination Plan

Plans to disseminate this DNP project to the institution included meeting with the BICU's burn nurse educator. The 30-minute meeting included a discussion of course objectives, materials, and compatibility with the current educational platform. This meeting focused on the five Ws (who, what, where, when, and why) of sepsis education. I described the gap in nursing knowledge and presented three strategies that bridge the void in nursing knowledge. I also shared how a sepsis course may reduce morbidity and mortality and improve nursing knowledge compliance with sepsis and infection prevention measures. The BICU's nurse educator will meet with key Burn Center leaders to discuss options for implementing the course. If selected for use in the facility, the burn nurse educator will facilitate the implementation and measurement of nursing knowledge gained from the course.

Analysis of Self

Astute advanced practice registered nurses (APRN) infuse evidence-based change into practice. Deliberate application of current science improves organization efficiency, reduces adverse patient outcomes, and improves patient safety (Fencl & Mathews, 2017). Fencl and Mathews (2017) called on APRNs like me to use existing evidence to enhance the quality of care, develop healthcare policy, and enhance nursing knowledge. I am passionate about customer service and evidence-based education. When designing this project, I learned how to conduct an extensive search for reliable sources of literature. My confidence in appraising evidence-based literature improved after using the GRADE system to analyze peer-reviewed articles and studies. I learned to critically review a body

of research before making recommendations about applying an intervention into practice. I overcame my frustrations with the time it takes to include evidence into practice because I learned that it is crucial to develop a body of knowledge about a topic or clinical question. For example, managing fluid resuscitation is a fundamental task for critical care nurses. It is one of the six components of the Hour-1 Bundle. However, as I analyzed current and classic literature on fluid resuscitation, I appreciated the diversity of knowledge on this topic. The application of fluid resuscitation interventions is continually evolving. Fluid resuscitation is a dynamic intervention guided by noninvasive technologies. I also learned that current recommendations for fluid resuscitation depend on the availability of resources, patient preference, the cost of fluid management technologies, and the opinion of prominent clinicians. Each of these factors contributed to the application of dynamic fluid measures in the sepsis course.

The most valuable lesson I learned during this DNP project was how to develop an evidence-based course for a unique population of nursing staff. When designing the education module, I learned that the ADDIE is not a module but an instructional design framework that may be applicable in any setting. The ADDIE framework helped me to understand the process assessing gaps in nursing knowledge and practice. Finally, I learned a great deal about sepsis in burn and critical care populations. Now, I feel confident that I can develop a comprehensive sepsis education initiative that meets the needs of nurses, patients, and an organization.

Summary

Sepsis is a medical emergency. More than 270,000 Americans die from sepsis each year (Sepsis.org, 2020). Hospital-acquired infections such as pneumonia, urinary tract infections, and wound infections are the leading cause of sepsis-related morbidity and mortality for burn patients (Greenhalgh, 2017). BICU nurses are intimately involved in the early detection and treatment of sepsis. Prevention and treatment of infection require deliberate attention to the signs and symptoms of sepsis. The American Burn Association expects burn nurses to detect infection rapidly, and prudently manage multiple organ failure. Unfortunately, the hypermetabolic response to burn injury confounds early recognition and treatment of sepsis in burn patients. Also, a review of the scientific literature did not elucidate a formal or informal sepsis course educating burn nurses about the nuances of sepsis in burn populations.

The Burn Center has a robust nursing orientation program, but it does not have a standardized process to educate staff about the nuances of sepsis and the criteria for early recognition and treatment of sepsis. In 2019, the hospital system adopted CMS's Sepsis Core Measure. Since implementing this quality benchmark, audits demonstrate that compliance with the sepsis core measure is less than 50%. The Burn Center conducted a PI project on antibiotic therapy in the fall of 2019. Results from the PI project revealed delays – up to five hours - in antibiotic administration. Project results also suggested that BICU nurses may be unaware that early and on-time administration of antimicrobial therapy is vital to improving burn patient outcomes. Considering these findings, the goal of this DNP project is to develop and validate a sepsis course for BICU nurses. This

evidence-based, eLearning module may enhance nursing knowledge of the criteria for early recognition and treatment of burn sepsis. The course applies the 2016 Surviving Sepsis Campaign's Sepsis guidelines, the ABA's 2007 Consensus on Sepsis, and Hour-1 Bundle to the assessment and management of critically ill burn patients. The ADDIE Approach and the adult learning theory helped design a multifunctional course that may improve BICU nursing knowledge of evidence-based strategies to manage sepsis-related organ failure. Exposure to the burn sepsis concepts and current evidence may create positive social change burn center patients and staff. Social changes amongst nursing staff include improved compliance with hand hygiene, VAP, CAUTI, CLABSI, and sepsis bundles. Enhanced compliance with sepsis and infection prevention bundles may lead to a reduction in morbidity, mortality, and length of hospital stay for Burn Center patients. Sepsis education initiatives are essential to reducing the risk of death, disability, and other adverse outcomes (Davis et al., 2016). In the future, population-specific courses like this burn sepsis course may become part of a unit, hospital, and system-wide strategies that improve early recognition and treatment of sepsis.

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Appendix A: ABA 2007 Diagnostic Criteria of Sepsis in Burn Patients

Table 1 ABA 2007 diagnostic criteria of sepsis in burn patients

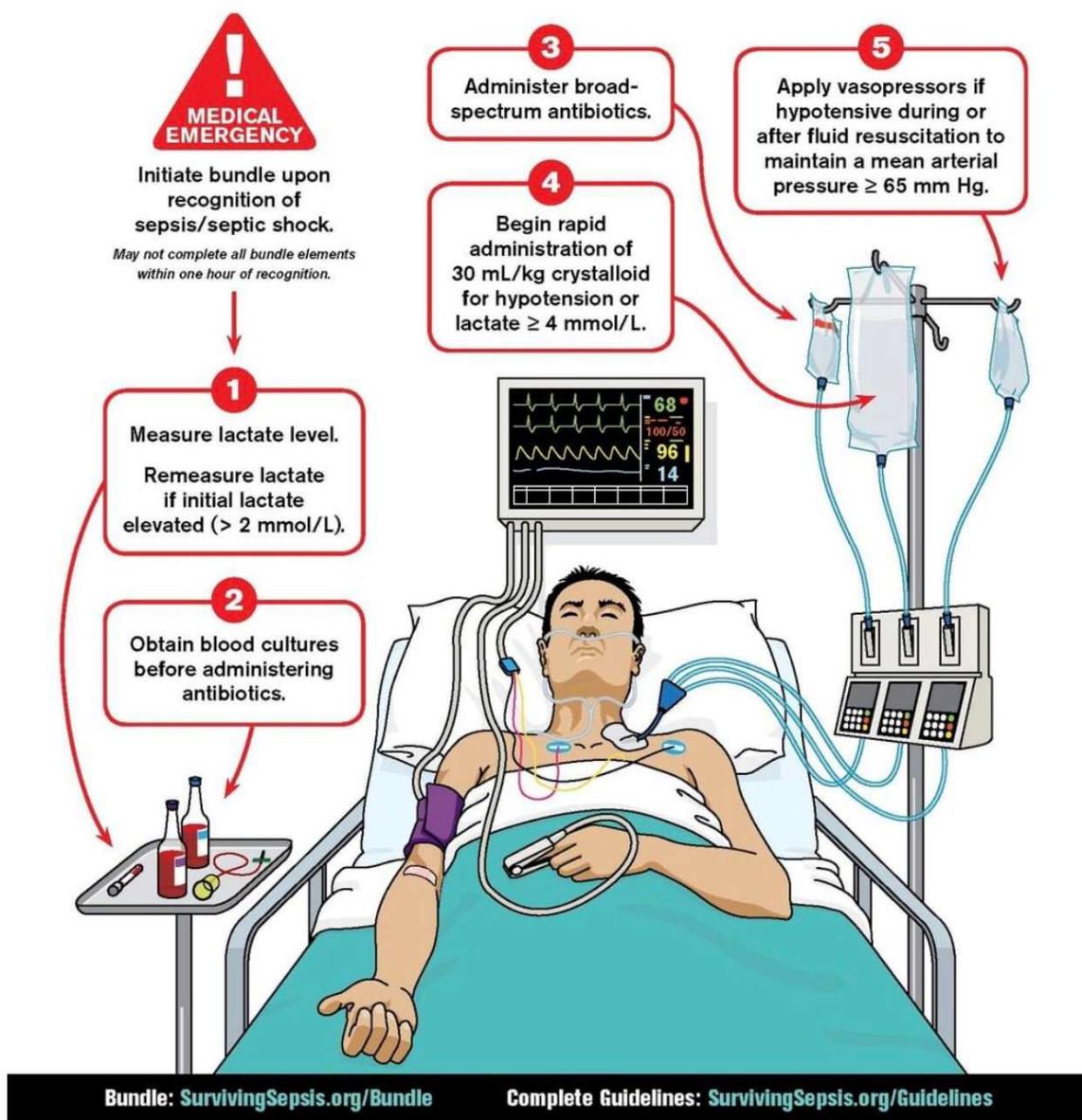
	Children	Adults
Progressive tachycardia	>2 SD age-specific norms (85% age-adjusted maximum heart rate)	>110 bpm ^a
Progressive tachypnea	>2 SD age-specific norms (85% age-adjusted maximum respiratory rate)	>25 bpm ^b (not ventilated) or >12 L/min (ventilated)
Thrombocytopenia (applicable only 3 days after initial resuscitation)	<2 SD age-specific norms	<100×10 ³ /μL
Hyperglycemia (without preexisting diabetes mellitus)	>200 mg/dL (without treatment) or insulin resistance: >25% increase in insulin requirements in 24 hours	>200 mg/dL (without treatment) or insulin resistance: >7 IU/hour IV insulin
Inability to continue enteral feedings >24 hours	Abdominal distension, enteral feeding intolerance (residual >150 mL/h), uncontrollable diarrhea	Abdominal distension, enteral feeding intolerance (residual >2× feeding rate), uncontrollable diarrhea

Notes: ^aBeats per minute; ^bBreaths per minute. Reproduced with permission from Greenhalgh DG, Saffle JR, Holmes JH 4th, et al. American Burn Association consensus conference to define sepsis and infection in burns. *J Burn Care Res.* 2007;28(6):776–790, http://journals.lww.com/burncareresearch/Abstract/2007/11000/American_Burn_Association_Consensus_Conference_to_2.aspx.¹⁰

Abbreviations: ABA, American Burn Association; SD, standard deviation.

Reference: Lopez et al., 2017

Appendix B: Surviving Sepsis Campaign Hour-1 Bundle

Hour-1 Bundle**Initial Resuscitation for Sepsis and Septic Shock**Surviving Sepsis
Campaign

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***Remeasure lactate if initial lactate elevated (>2 mmol/L)
Reference: Society of Critical Care Medicine, 2019

Appendix C: Sepsis-Related Organ Failure Assessment (SOFA) Score

Table 2 Sepsis-related organ failure assessment (SOFA) score¹⁷

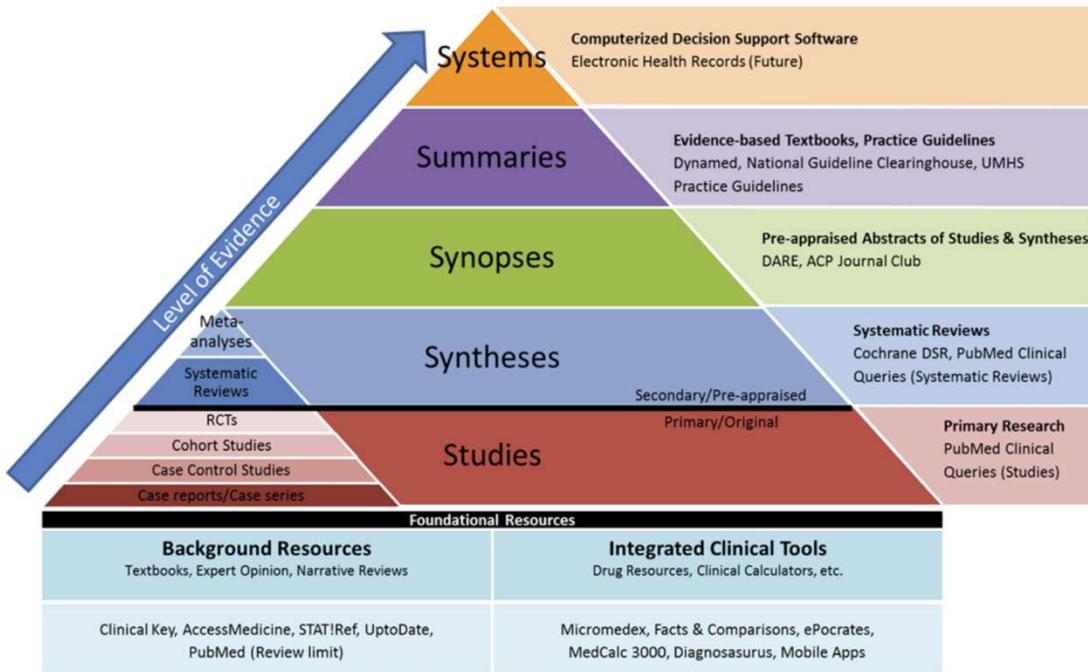
	Score				
	0	1	2	3	4
Respiratory system					
PaO ₂ /FiO ₂ (mmHg)	≥400	<400	<300	<200 with respiratory support	<100 with respiratory support
Hepatic system					
Bilirubin (mg/dL)	<1.2	1.2–1.9	2.0–5.9	6.0–11.9	>12.0
Cardiovascular system					
MAP ≥70 mmHg	MAP <70 mmHg	Dopamine <5 or dobutamine (any dose) ^a	Dopamine 5.1–15 or epinephrine ≤0.1 or norepinephrine ≤0.1 ^a	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1 ^a	
Coagulation					
Platelets ×10 ³ /μL	≥150	<150	<100	<50	<20
Central nervous system					
Glasgow coma scale	15	13–14	10–12	6–9	<6
Renal system					
Creatinine (mg/dL)	<1.2	1.2–1.9	2.0–3.4	3.5–4.9	>5.0
Urine output (mL/d)				<500	<200

Notes: ^aAll catecholamine doses represent μg/kg/min. Organ dysfunction is identified as an increase in the SOFA score of ≥2 points. In patients with not known preexisting organ dysfunction, the baseline SOFA score is assumed to be zero. *Intensive Care Med.* The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. 22(7), 1996, 707–710, Vincent JL, Moreno R, Takala J, et al. With permission of Springer.¹⁷

Abbreviations: PaO₂, partial pressure of oxygen; FiO₂, fraction of inspired oxygen; MAP, mean arterial pressure.

Reference: Lopez et al. (2017)

Appendix D: 6S Pyramid of Evidence



Reference: Peterson et al., 2014.

Appendix E: The GRADE System

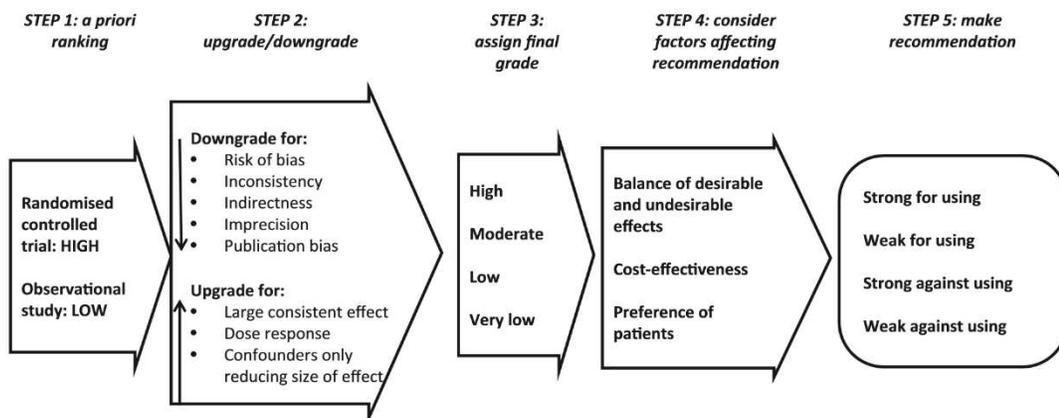


Figure 1 How GRADE is used to make recommendations; steps 1 to 3 are repeated for each critical outcome.

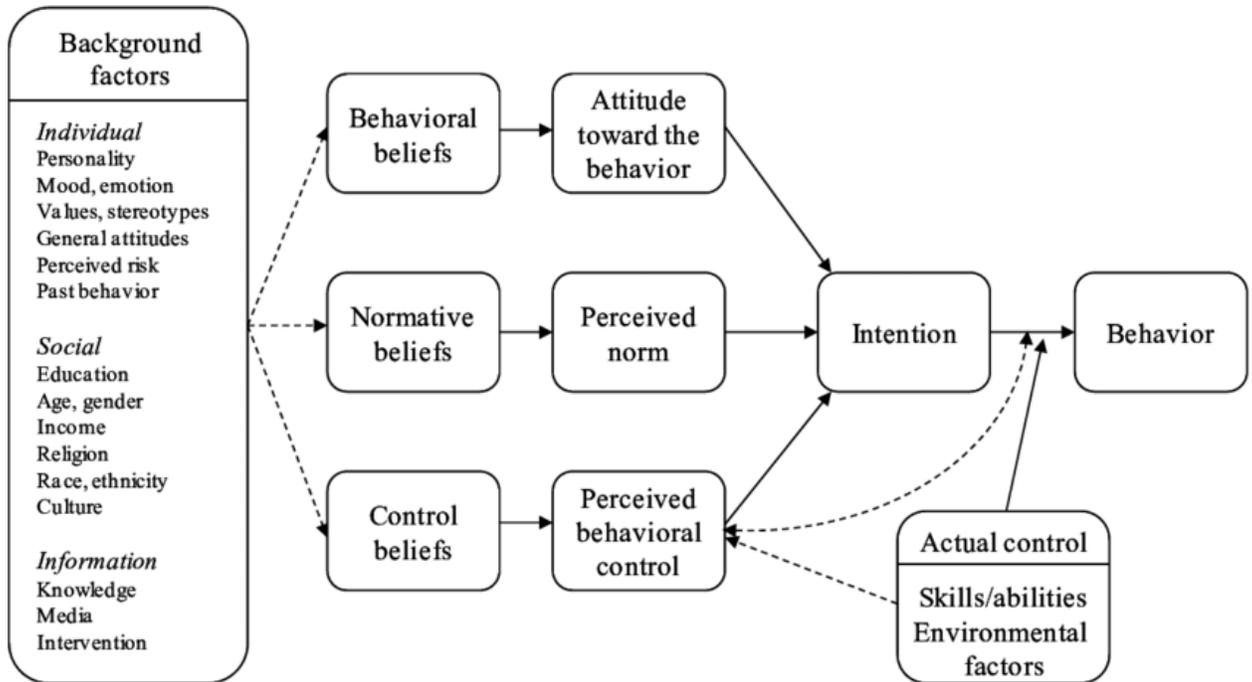
Reference: Goldet et al., 2013

Appendix F: The ADDIE Approach

	Analyze	Design	Develop	Implement	Evaluate
Concept	Identify the probable causes for a performance gap	Verify the desired performances and appropriate testing methods	Generate and validate the learning resources	Prepare the learning environment and engage the students	Assess the quality of instructional products and processes, both before and after implementation
Common Procedures	<ol style="list-style-type: none"> 1. Validate the performance gap 2. Determine the instructional foals 3. Confirm the intended audience 4. Determine the potential delivery system 5. Compose a project development plan 	<ol style="list-style-type: none"> 6. Conduct a task inventory 7. Compose performance objectives 8. Generate testing strategies 9. Calculate the return on investment 	<ol style="list-style-type: none"> 10. Generate content 11. Select or develop supporting media 12. Develop guidance for the teacher 13. Conduct formative revisions 14. Conduct a pilot test 	<ol style="list-style-type: none"> 15. Prepare the teacher 16. Prepare the student 	<ol style="list-style-type: none"> 17. Determine evaluation criteria 18. Select evaluation tool 19. Conduct evaluations
	Analysis Summary	Design Brief	Learning Resources	Implementation Strategy	Evaluation Plan

Reference: Branch, 2009

Appendix G: Theory of Reasoned Action



Reference: Fishbein and Ajzen (2010)

Appendix H: Survey/Interview Validation Rubric for Expert Panel (VREP)

Expert Panel Evaluation of Burn Sepsis Questions & Post-Course Survey

Reviewers Name: _____

Expertise: _____
(professional experience, publications, or degrees in related areas)

Thank you for taking the time out of your busy schedule to assess my education module. **Please use this survey to evaluate the Post Course Questionnaire. The Questionnaire includes twelve questions about the clinical scenarios and a three-item post-course survey.** You will also receive an email from survey monkey. **Please use Survey-Monkey to assess and provide recommendations about the course content.**

Criteria	Operational Definitions	Score				Questions NOT meeting standard (List page and question number) and need to be revised. <i>Please use the comments and suggestions section to recommend revisions.</i>
		1 1=Not Acceptable (major modifications needed)	2 2=Below Expectations (some modifications needed)	3 3=Meets Expectations (no modifications needed but could be improved with minor changes)	4 4=Exceeds Expectations (no modifications needed)	
Clarity	<ul style="list-style-type: none"> The questions are direct and specific. Only one question is asked at a time. The participants can understand what is being asked. There are no <i>double-barreled</i> questions (two questions in one). 					
Wordiness	<ul style="list-style-type: none"> Questions are concise. There are no unnecessary words 					
Negative Wording	<ul style="list-style-type: none"> Questions are asked using the affirmative (e.g., Instead of asking, "Which methods are not used?" the researcher asks, "Which methods <i>are</i> used?") 					
Overlapping Responses	<ul style="list-style-type: none"> No response covers more than one choice. All possibilities are considered. There are no ambiguous questions. 					
Balance	<ul style="list-style-type: none"> The questions are unbiased and do not lead the participants to a response. The questions are asked using a neutral tone. 					

Use of Jargon	<ul style="list-style-type: none"> • The terms used are understandable by the target population. • There are no clichés or hyperbole in the wording of the questions. 					
Appropriateness of Responses Listed	<ul style="list-style-type: none"> • The choices listed allow participants to respond appropriately. • The responses apply to sepsis situations or offer a way for those to respond with unique situations. 					
Use of Technical Language	<ul style="list-style-type: none"> • The use of technical language is minimal and appropriate. • All acronyms are defined. 					
Application to Praxis	<ul style="list-style-type: none"> • The questions asked are relevant to the daily practices or expertise of burn nurses 					
Relationship to Problem	<ul style="list-style-type: none"> • The questions are sufficient to prompt nursing knowledge of sepsis 					

Again, thank you for your time and assistance with my graduate project.

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References

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Appendix I: Old and New Definitions of Sepsis

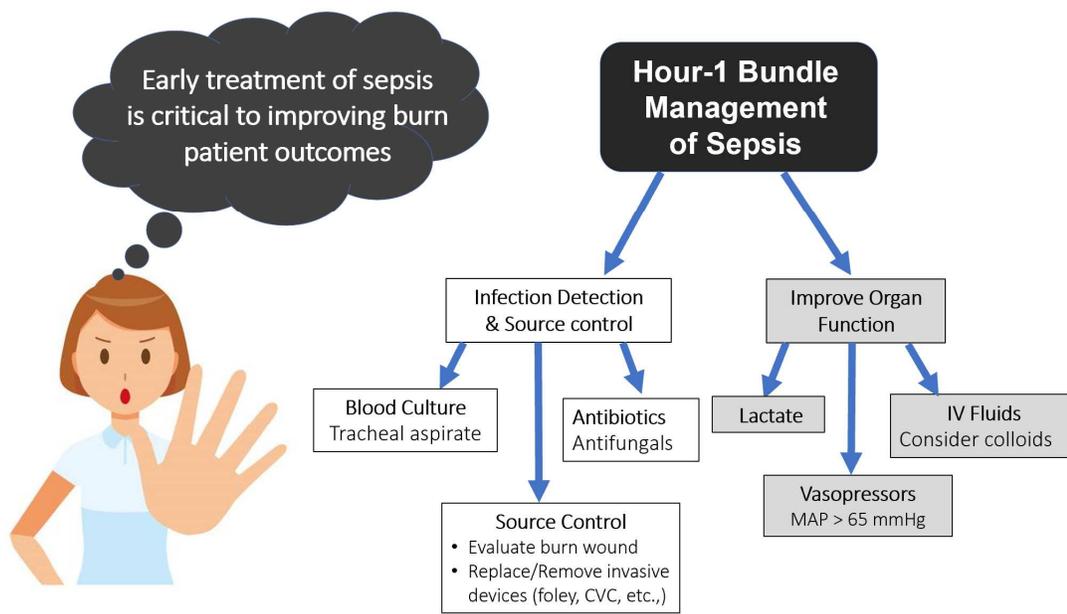
Table 1 Old and new definition of sepsis

Term	Sepsis-1	Sepsis-2	Sepsis-3
SIRS	At least two of the following conditions: (I) temperature >38 °C or <36 °C; (II) heart rate >90/min; (III) respiratory rate >20/min or PaCO ₂ <32 mmHg; (IV) WBC >12,000 or <4,000 or >10% immature (band) forms	As Sepsis-1, future SIRS diagnosis by biochemical features suggested	Abandoned
Sepsis	SIRS induced by infection	Presence of both infection and systemic inflammatory response (6 main diagnostic criteria)	Acute change in total SOFA score of at least 2 points associated with infection
Severe sepsis	Sepsis associated with organ, hypo perfusion, or hypotension	Use Multiple organ dysfunction score or SOFA-score	Abandoned
Septic shock	Sepsis induced arterial hypotension (systolic arterial pressure <90 mmHg or reduction in systolic blood pressure of ≥40 mm Hg from baseline) despite adequate fluid resuscitation and presence of perfusion abnormalities	Systolic arterial pressure <90 mmHg, an MAP <60, or a reduction in systolic blood pressure of 40 mmHg from baseline, despite adequate volume resuscitation, in the absence of other causes for hypotension	Sepsis with persisting hypotension requiring vasopressors to maintain MAP ≥65 mmHg and having a serum lactate level >2 mmol/L despite adequate volume resuscitation

Sepsis-1, ACCP/SCCM consensus conference from 1992 (15); Sepsis-2, SCCM/ESICM/ACCP/ATS/SIS International Sepsis Definitions Conference from 2001 (16); Sepsis-3, international consensus conference from 2015 (13). MAP, mean arterial pressure; SIRS, systemic inflammatory response syndrome; SOFA, sequential organ failure assessment; WBC, white blood cell count.

Reference: Bloos (2018)

Appendix J: Hour-1 Sepsis Bundle for Burn Patients



30

Reference: Graphic created by DNP student

Appendix K: Sample of Post Course Test Questions

Clinical Scenario #1 Questions

5. When should the initial dose of broad-spectrum antibiotics be administered to this patient?

- a) within 3 hours
- b) within 1 hour
- c) within 6 hours
- d) within 8 hours

6. Given the patient's history and symptoms, which treatment regimen is most appropriate for initial treatment of sepsis in this patient?

- a) vancomycin and cefepime
- b) vancomycin and zosyn (piperacillin and tazobactam)
- c) zosyn (piperacillin and tazobactam) and fluconazole
- d) meropenem and fluconazole

7. List three infection prevention strategies / bundles which may be used to decrease this patient's risk of developing sepsis.

- a. _____ b. _____ c. _____

Reference: Graphic created by DNP student

Appendix L: Course Content Validation: Responses from the Expert Panel

Question 1

Is course content consistent with the course objectives?

Answered: 5 Skipped: 1

**Question 2**

Was the content arranged in a clear and logical format?

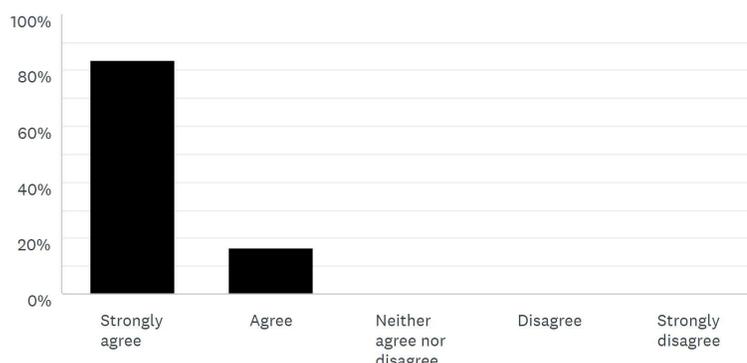
Answered: 6 Skipped: 0



Question 3

Was the content appropriate for educating BICU nurses about sepsis?

Answered: 6 Skipped: 0

**Question 4**

Is the course content relevant to nursing practice in the Burn Center?

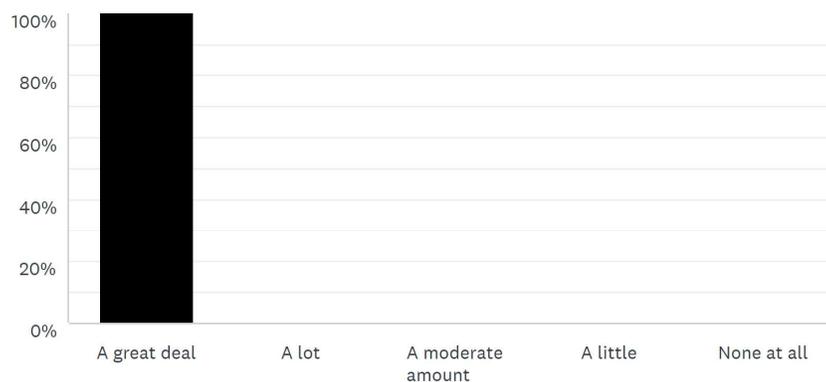
Answered: 5 Skipped: 1



Question 5

Were sepsis concepts adequately explained?

Answered: 6 Skipped: 0

**Question 6**

Did the sepsis course cover the content you expected?

Answered: 6 Skipped: 0



Thematic Analysis of Responses from Expert Panelist

<i>Course Content Validation: Thematic Analysis of Responses from Expert Panelist</i>		
Question: 7. What topics would you have liked to see addressed that were not covered in the course?		
Response <ul style="list-style-type: none"> • NA • Fungemia and Sepsis • Medication-related reactions that could be confused as burn wound infection or sepsis - TENS • The course was very thorough. All topics related to Burn Sepsis were covered appropriately • Everything was covered • None - topic content was complete 	Initial Code <ul style="list-style-type: none"> • Relationship between fungemia and sepsis • Medication reactions and sepsis • Course was thorough • Content related to burn sepsis • Topics / content complete 	Theme <ul style="list-style-type: none"> • Causes of burn sepsis • Misdiagnosis of burn sepsis • Thorough presentation of course content
Question: 8. What area(s) of the course (or section) could be improved?		
Response <ul style="list-style-type: none"> • More supporting literature for antibiotic stewardship • Nothing • Although the slides contain a lot of content, the author did a wonderful job of providing vital information to ensure the learner understands Burn Sepsis. Everything looked great! • Nothing further to add • Limit amount of slides • Very well done 	Initial Code <ul style="list-style-type: none"> • More information about antibiotic stewardship • Slides lots of content • Content meets learner needs • Too many slides 	Theme <ul style="list-style-type: none"> • Course meets learner needs • Reduce / simplify content • Review antibiotic stewardship

Question: 9. What area(s) or section of course did you find most useful?		
<p>Response</p> <ul style="list-style-type: none"> • The antibiotics and bacteria slides were great refresher • Provided the learner with relevant, up to date research information on Burn Sepsis • Diagrams with vital information to facilitate visual adult learning • Sepsis Bundle Steps are very clear and organized, Realistic Burn Patient Scenarios • The review of the sepsis criteria and how it is different for the burn patient • Clinical Practice Guidelines, medication review, treatment algorithms; charts - said a lot in just pictures <p>The entire presentation was very succinct - I didn't find any one section better than the other. It was all part of a complete package.</p>	<p>Initial Code</p> <ul style="list-style-type: none"> • Current research on burn sepsis • Antibiotic therapy • Diagrams contain vital information • Sepsis bundles • Realist clinical Scenario • Sepsis Criteria review • Review of treatment algorithms • Pictures helpful 	<p>Theme</p> <ul style="list-style-type: none"> • Visual aids make complex information easier to understand • Information about antibiotic therapy is essential • Review current sepsis treatment bundles • Realistic scenarios
Question: 10. What additional material would you like presented in the course?		
<p>Response</p> <ul style="list-style-type: none"> • Impacts on length of stay & resources if sepsis is caught late • Antibiotic stewardship • Timeline of common infections and pathogens after burn injury and incidence over time • None • Author did a fantastic job with content • None 	<p>Initial Code</p> <ul style="list-style-type: none"> • Review impact of late diagnosis of sepsis • Timeline of infections and pathogens • Antibiotic stewardship 	<p>Theme</p> <ul style="list-style-type: none"> • Review antibiotic stewardship • Timeline of burn sepsis

Appendix M: Burn Sepsis Pocket Card

Sepsis Is a Medical Emergency!

Search for the source – wounds & indwelling devices

Time Zero – initiate Hour-1 Sepsis Bundle

Optimize - nutrition & wound healing

Persistent focus on Perfusion, infection prevention & Multiple Organ Dysfunction (MODs)



Signs & Symptoms of Sepsis

Shivering - hypo/hyperthermia
(Temp >39 °C or < 36.5 °C)

Extrême pain / general discomfort
(weepy, malodorous wound / pain out of proportion to injury)

Progressive tachycardia / tachypnea
(HR > 110 bpm; RR > 25 bpm)

Inability to tolerate feeds / nausea - > 24 hrs
(abdominal distension, enteral feeding intolerance, uncontrolled diarrhea > 2500 ml/day)

Sleepy, confusion, or difficult to arouse (change in mental status)

- Hypotension SBP < 90 or MAP < 65 mmHg
- Elevated lactate (> 2 mmol/L)
- Culture positive infection (blood, urine, or lungs)
- Pathologic tissue source identified
- Thrombocytopenia < 100,000/ml (> 3 days post resuscitation)
- Persistent hyperglycemia without history of diabetes mellitus (glucose > 200 mg/dl, insulin resistance > 25% increase in insulin requirements < 24 hrs)

3 or more Symptoms




Screen Every Patient Every Shift Every Day

Reference: The DNP student created this pocket card

Appendix N: Burn Sepsis Checklist

Burn Sepsis Checklist			
TIME	Collaborative Tasks	Time	Initials
5 mins 	1. Q Shift (every 12 hours); Nurse assess patient & identify signs / symptoms of sepsis 2. Notify physician of concern for sepsis (≥ 3 criteria) 3. Time Zero _____ (suspicion of sepsis or confirmation of infection)		
15 mins 	4. Physician evaluates patient, enters orders & nurse completes the Sepsis bundle <input type="checkbox"/> Blood Culture X 2 (central line, arterial line, PICC or PIV) <input type="checkbox"/> Central access or 2 large bore IV's for medication administration <input type="checkbox"/> Blood Glucose, VBG & lactate, ABG (if appropriate) <input type="checkbox"/> Urine & Sputum cultures; CXR (if appropriate) <input type="checkbox"/> Order broad spectrum antibiotics / antifungals per antibiogram		
1 hour 	5. Administer antibiotics within 1 hour of suspicion or confirmation of sepsis 6. If SBP < 90, MAP < 65 or lactate > 4 administer fluid bolus (goal 30 ml/kg); and assess patient's fluid responsiveness 7. Wound discussion / evaluation (pain, color, odor, weeping, or positive tissue specimen) 8. Consider insulin if 2 X blood glucose ≥ 180 (absence of history of diabetes mellitus) 9. If persistent hypotension or signs of shock (SBP < 90, MAP < 65, altered mental status, worsening lactate); Transfer to ICU for close monitoring & administration of vasopressors		
2 hours 	10. Perform focused exam to reassess for worsening sepsis or development of shock (SBP < 90, MAP < 65, lactate > 4, pH < 7.25, altered mental status, low urine output, tachycardia or tachypnea, hypo/hyperthermia, positive blood cultures, invasive wound infection, etc.,)		

Reference: The DNP student created this checklist