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Barriers to Implementation and Strategies to Improve Adherence to the Sepsis Bundles

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Abstract

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Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Sepsis is associated with high mortality and morbidity. Immediate recognition and treatment are crucial to prevent complications that can be detrimental and impact the healthcare economy in the United States. The focus of this study was to explore and identify barriers to the implementation of the sepsis bundles and strategies to enhance healthcare providers' adherence to these bundles. A systematic review of articles was conducted using the Academic Center for Evidence-Based Practice star model of knowledge transformation. Studies such as randomized controlled trials, systematic reviews, retrospective studies, and prospective observational studies conducted in intensive care unit (ICU) settings in the last 10 years were reviewed, guided by the American Association of Critical-Care Nurses' grading system. The results of this study might support evidence-based clinical practice among providers caring for patients with sepsis and septic shock in an ICU setting using evidence-based guidelines. The results of this study provide an opportunity for healthcare systems to relieve financial burdens from sepsis and thus contribute to positive social change.

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Dedication

This project is specially dedicated to my husband, Aris, who was with me all the way throughout my years of studying, and to my children, Mac, Audrey, and Aldrin who I hope to inspire in aspiring for higher learning.

Acknowledgments

I would like to take this opportunity to extend my deepest gratitude to my preceptor, Ms. Myrtle Brown, for her continuous support and patience with me in this journey. To Dr. Burton, who I will forever be in debt and thankful to, for her encouragement, dedication, and guidance as my chairman in this project. I would like to give a special mention to Dr. Cohn as well, for her assistance throughout the completion of this project.

To my husband, who never gave up on me and who was always there to encourage me when I was feeling down and overwhelmed. To my children, who were always willing to help me when I needed help. To everyone, who was instrumental in the success of this project, thank you all!!!

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Section 1: Nature of the Project

Introduction

Sepsis is a medical condition that can be life-threatening if not recognized and treated immediately. Based on the Third International Consensus Definitions of sepsis and septic shock (Sepsis-3), it is a "life-threatening organ dysfunction caused by a dysregulated host response to infection" (Singer et al., 2016, p. 801). The focus of sepsis management as recommended by the Surviving Sepsis Campaign (SSC) guidelines is towards early goal-directed therapy (EGDT), which is a protocol that includes a series of specific early resuscitation efforts within the first 6 hours to reverse tissue hypoperfusion brought about by sepsis (Dellinger et al., 2013). Successful management of sepsis requires healthcare providers' knowledge of the updated sepsis bundles. The SSC guidelines recommended that healthcare systems have performance improvement efforts in the management of sepsis in order to improve patient outcomes and reduce healthcare costs (Rhodes et al., 2017).

Healthcare providers' knowledge of the sepsis bundles is crucial in the prevention of sepsis complications. However, compliance is highly instrumental especially during the first 3 to 6 hours of its recognition to prevent tissue death and organ failure (Rhodes et al., 2017). The Centers for Disease Control and Prevention (CDC; 2016) published an astounding statistic stating that over 1.5 million Americans are afflicted with this condition each year resulting to at least 250,000 deaths. The CDC also added that 1 in 3 hospital deaths can be attributed to sepsis. Increased morbidity and mortality resulting

from sepsis and all its complications led to almost $24 billion of healthcare expenditure in the year 2013 (Novosad et al., 2016).

Despite the plethora of evidence linking noncompliance with sepsis bundles to poor patient outcomes, many studies suggest that a gap exists between evidence-based interventions and actual practice (Hooper et al., 2012). The purpose of this project was to conduct a systematic review of literature in order to explore the barriers to the implementation of the sepsis protocol based on the SSC guidelines and identify strategies to enhance adherence among healthcare providers in the hospital setting.

Problem Statement

Sepsis is a serious condition that, when left undiagnosed, can lead to longer hospital stay, complications, and mortality. In the United States, there are over 1.5 million individuals afflicted with sepsis yearly and approximately 250,000 die from it (CDC, 2017). Although, it is a preventable condition, 1 out of 3 deaths in U.S. hospitals are from sepsis (CDC, 2017). Sepsis has a staggering impact on the U. S. healthcare economy. A patient's overall hospital cost from sepsis could exceed $32,000, while an intensive care unit (ICU) cost could exceed $27,000 (Arefian et al., 2017). A retrospective study by Novosad et al. (2016), in partnership with the CDC, revealed that 58% of adults hospitalized with sepsis came from healthcare facilities within 30 days prior to admission and 42% came from the community which make them more vulnerable to complications from sepsis.

Studies reveal that low compliance to the sepsis protocol is significantly related to higher mortality rates from sepsis and septic shock, and high adherence is observed to be

directly linked to lower mortality (Castellanos-Ortega et al., 2010; Levy et al., 2015). Prompt recognition and timely management of sepsis is crucial. Healthcare providers need to be equipped with knowledge of the sepsis protocol guided by the SSC guidelines in order to effectively treat this condition and prevent severe outcomes (Schramm et al., 2011). Most inpatients have comorbid conditions that put them at high risk for infection. Compliance to the sepsis bundles among providers remains a challenge and needs to be addressed (Kisson, 2014).

Purpose

The purpose of this project was to conduct a systematic review to explore the barriers affecting the implementation of the SSC bundle and identify strategies that could enhance providers' adherence. Several performance improvement programs have been utilized by healthcare systems in order to enhance providers' use of the SSC guidelines in facilitating treatment of sepsis (Ferrer et al., 2014; Kim et al., 2012; Vink & Bakker, 2017). However, compliance among healthcare providers continues to be a problem (Pronovost, 2013; Wang, Xiong, Schorr, & Dellinger, 2013). Lack of knowledge about the SSC guidelines, absence of a clinical pathway, or lack of strict implementation are some of the barriers that can affect adherence to the sepsis bundles (Kissoon, 2014). Clearly, these barriers hugely affect the translation of evidence-based practice (EBP) to the clinical practice. Although the SSC provides evidence-based guidelines in the management of sepsis, severe sepsis, and septic shock, it does not represent a provider's decision-making when confronted with a situation where a patient with suspected sepsis has multifactorial problems to be considered (Rhodes et al., 2017). It is still

recommended that a performance improvement program be in place and the sepsis bundles be implemented in the hospital setting (Rhodes et al., 2017).

Nature of the Doctoral Problem

There is an existing gap identified in the management of patients with sepsis and septic shock among providers in an academic tertiary hospital, one of the two largest hospitals in a New York health system. The current practice is not in line with the guidelines recommended by the SSC despite the presence of the sepsis bundles as electronic order set as revealed by the 2016 NY State Report (Office of the Medical Director, Office of Quality and Patient Safety, 2018). According to this report, there was only 46% compliance with the 3-hour bundle and 25% with the 6-hour bundle (Office of the Medical Director, Office of Quality and Patient Safety, 2018). Because this is an academic institution, many of the inpatient healthcare providers are interns and residents. Additionally, many are also nurse practitioners (NPs) and physician assistants (PAs) who are new graduates. In this clinical setting where there is lack of compliance to the SSC guidelines, it is important to identify the barriers resulting in providers' poor adherence and explore the different strategies that can improve the translation of the sepsis bundles into practice.

To explore the barriers affecting providers' compliance to the sepsis bundles and to determine different strategies to enhance their compliance, I conducted a systematic review of literature from 2008 to 2018. Randomized controlled trials (RCTs), retrospective studies, and prospective observational studies were included in this study. Evidence was obtained from search engines such as PubMed, CINAHL, and

GoogleScholar. I screened abstracts to determine that inclusion criteria were met. The data extracted included the author, year of publication, type of study or design, setting (ICUs), participants (providers), and study population (adults). The criteria utilized in study selection were that studies must pertain to the barriers to compliance and strategies in the implementation of the sepsis bundles as recommended by the SSC guidelines. In cases where I could determine from the abstracts whether the inclusion criteria were met, I conducted a full text screening.

Significance of the Study

The World Health Organization (WHO, 2018) estimated that approximately 30 million individuals are afflicted with sepsis globally every year, leading to at least 6 million deaths, and emphasized that sepsis may be the most preventable adverse event in an inpatient setting. In the United States alone, a large retrospective study of 409 hospitals involving 2.9 million patients in 2014 revealed that at least 6% of those inpatients were diagnosed with sepsis and 21% either died or were discharged to hospice care (Rhee et al., 2017). Rhee et al. (2017) concluded that almost 55% required an ICU, almost 16% progressed to septic shock, and 15% resulted to death during hospitalization.

Studies have shown that inpatients are more vulnerable to develop sepsis and its complications. Providers caring for this population are guided with the latest recommendations based on the most recent evidence according to the SSC guidelines of 2016 (Rhodes et al., 2017). This systematic review could inform all physicians, NPs, and PAs who are directly involved in the care of patients with suspected sepsis on the first 3 critical hours of their diagnosis in conjunction with patient screening. As barriers to the

implementation of the SSC bundles and strategies to improve clinicians' compliance to the bundles are identified, this project could become an instrument of change in the management of sepsis in the hospital setting, most particularly in academic hospitals, where many of the providers are interns, residents, NPs, and PAs who may be less familiar with the guidelines than providers in non-academic hospitals are. The outcome of this study could be utilized in other inpatient facilities across the health system in order to improve overall patient outcomes, reduce mortality, and lower healthcare expenditures.

Summary

There is a need to increase healthcare providers' adherence to the SSC guidelines to effectively manage patients with sepsis and septic shock in a large academic tertiary hospital in a New York health system. In order to accomplish this goal, I conducted a systematic review of literature from 2008 to 2018 as a doctoral project to identify the barriers to the SSC implementation as well as the strategies to enhance providers' adherence. The best strategy identified could inform patient care on admitted patients identified with sepsis or septic shock. The results of this project could serve as a basis of practice in other hospitals across the health system.

Section 2 of this project identifies the model and framework that guided the systematic review of the barriers to the implementation of the sepsis bundles and the strategies to improve adherence among providers in the inpatient settings. In this section, I will also discuss the project's relevance to nursing practice, the local background and context, and the role of the DNP student.

Section 2: Background and Context

Introduction

Sepsis is a medical emergency and a major health concern that, when left untreated, could lead to multi-organ failure and, eventually, death. It is defined by Sepsis-3 as a "life-threatening organ dysfunction caused by a dysregulated host response to infection" (Singer et al., 2016, p. 801). Screening of patients suspected with sepsis needs prompt recognition and timely management to prevent the sequelae of this condition.

Studies revealed that sepsis and septic shock have been implicated in a large percentage of hospital deaths. Healthcare providers are on the frontline in the management of sepsis and septic shock. The SSC guidelines recommend that all providers' decision-making be guided by evidence-based guidelines and that hospitals have performance improvement programs in place to successfully treat sepsis (Rhodes et al., 2017). It is vital that providers be well informed of the sepsis initiatives because, when they are, it increases compliance to the sepsis protocol, as evidenced by a systematic review conducted by Damiani et al. (2015).

This doctoral project was a systematic review that aimed to explore the barriers affecting the utilization of the sepsis bundles in patient management of sepsis. This systematic review identified the best strategies that could serve as quality improvement efforts to meet the SSC recommendation. The results of this doctoral project could help support the need to implement the sepsis bundles as recommended by the SSC Guidelines in an inpatient setting. The results of this project could potentially improve patient

outcomes, decrease mortality, and cut healthcare costs. This section includes discussion of the model and the theory used in the review of literature addressing the barriers to the translation of the sepsis bundles as recommended by the SSC in clinical practice as well as the strategies to enhance adherence among healthcare providers. The relevance of this doctoral practice to nursing as well the local background and the context of the problem are also discussed in this section. Finally, I will describe the role of the DNP student in the project.

Concepts, Models, and Theories

The import of this doctoral project was the motivation to improve patient care and outcomes by utilizing the best evidence recommended by the SSC in the management of sepsis and septic shock. EBP is the result of critically appraised and scientifically-grounded evidence that informs clinical decision-making (Majid et al., 2011). Clinical practice that is grounded in the most recent evidence replaces the historical basis of patient care and lays the foundation of scientifically-sound delivery of care. This paradigm shift of patient care is strongly supported by the Institute of Medicine (White & Dudley-Brown, 2012).

Improved compliance to the SSC guidelines has been linked to performance improvement efforts; however, these efforts are more successful and sustainable with the concerted effort of all providers who are on the frontline in the management of sepsis and septic shock. These performance improvement efforts must focus on early recognition and timely management of patients identified with sepsis (Rhodes et al., 2017). Numerous studies have been done to identify the most successful strategy in

order to improve compliance with the sepsis protocol. Some of these performance improvement programs are as follows: implementation of the sepsis bundle in the Emergency Department (ED) (Wang et al., 2013); integration of the sepsis bundles in the clinical pathways (Laguna-Peres et al., 2012), and staff education (McRedmond et al., 2010).

The ACE Star model of knowledge transformation was utilized to guide this systematic review. The Ace Star Model is a framework highlighting the different barriers in the integration of EBP into practice with subsequent elucidations making it more transferrable to clinical practice (Stevens, 2013). This model shows how stages of transformation of robust scientific knowledge can be reduced into a form that is more directly applicable to practice and clinical decision-making (Stevens, 2013). Stevens (2013) further explained that this model is a 5-point star:

Point 1: Discovery – includes peer reviewed primary studies

Point 2: Evidence summary such as, systematic reviews and meta-analysis

Point 3: Translation – guidelines and recommendations as a result of evidence-based knowledge

Point 4: Integration – the translation of these evidence-based recommendations into practice

Point 5: Evaluation – evaluating the impact of EBP on healthcare

This systematic review was conducted to bridge the gap in practice between the SSC guidelines and the present management of sepsis among healthcare providers.

Relevance to Nursing Practice

Sepsis is a major public health concern. In the United States, performance improvement programs have been initiated in an effort to improve providers' adherence to the SSC guidelines because studies have shown that higher compliance is linked to better patient outcomes, decreased mortality, and lower healthcare costs (Castellanos-Ortega et al., 2010; Damiani et al., 2015; Mitchell et al., 2015; Rolnick et al., 2016). Ironically, despite the plethora of evidence to prove this link, there are still barriers to the translation of guidelines to clinical practice. Such barriers can lead to providers' failure to effectively treat sepsis and septic shock. Identification of these barriers provides the opportunity to reduce varying clinical practices, promote the effective resource utilization, empower frontline providers, and inform clinical decision-making (Kissoon, 2014).

Although, numerous studies on sepsis management have identified barriers to guideline implementation, there remains an obvious need to discover the best performance improvement program to effectively strategize a sustainable adherence to the SSC guidelines. A delay in treatment initiation over 6 hours after sepsis recognition can significantly affect patient outcomes, potentially leading to death due to organ dysfunction (Bloos et al., 2014). This is evident in Bloos et al.'s (2014) multicenter cohort study of 44 ICUs in Germany that revealed a significantly low compliance to the SSC guidelines, resulting to higher mortality and longer ICU stay. It is imperative to increase clinicians' compliance to these guidelines because timely and appropriate

treatment of sepsis is a strong predictor of mortality, as evidenced by a meta-analysis conducted by Barochia et al. (2010).

Local Background and Context

Sepsis is the body's response to an insult from infection that, when untreated promptly, can lead to multi-organ dysfunction and eventually, death (CDC, 2018). The CDC (2018) also emphasized that individuals who are young (less than 1 year old) and elderly (over 65), with chronic medical conditions (diabetes, kidney and lung diseases, and cancer), and with depressed immune system are more susceptible to sepsis. The patient population in this project site has a wide age range with the older population having multiple comorbid conditions that place them at a higher risk for sepsis and its sequelae.

According to the Office of the Medical Director, Office of Quality and Patient Safety (2018), about 50,000 patients are affected by severe sepsis and septic shock (reported as sepsis) each year in the state of New York (NY) alone. In 2014, the NY State Codes, Rules, and Regulations Amendment 10 began requiring all acute hospitals in the state of NY to develop performance improvement protocols, which included early recognition and timely management of sepsis (Office of the Medical Director, Office of Quality and Patient Safety, 2018). According to the 2016 NY State Report on Sepsis Care Performance Initiative, out of 945 cases of sepsis in the project site, 274 resulted to death, and 27.97 as the risk-adjusted mortality rate (RAMR) which categorized it as a middle performer with no change in performance (Office of the Medical Director, Office of Quality and Patient Safety, 2018).

As one of the participating hospitals on the NY State Sepsis Initiative, there is a protocol currently in place at the project site that includes early recognition of sepsis and the presence of the sepsis bundles as an order set in the electronic system. However, according to the 2016 NY State Report, in this project site, among the 727 adult cases, the 3-hour bundle was only met 46% and the 6-hour bundle, less than 25% based on the data from second quarter (Q2) of 2014 to fourth quarter (Q4) of 2016 (Office of the Medical Director, Office of Quality and Patient Safety, 2018). The 2016 NY State Report purported that possible reasons for not implementing the sepsis protocol may be late diagnosis, absence of clear documentation of interventions given prior to transfer to another hospital, and failure to document in patients' medical records.

Role of the DNP Student

Currently, I practice in the role of an advanced practice nurse (APN) in the coronary care unit (CCU) of the project site, the functions of which include immediate care of critically ill cardiac patients whose diagnoses run the gamut of acute decompensated heart failure, acute myocardial infarction, and cardiac arrests. Most patients have multiple comorbidities that can lead to complications such as respiratory failure, kidney failure, and sepsis. As an APN working hand in hand with residents and cardiology fellows, I have a shared responsibility with them to provide the best patient care by ensuring that practices are based on guidelines and EBP. Optimizing patient care is our goal in order to prevent complications from sepsis.

Sepsis is a common complication observed among cardiac patients, not usually as a direct result of their cardiac presentation, but as a result of their comorbidities. In order

to optimize care for cardiac patients, it is imperative that healthcare providers enhance the utilization of clinical practice guidelines (CPGs) which are necessary tools to direct patient care (Arnett et al., 2014). Being at the forefront of patient care in the CCU, providers need to be equipped with the knowledge of the most recent EBP in the management of sepsis to minimize unit length of stay as well as hospital stay, improve patient outcomes, and reduce health care costs. My role as one of the providers in this patient care setting is to ensure that the sepsis bundles in the electronic order set be implemented once a patient is suspected to be exhibiting symptoms of sepsis or septic shock.

In this doctoral project, I was the sole individual who had the responsibility to gather all sources of evidence, which included significant literature within the past 10 years. I was responsible for screening all articles by reviewing the abstracts to ensure that the inclusion and exclusion criteria were fulfilled. In cases where I could not clearly determine this from the abstracts, a full text screening was conducted.

Summary

Sepsis is a major public concern that is increasingly becoming a problem worldwide. The SSC guidelines were developed and implemented in 2004 and have been revised every 4 years for the past 14 years based on more robust research in order to provide the latest evidence-based recommendations. The latest revision in 2018 puts together the 3-hour and the 6-hour bundles into a 1-hour bundle with the goal of initiating resuscitation and treatment of sepsis as soon as it is recognized (Levy, Evans, & Rhodes, 2018). Although, the 3-hour and the 6-hour bundles are available in the electronic system

as an order set, evidence showed that it is not fully implemented in the clinical site. The aim of this project was to explore the barriers to the implementation of the sepsis bundles and the strategies to enhance providers' adherence to these bundles. In this project, I identified the best strategies to assist providers, who are the front line in identifying sepsis and initiating resuscitation and treatment in compliance with the SSC guidelines.

Section 3 includes the practice-focused questions, a list of operational definitions, and sources of evidence, which included published outcomes and research that further supported the need to conduct this systematic review. I will also discuss how to analyze and synthesize the data collected, and I will describe the methodology of data collection used to inform this doctoral project.

Section 3: Collection and Analysis of Evidence

Introduction

The SSC guidelines were first published in 2004 and have been revised several times, with the fourth edition being the 2016 "Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock." The 2016 guidelines highlight the 3-hour and the 6-hour bundles, which include early recognition of sepsis and performance improvement programs (Rhodes et al., 2017). In 2015, the Centers for Medicare and Medicaid Services (2016) released a core measure in a continuous effort to improve practice and to provide adequate guidance to healthcare providers in the management of sepsis and septic shock. However, despite these efforts, compliance to the SSC guidelines remains low. This project focused on analyzing and synthesizing literature addressing the barriers to the implementation of the sepsis bundles and the strategies to enhance providers' adherence to these bundles.

Practice-Focused Questions

The sepsis bundles were initiated in 2002 and established in 2004 with a goal of saving lives through early recognition of patients who are suspected to have sepsis or septic shock, initiation of treatment within 6 hours, and completion of treatment within 24 hours (Barochia, Ciu, & Eicherhar, 2013). It was then revised most recently in 2012 to change the guidelines to the initiation of the bundle within 3 hours with completion within 6 hours (Barochia et al., 2013) which was implemented in 2016. However, studies revealed that compliance among healthcare providers remains low on both bundles.

Clinical practice guidelines (CPGs) such as those recommended by the SSC are meant to direct providers in improving quality of patient care and standardizing overall practice in the global management of sepsis. Although clinicians do not intend to provide patient care outside the realms of EBP, translation and dissemination of the CPGs become a challenge when they are not properly introduced and woven into the daily practice (Kissoon, 2014). It was then the purpose of this study to answer the practice questions: Among healthcare providers, what are the barriers affecting the implementation of the revised SSC bundle guidelines in the inpatient setting? What available strategies can potentially improve providers' adherence to the bundles?

The purpose of this doctoral project was to identify the different barriers that affect the translation of the SSC bundles to clinical practice in inpatient settings. There was a need to collate and synthesize the literature obtained in this study in order to establish different strategies that would support a successful implementation of the SSC guidelines in the care of patients with sepsis or septic shock. This doctoral project was crucial to bridge the gap in the current management of sepsis and septic shock by reducing the variation in clinical practice and decision-making among providers in the practice setting. The purpose of this systematic review aligned with the practice-focused question.

Operational Definitions

SSC Guidelines: International guidelines for management of sepsis and septic shock.

Sepsis: A life-threatening organ dysfunction caused by a dysregulated host response to infection where, organ dysfunction corresponds to an increase in the Sequential Organ Failure Assessment (SOFA) score of 2 or more which is associated with a 10% increase in mortality (Singer et al., 2016).

Septic shock: A manifestation of profound circulatory, cellular, and metabolic derangement associated with an increased risk of mortality compared to sepsis (Singer et al., 2016).

Early goal-directed therapy: A 6-hour bundle that includes a protocolized quantitative measurement of hemodynamics with a goal of central venous pressure (CVP) of 8-12; mean arterial pressure (MAP) of ~65mmHg; central venous oxygen saturation (ScvO2) of ~70% (Rivers et al., 2001).

3-hour bundle: The 3-hour bundle includes measuring lactate level, blood cultures, broad spectrum antibiotic, and IV infusion of crystalloids at 30 cc/kg for hypotension or for lactate ~4 mmol/L (Rhodes et al., 2017).

6-hour bundle (septic shock-bundle): Vasopressors for hypotension unresponsive to fluids to maintain a mean arterial pressure of ~65 mmHg; If hypotension (<65 mmHg) persists after initial fluid resuscitation or initial lactate ~4mmol/L, reassess volume status and tissue perfusion (Rhodes et al., 2017).

Sources of Evidence

The SSC guidelines were obtained from the Society of Critical Care Medicine and the European Society of Intensive Care Medicine. The sepsis bundles were based on the SSC guidelines. I searched databases such as the PubMed, CINAHL, and GoogleScholar

for peer-reviewed and scholarly articles from 2008 to 2018 addressing sepsis management in the inpatient setting. Additionally, I scanned the references of these articles for other potentially relevant sources of evidence. Keywords applied in the search process were *sepsis, septic shock, sepsis bundles, sepsis protocol, SSC guidelines, barriers,* and *adherence*.

This systematic review was conducted to gather, evaluate, and synthesize the best available literature that would provide the most relevant evidence in identifying different strategies employed by many healthcare institutions to enhance providers' adherence to the sepsis bundles. I ranked evidence according to the American Association of Critical Care Nurses' (AACN's) new leveling system. The aim of this doctoral project was to obtain evidence only at the highest levels. Based on the AACN's system, evidence was classified as follows:

Level A – includes meta-analysis of various controlled studies as well as meta-synthesis of qualitative studies that consistently support an intervention.

Level B – all well-designed randomized and nonrandomized studies consistently supporting an intervention.

Level C – studies that can produce inconsistent outcomes, which include qualitative, descriptive, or correlational studies, systematic reviews, and RTCs.

Level D – peer-reviewed clinical studies to support guidelines or recommendations.

Level E – case reports or expert opinions

Level M – recommendations from manufacturers only. (Armola et al., 2009).

Inclusion criteria in searching for evidence were that studies must be (a) written in the English language, (b) conducted in an ICU involving adults with sepsis and/or septic shock in the United States and other countries, and (c)published between 2008 and 2018. Participants in the studies were healthcare providers such as physicians, NPs, and PAs. The studies addressed the barriers to the implementation of the sepsis bundles and strategies to enhance providers' adherence to the bundles. Only studies categorized to be Levels A to C were included in this doctoral project to ensure rigor in evidence. I excluded studies that met the following criteria: studies written in any language other than English, studies done on pediatric patients, studies where participants were non-providers, and studies done prior to the year 2008.

Published Outcomes and Research

Studies conducted in other countries were included, as long as they met the inclusion criteria because the SSC provides the international guidelines for the management of sepsis and septic shock. RTCs, retrospective, and prospective observational studies on sepsis involving inpatients were the types of study included in this systematic review.

In their study on the epidemiology of sepsis, Fleischman et al. (2015) were not able to reveal an accurate comparison of the incidences of sepsis and its mortality between low- or middle-income countries compared to high-income countries; however, the information extracted from their study yielded important facts on the burden of sepsis worldwide. Fleischman et al. (2015) found that the incidence of hospital-treated sepsis and severe sepsis is higher in high-income countries compared to other diseases. Despite

its limitations, this study demonstrated that the global statistics on sepsis are overwhelming and suggest that there are over 31 million cases of sepsis and the deaths resulting from sepsis in the hospital settings can reach up to 5 million (Fleischman et al., 2015).

Sepsis is a growing global health issue; therefore, it is important to understand and gain knowledge on the global strategies to reduce mortality and morbidity from sepsis. In 2001, Rivers et al. (2001) conducted an RCT in the United States using early goal directed therapy (EGDT) which included oxygen supplementation, hemodynamic monitoring, fluid resuscitation, vasoactive drugs, blood transfusion, and inotropes when necessary, in treating severe sepsis and septic shock. This trial had 2 interventions, the EGDT which was given within 6 hours and the standard therapy. Rivers et al. concluded that the EGDT significantly improved outcomes on patients with severe sepsis and septic shock. However, EBP in the management of sepsis continues to evolve based on the most recent evidence. Peake et al. (2009) published another RCT conducted in Australia and New Zealand, known as the ARISE study, which revealed that, although EGDT is not routinely practiced in these countries, it did not significantly affect patient mortality. Another large RCT conducted in the United States, called the ProCESS study, was published in 2014 (The ProCESS Investigators) comparing three arms of resuscitation within 6 hours: the protocol-based EGDT, protocol-based therapy without EGDT, and the usual care. The ProCESS trial concluded that there was no difference in the mortality between the two protocol-based arms. However, despite the study revealing a significant adherence to both protocols, the investigators (The ProCESS Investigators, 2014)

attributed the result to incomplete adherence to the protocol. Most recently, another large RCT (n = 1260), the ProMISE study, using EGDT compared to the usual care was conducted in England by Mouncey et al. (2015). The ProMISE study concluded that there was no significant decrease in mortality within 90 days between the two groups; instead, the healthcare costs were actually higher in the EGDT group (Mouncey et al., 2015).

In 2016, an updated SSC guideline was published with recommendations that are more appropriate in managing sepsis and septic shock in the hospital setting. However, Rhodes et al. (2017) emphasized that clinical judgment is crucial in individualizing care based on factors influencing each patient's outcome. In the 2016 guidelines, the bundles were changed to 3 and 6-hour, in an effort to further reduce mortality from sepsis. The result of a systematic review and meta-analysis by Damian et al. (2015) suggested that increased survival was significantly determined by early implementation of the 6-hour bundle. A recent large multicenter retrospective study of 2172 adult patients in the emergency department (ED) revealed that the completion of the 3-hour bundle from arrival resulted to 34% reduction in patient mortality risk (Amland & Sutariya, 2018). However, there needs to be a standardized and consistent definition and management of sepsis for the bundles to be effectively utilized.

Protection of Human Rights

The Institutional Review Boards (IRB) plays a significant role in maintaining and ensuring the safety and well-being of any study participant. It has a pivotal role in preventing the distortion of any research procedure so that ethical issues can be avoided

(Seiber & Tolich, 2013). This doctoral project is a systematic review of literature that did not involve human subjects. An approval from Walden University's IRB (Approval number: 02-16-18-0610961) was obtained to ensure that any ethical matters were properly addressed.

Analysis and Synthesis

Peer-reviewed and scholarly articles that met the criteria were selected and screened for eligibility using the Preferred Research Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Liberati et al., 2009). Liberati et al., (2009) explained that the PRISMA flow diagram starts by identifying evidence through database search followed by screening with the removal of duplicates. After screening the evidence, eligibility for inclusion is assessed. The last step is the selection of evidence to be included in the study. Abstracts were screened to ensure that the sepsis bundles used in the studies were based on the SSC guidelines. The studies chosen included the barriers to the SSC guidelines implementation as well as the strategies to enhance clinicians' adherence to these guidelines. All studies conducted internationally that were written in the English language from 2008 to 2018 were included in this study. The setting of all studies were the ICUs and the patients were 18 years of age and older.

In grading of evidence, the AACN's newest evidence-leveling system was utilized, which was an update of their original rating system (Armola et al., 2009). This system specified the design utilized in the study, emphasizing designs such as meta-analysis and meta-synthesis at the highest level as sources of evidence. This grading

system was utilized in this doctoral project to provide guidance in the selection of evidence in order to ensure the validity of results.

Summary

The SSC guidelines were originally released in 2004 and have gone through several updates with recommendations focusing on early recognition and management of sepsis and septic shock. Literature showed that the sepsis bundles significantly improve patient outcomes, reduce mortality, and lower healthcare costs. However, multiple studies have repeatedly proven that adherence among providers remains low. Consequently, mortality from sepsis and septic shock continues to be high.

This doctoral project was a systematic review of the literature published between 2008 to 2018 addressing the many barriers to the implementation of the sepsis bundles and the strategies that enhance clinician's compliance to these bundles. The grading system used in choosing the research design was the new AACN's system. Peer-reviewed and scholarly articles were screened using the PRISMA flowchart. The results of this project could provide an opportunity to modify existing practice in the management of sepsis and septic shock in the clinical site.

Section 4: Findings and Recommendations

Introduction

In 2015, the Centers for Medicare and Medicaid Services instituted sepsis core measures that could improve the care of patients with sepsis highlighting the sepsis bundles recommended by the SSC. Multiple studies have shown that these bundles reduced mortality. Performance improvement programs have also proven successful in improving compliance among healthcare providers. There is a gap in the management of sepsis when EBP is not implemented in the clinical practice. At this project site, electronic order sets of the sepsis bundles exist that can be used the moment a patient is identified as exhibiting symptoms of sepsis. However, the Office of the Medical Director (2018) published findings from the NY State Sepsis Initiative 2016 revealing that there was less than 50% compliance with the 3-hour bundle and only about 25% with the 6-hour bundle in this project site.

The aim of this project was to elucidate the following focus questions in an effort to identify a sustainable performance improvement program in the management of sepsis:

1. Among healthcare providers, what are the barriers affecting the implementation of the revised SSC bundle guidelines in the inpatient setting?
2. What available strategies can potentially improve providers' adherence to the bundles?

It was then the purpose of this doctoral project to collect and synthesize the evidence relevant to the management of sepsis and septic shock in the ICU patients, such as the

sepsis bundles provided by the SSC guidelines, the barriers in its implementation, and the strategies to enhance its integration to clinical practice.

The sources of evidence used in this systematic review were peer-reviewed original articles from different nursing and medical professional journals from databases such as PubMed, CINAHL, and GoogleScholar. I searched for articles published from 2008 to 2018, obtained relevant materials, and screened them based on the inclusion and exclusion criteria. The keywords used were *sepsis, septic shock, sepsis bundles, sepsis protocol, SSC guidelines, barriers,* and *adherence*. The AACN's newest leveling system of evidence was utilized in the selection of articles to ensure reliability. Only articles falling under the category of levels A-C were chosen. The PRISMA flow chart was used to screen for eligibility of articles. The data analysis table included the year of publication, authors/s, study design, barriers to implementation of the sepsis bundles, strategies to enhance implementation, and level of evidence.

Findings and Implications

The literature search in PubMed through publication years of 2008 and 2018 initially yielded 320 articles with titles including sepsis bundles, which I narrowed down to 54 articles after screening the abstracts. Further screening based on the inclusion and exclusion criteria further reduced the set to 12 articles. The initial search in CINAHL resulted in 62 potential articles, which I then narrowed down to 17 articles. Searching GoogleScholar yielded 760 articles, which I narrowed down to 40 articles after title screening. Reviewing the abstracts guided by inclusion and exclusion criteria resulted in 15 articles. The screening process continued based on the PRISMA flow chart

(Appendix D), which eliminated duplicates. Finally, after screening for eligibility by full text, the literature search in this DNP project resulted in 9 articles. The selection process resulted to one RCT, three before and after design, two prospective, two quasi-experimental, and one observational study. This systematic review supports the importance of reconciling the EBP of sepsis management with actual clinical practice among healthcare providers.

Semler et al. (2015) conducted an RCT to evaluate and treat ICU patients (N = 407) with sepsis within the scope of the sepsis bundle guidelines using an electronic tool with the capability to transfer data-related sepsis into the patients' medical record. Semler et al. concluded that, although this electronic tool is reliable and practical, it did not result to timely completion of the sepsis bundles compared to the usual care. The study did not demonstrate a resultant reduction in ICU mortality, ICU stays, and days off ventilators and vasopressors. It was found in this study that the electronic tool was underutilized (Semler et al., 2015). Identified barriers to the appropriate use of this tool were the rotation of resident house staff to the ICU, which limited their familiarity with the tool, the restriction of its use in the ICU instead of it initiation in the emergency department, and the different levels of severity of sepsis among the ICU patients.

Three pre and post studies were included in this systematic review. Arabi et al. (2017) conducted a study in a 900-bed academic hospital to examine the relationship between a two-phase intervention (Phase I- electronic alert; Phase II- addition of Sepsis Response Team [SRT]) and compliance with the bundles, ventilator days, length of stay (LOS), and hospital mortality. This study showed that the addition of SRT to the

electronic alert system resulted in an earlier recognition of sepsis and enhanced compliance to the sepsis bundles (Arabi et al., 2017). It was then concluded that Phase II intervention significantly reduced hospital mortality, mechanical ventilation days, ICU LOS, and hospital LOS. Although, Arabi et al. were able to support the positive relationship between variables, one barrier they encountered was physicians' preference of slower administration of intravenous fluid resuscitation. Another pre and post intervention study was conducted in Brazil by Noritomi et al. (2014) from 2010 to 2012 involving 10 private hospitals. Noritomi et al.'s approach involved different strategies: (a) screening strategies, (b) multidisciplinary educational classes, (c) involvement of case management, and (d) continuous performance evaluation. This comprehensive approach to sepsis management resulted in significant improvement: 62% compliance with the sepsis bundles (Noritomi et al., 2014). Noritomi et al. also showed a reduced hospital mortality from 55% to 26%, reduced total hospital cost per patient from $29,300 to $17,500 U.S. dollars, and increased quality-adjusted life years gain from 2.63 to 4.06. A perceived barrier in this study was the challenge of influencing physician's attitudes towards the implementation of change (Noritomi et al., 2014). Chen et al. (2013) conducted a nationwide educational training program on the sepsis bundles consisting of 10 hours for each intensivist in Taiwan to study the change in their clinical practice and its impact on mortality. Chen et al. enrolled 14,848 preintervention cohorts and 24,858 postintervention cohorts. At the end of the study period (2005-2008), Chen et al. concluded that, although there was only a slight reduction in mortality, overall, there was a consistent decline observed over time. On the other hand, use of the sepsis bundles

increased significantly, which consequently reduced Taiwan's mortality from sepsis (Chen et al., 2013).

The search process produced two prospective cohort studies, each utilizing different performance improvement interventions to increase sepsis bundle compliance. Schramm et al. (2011) conducted a 33-month study that included 984 ICU patients. Interventions used were daily auditing and weekly feedback as well as SRT. Schramm et al. concluded that, although there was a 37.7% increase in compliance rate on the sepsis bundles, there was a more significant increase (53.7%) with the activation of the SRT. After weekly feedback, it was noted that there was a 2% reduction in hospital mortality, whereas with SRT there was a more significant reduction (10%). Larosa et al. (2012) implemented a sepsis screening tool and an alert system, called Code Smart, for ICU patients ($N = 58$) in a New Jersey tertiary teaching hospital within a period of 6 months in 2009 to improve healthcare providers' compliance with the sepsis bundles and the effect of this implementation on hospital mortality. There were 34 patients enrolled in the Code Smart and 24 in non-Code Smart (Larosa et al., 2012). The screening tool was utilized in the ED by physicians to determine eligible patients for ICU admission after implementation of the Code Smart (Larosa et al., 2012). While in the ICU, patients were managed according to the sepsis bundles (Larosa et al., 2012). Statistical analysis showed that compliance to the bundles was higher in the Code Smart group ($p = 0.01$) than the non-Code Smart group: on the other hand, the Code Smart group showed a statistical significance ($p = 0.04$) in survival rate compared to the non-Code Smart group

(Larosa et al., 2012). Larosa et al. (2012) concluded that an early alert system can significantly enhance providers' compliance to the sepsis bundles.

Two quasi-experimental studies were included in this systematic review project. The first study was conducted on ICU patients (n = 564) of a tertiary private hospital in Brazil to explore the effect of performance improvement programs in optimizing compliance to the SSC sepsis bundles. In their study, Schiramizo et al. (2011) used an educational program given in the form of lectures, e-learnings, and protocols which were reinforced on a yearly basis. The compliance on both bundles increased significantly (13.7%) over the period of 3 years from May 2006 to December 2009 (Shiramizo et al., 2011). The in-hospital mortality declined substantially from 54% to 16.2% within the timeframe of 2005-2009 (Shiramizo et al., 2011). The second study was conducted on ICU patients admitted over a 2-year period in 2009-2011 in Saudi Arabian hospital using interventions such as, a written evidence-based sepsis pathway, appropriate antibiotic recommendations, and educational program (Memon et al., 2012). In this study, the impact of the sepsis bundle (6-hour) compliance on hospital mortality was explored which resulted to a significant improvement in compliance from 5.1% to 23.6% was found after the intervention (Memon et al., 2012). Both studies did not only focus on the effect of performance improvement programs on the compliance with sepsis bundles (Shiramizo et al., 2011; Memon et al., 2012). Results from both studies also showed a direct association between increased compliance and lower hospital mortality from sepsis (Shiramizo et al., 2011; Memon et al., 2012).

An observational study was done on ICU patients (n = 4,329) of 11 hospitals in Utah and Idaho between January 2004 and December 2010 to assess the impact of increased compliance to the sepsis bundle on mortality (Miller et al., 2012). After the development and strict implementation of the sepsis bundles, complete compliance of all the bundles increased by a staggering 68.5% (Miller et al., 2012). At the end of the 7-year study period, Miller et al. concluded that a steady decline in mortality from a baseline of 21.2% in 2004 to 8.7 in 2010 was a result of compliance to the sepsis management bundle. Compliance to all the bundles resulted to a 59% decline in hospital mortality (Miller et al., 2012). This study also found that compliance to the 3-hour bundle can lower the chances of patients to deteriorate requiring the need for further resuscitative measures (Miller et al., 2012).

Limitations

The limitation identified in this systematic review was the insufficient evidence involving healthcare providers such as physicians, NPs, and PAs. Many articles identified focused on the compliance to the sepsis bundles are also conducted among other health care professionals in addition to providers mentioned previously. These were nurses, pharmacists, and respiratory therapists among others. Additionally, when limiting my literature search on studies done on the latest SSC guidelines on the sepsis bundles, I found that there was substantially less evidence available. I then focused my search on healthcare providers' compliance on the sepsis bundles by itself.

Implications from Findings

The implications resulting from this doctoral project could inform healthcare providers with evidence-based management of sepsis, assist them with decision-making in caring for patients with this condition, and reduce the variation in their practice. A multicenter survey conducted in the U.S. revealed that physicians' knowledge on the sepsis bundles was minimal (Tufan et al., 2015). Despite having performance improvement programs in place in every healthcare institution, compliance remains to be a challenge. Barriers to the implementation of the sepsis bundle have been identified in the literature. Exploring these barriers could assist healthcare institutions find solutions to overcome this challenging issue. With the growing complexity in healthcare, as well as with the population becoming more vulnerable to sepsis and its complications, the results of this systematic review could be instrumental in improving the implementation of evidence-based management of sepsis in compliance with SSC guidelines. Identifying the best strategy and integrating it to everyday patient care could ensure a sustainable clinical practice. Results from this doctoral project could complement the SSC guidelines in the management of sepsis as a standard of practice across the healthcare system.

Implications to Positive Social Change

Although, multiple studies have successfully linked performance improvement programs with better outcomes, multiple studies also found that low compliance with the SSC guidelines remains a challenge that needs to be focused on. Providing consistent education to healthcare providers on the guideline-specific management of patients with

sepsis along with a collaboration of a multidisciplinary team in the form of an SRT could enhance compliance to the sepsis bundles that can promise sustainability. These strategies could help standardize clinical practice in the practice site and serve as a guide in influencing change across the healthcare system. Sustainable compliance to the sepsis bundles could help improve patient outcomes, reduce mortality, and drive down healthcare costs from sepsis and its complications.

Recommendations

In the world where patient population is becoming more complex and where healthcare architecture is consistently evolving towards more EBP complicated by the demands to improve patient outcomes, the challenge to successfully strategize a sustainable compliance to the sepsis bundles becomes an arduous undertaking. The goal of improving patient outcomes by identifying the best strategy to enhance compliance to the sepsis bundles as recommended by the SSC was the mainstay of this doctoral project. Identifying barriers that impede the translation of evidence-based management of sepsis to the actual care of these patients is paramount in finding solutions to change healthcare providers' clinical behavior. The findings in this study suggest that it is not implausible to have a successful translation of guideline-specific sepsis management to daily clinical practice. An educational program for healthcare providers geared towards SSC recommendation complemented by a multidisciplinary team approach, such as an SRT, consistently produced positive outcomes. This study identified these two strategies that consistently resulted to enhanced providers' compliance to the sepsis bundles and a reduction in mortality.

Strengths and Limitations

The strength of this study was the plethora of evidence in the literature due to the fact that sepsis is a public concern worldwide and it affects all population. It is an area that is widely researched not only in the US but also in other countries. Another strength identified in this study was the reliability of the evidence. The level of evidence of chosen articles based on AACN's grading were maintained mostly at level C and nothing lower. Lastly and most importantly, the results of this project is transferrable in any healthcare anywhere in the world because the studies that were chosen as evidence to support this project were not only limited to those that were conducted in the US, but also in other countries.

One limitation identified was, although, multiple studies were done to explore the barriers to the sepsis bundles as well as healthcare providers' compliance to this protocol, there was not a significant amount of studies that addressed the issue focusing on healthcare providers alone. Most studies were conducted on physicians, nurses, pharmacists, and other disciplines involved in patient care. Another limitation identified was, although, the intent of this project was to obtain and include studies classified as LOE A to C, there was only evidence that supported level A and there was no study included which was classified as level B. Lastly, although, some of the evidence were large-scale studies (n = 3) with subjects ranging from 4329 to 39,706, most of the evidence were conducted on a smaller scale (n = 6).

Summary

This systematic review of studies conducted in different areas of the world identified different barriers affecting the transformation of healthcare providers' clinical behavior towards guideline implementation on sepsis management. Contrary to what one author claimed that some barriers are fixed and some are modifiable (Ryan, 2017), this systematic review revealed strategies that could overcome those barriers. The results of utilizing performance improvement strategies consistently produced a significant improvement in healthcare providers' compliance to the sepsis bundles. As such, it was concluded in this study that education along with an SRT are effective tools to change current practices in caring for patients with sepsis.

Section 5: Dissemination Plan

An educational program focused on the current SSC guidelines with the use of the sepsis bundles along with an SRT are effective tools that could be added as complementary strategies to the sepsis order set in the electronic medical record (EMR) that is currently in place in the practice site. This multifaceted approach could be implemented to study its impact on sepsis bundle compliance, ICU LOS, overall hospital LOS, and mortality. Successful implementation of this performance improvement program could serve as a basis of standardized practice among healthcare providers across the healthcare system.

The plan for further dissemination of the results of this doctoral project is through participation in local and statewide poster presentations, especially, on topics involving guideline implementation. I also plan to submit my abstract to different nursing journals. Lastly but most importantly, I plan to submit my work to ProQuest Central for publication to guide clinical practice and to assist healthcare providers in their decision-making in their management of sepsis.

Analysis of Self

Analysis of Self as a Practitioner

As I stepped out of my career from a nursing role to transition to a more advanced role of an NP, I realized the gravity of the responsibility I then had on my shoulders. While in a nursing role, although I shared responsibility for my patients' care and outcomes with other healthcare professionals, I felt a different level of accountability. However, as my nursing knowledge was enhanced and my clinical experience expanded

over the years, I developed a different sense of awareness in nursing and, more importantly, of patient experiences and outcomes.

As my role shifted to an APN working as a provider in the CCU in one of the largest health systems in the northeast, I found myself increasingly aware of the gravity of patients' illnesses that I encounter each day. These patients end up with complications that are otherwise preventable if we as providers are more cognizant of the warning signs of sepsis and able to identify appropriate patients for prompt initiation of the sepsis protocol. Knowledge of the SSC guidelines is indispensable in one's practice. However, transferring that knowledge to a provider's daily patient care is even more crucial.

As an APN, I found myself in a situation where I wished I could do something to move EBP forward in a quicker fashion. However, the question was, how can I influence the current practices among healthcare providers? How can I effect change in order to improve patient outcomes and help reduce healthcare costs for the healthcare system?

Challenges, Solutions, and Insights Gained

Going into the DNP program and proposing and implementing a project was not an easy road for me. Initially, I started a quality improvement project (QI) to reduce my clinical site's heart failure 30-day readmission rate. It was a very challenging undertaking because it proved to me how difficult it was to win the support of my stakeholders. However, the will to become a nurse scholar did not allow me to be deterred by roadblocks.

Walden University provided me an opportunity to explore many different approaches to instill EBP into current practices. Despite the healthcare system's effort to

implement EBP through a performance improvement project, such as the electronic sepsis bundle order set, low compliance persists among the healthcare providers. Many of these providers I have spoken to in my clinical site are not sufficiently familiar with the guidelines. Instead of utilizing the order set that is already in place, many providers prefer to put in orders individually. Still many of them cannot recognize patients who are presenting with sepsis. These challenges can be attributed partly to having interns and residents rotating in a teaching hospital such as this clinical site, as well as NPs and PAs who are new graduates.

I have come to realize that as a healthcare provider and a patient advocate, I owe it to my patients to practice medicine in a conscientious manner while maintaining the highest standards of patient care. As I assume the role of a healthcare provider, I have to always be cognizant of the principles of ethics such as, nonmalefiscence, professional competence, and accountability.

Summary

Sepsis is a common illness in the ICUs and its sequelae remain to be preventable if recognized early by healthcare providers who are at the forefront of its management. The SSC guidelines recommend a performance improvement strategy using the sepsis bundles to ensure compliance to the guidelines. However, researchers have maintained that compliance among healthcare providers remains a problem anywhere in the world. I conducted a systematic review that examined and synthesized available evidence in the literature for strategies that could be recommended to be added into the existing sepsis order sets in the EMR of my clinical site. My findings suggest that an educational

program on the sepsis bundle provided to healthcare providers as well as a multidisciplinary approach in a form of an SRT have consistently proven to enhance compliance and reduce mortality from sepsis. Further research should be done to evaluate the relationship of this multi-faceted performance improvement programs, namely, electronic sepsis bundle order set, education program, and SRT with compliance, ICU LOS, overall hospital LOS, and mortality.

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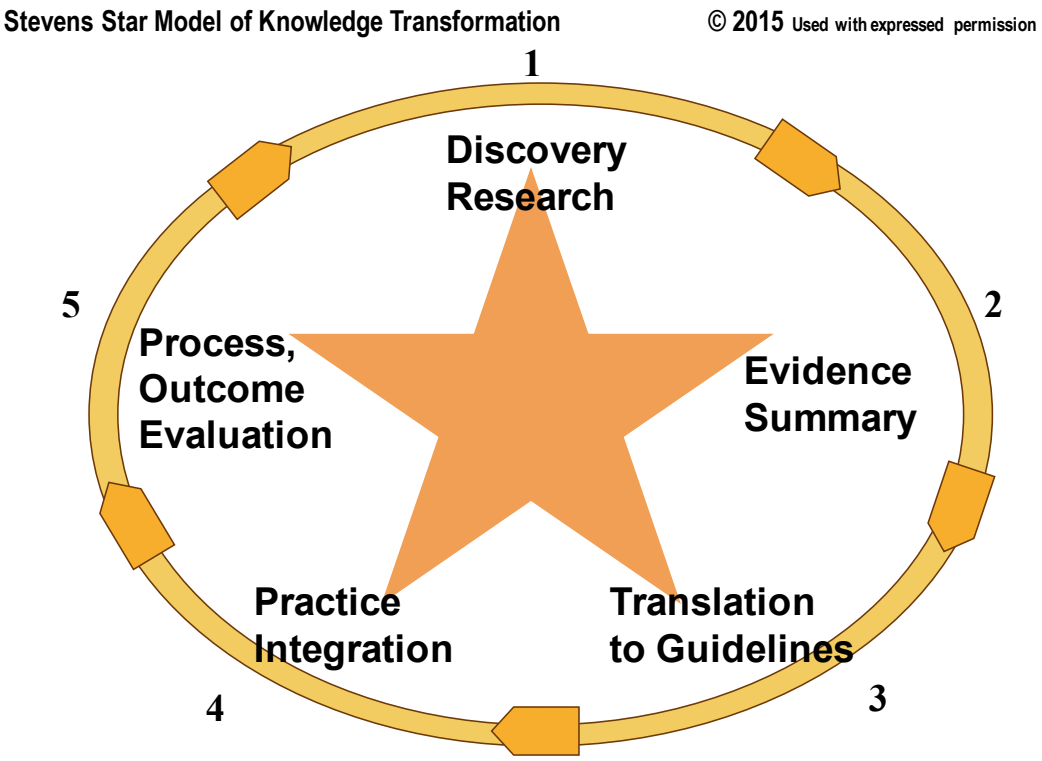
Fact sheets › Detail

Appendix A: The ACE Star Model of Knowledge Transformation



Adopted with permission from Dr. Kathleen Stevens (2015).

Appendix B: Permission Letter

Hi, Rowena…

I am aware that a number of other students have used the Star Model in their work and am pleased it is a helpful model.

I am happy to provide permission to you to use/reproduce the Star Model under the fair-use rule, with the stipulation that credit is cited, as you indicated. This includes publication of your project on your university site. If later, you are re-publishing the copyrighted material (as in publishing in a journal or book), specific permission is required by the publisher. In that case, there is usually a template letter of permission from the publisher that I will readily sign.
This email can serve as my confirmation of permission for your using the Model in your project.

Would you kindly provide me with your **faculty supervisor's name/contact information and a BRIEF description of your project**...I am studying the 'spread' of the Star Model and this would be very helpful.

I have attached an image that you may use.

The interconnected "suite" of EBP materials I developed have served well a number of projects:
1 The Model is attached…it is the core of understanding "knowledge transformation"; details can be organized around each point of the star.
2 The national consensus on *Essential EBP Competencies* (2005 and 2009) used the Model provides as the conceptual framework.
3 In turn, the competencies set the stage for the EBP Readiness Inventory…a self-efficacy instrument, shown to have strong psychometrics; currently being used in multiples studies by others.

Another resource is the Essential EBP Competencies booklet that was developed through ACE...the description of the development is found at http://nursing.uthscsa.edu/onrs/starmodel/ebp_compet.asp . If you're interested in ordering an Essential Competencies booklet, just let me know and I will send the order form ($30).

A number of clinical agencies and academic institutions have benefitted from using our EBP readiness survey, called the EBP - Readiness Inventory (ERI). The ERI is a self-report instrument based on national consensus EBP competencies (Stevens, 2005 & 2009). The survey can be administered electronically and can be used to assesses EBP Readiness in both clinician and student populations. If you are interested in more information about this instrument, contact me.

On another note, I am also involved with the Improvement Science Research Network (ISRN). The ISRN's work is to advance the emerging field of improvement science. Our mission is to advance the scientific foundation for quality improvement, safety and efficiency through transdisciplinary research addressing healthcare systems, patient centeredness, and integration of evidence into practice. It provides a laboratory to greatly enhance feasibility and generalizability of NIH (National Institutes of Health) proposals in improvement science. Additionally, it provides an infrastructure for a national program of research to test quality improvement interventions, such as those conducted by DNPs. The ISRN is comprised of national members, the Network Coordinating Center and a Steering Council. Research Priorities were adopted for

the ISRN as the best thinking to date about the direction that should be taken in improvement science. Please visit our ISRN website at www.ISRN.net for further details.

Many students from across the nation have discovered that the ISRN projects are a good fit for improvement projects…see our research priorities at http://isrn.net/research .
You may have already located these articles...describing the evolution of my work with Star:

Here is a brief description online... http://nursing.uthscsa.edu/onrs/starmodel/star-model.asp

The Star Model is also described in a number of book chapters...as well as descriptions in these articles...

- Stevens, KR. (2013). The impact of evidence-based practice in nursing and the next big ideas. Online Journal of Nursing Issues. 8 (2), 4. (open access) http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Vol-18-2013/No2-May-2013/Impact-of-Evidence-Based-Practice.html
- Saunders, H., Stevens, K. R., & Vehviläinen-Julkunen, K. (2016). Nurses' readiness for evidence-based practice at Finnish university hospitals: a national survey. Journal of advanced nursing. 29 MAR 2016. doi: 10.1111/jan.12963

If you have not already discovered the new world of "implementation science" I would like to say that you may be able to frame your study in the "uptake of EBP" framework. NIH calls this "implementation research" and it studies not only the patient outcomes but also the organizational barriers and facilitators related to the adoption of best practices. …more if you want/need it.

I would relish hearing your suggestions on how to improve/expand the Model.
Thank you for your interest in improving care, safety, and patient outcomes.

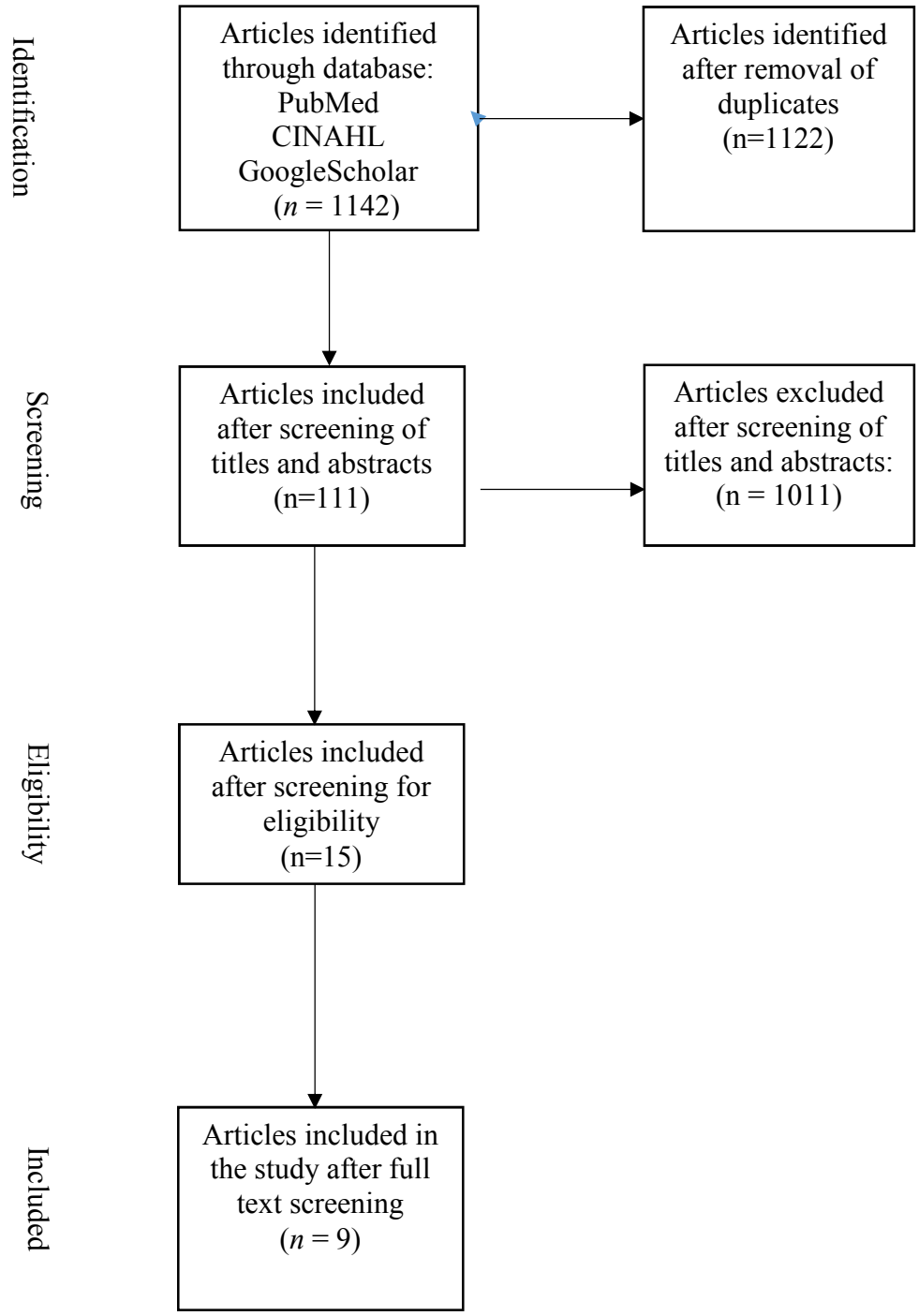
Congratulations on your professional goals. Good luck with your project!

Dr. Kathleen R. Stevens, RN, EdD, ANEF, FAAN
Castella Endowed Distinguished Professor
University of Texas Health San Antonio

Appendix C: AACN's Level of Evidence

Level A	Meta-analysis of multiple controlled studies or meta-synthesis of qualitative studies with results that consistently support a specific action, intervention or treatment
Level B	Well designed controlled studies, both randomized and nonrandomized, with results that consistently support a specific action, intervention, or treatment
Level C	Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results
Level D	Peer-reviewed professional organizational standards, with clinical studies to support recommendations
Level E	Theory-based evidence from expert opinion or multiple case reports
Level M	Manufacturers' recommendations only

Appendix D: Flow Chart of Evidence



Appendix E: Barriers and Strategies in Sepsis Bundle Implementation in ICUs.

Authors/ Publication	Title	Barriers	Strategies	Results	LOE
Arabi et al. (2017)	The impact of a multi-faceted intervention including sepsis electronic alert system and sepsis response team on the outcomes of patients with sepsis and septic shock	Complexity of the bundles, multiple players, resistance to change, long waiting time to access care in ED	Electronic alert; SRT	Increased compliance; reduced need for mechanical ventilation; lower mortality rate	C
Chen et al. (2013)	The impact of nationwide education program on clinical practice in sepsis care and mortality of severe sepsis: A population-based study in Taiwan	None identified	Nationwide educational program	Positive change in compliance; mild reduction in mortality	C
LaRosa et al. (2012)	The use of an early alert system to improve compliance with sepsis bundles and to assess impact on mortality	Not triggering Code SMART in all cases of sepsis	Sepsis screening tool and alert system, called Code SMART	Improved compliance; reduction in mortality	C
Memon et al. (2012)	Impact of 6-hour sepsis resuscitation bundle compliance on hospital	None identified	Sepsis pathway, antibiotic recommendation,	Improved compliance; reduction in 30-day mortality; no difference in	C

	mortality in a Saudi hospital		educational program	ICU mortality and LOS	
Miller et al. (2012)	Multicenter implementation of a severe sepsis and septic shock treatment bundle	None identified	All or none total bundle compliance	Substantial increase in sepsis bundle compliance; marked reduction in hospital mortality; lower rates of progression of sepsis	C
Noritomi et al. (2014)	Implementation of a multifaceted sepsis education program in an emerging country setting: Clinical outcomes and cost-effectiveness in a long-term follow-up study	Low awareness on sepsis; lack of adequate workflow to prioritize sepsis patients, resistance to guidelines, staff's lack of knowledge on sepsis guidelines	Screening, multidisciplinary educational sessions, case management, continuous performance assessment	Significant improvement in bundle compliance; reduction in mortality	C
Schramm et al. (2011)	Septic shock: a multidisciplinary response team and weekly feedback to clinicians improve the process of care and mortality	Delay in sepsis recognition in the ward before transfer to ICU	Daily auditing, weekly feedback, and SRT	Increased compliance; lower mortality rate	C
Semler et al. (2015)	An electronic tool for the evaluation and treatment of sepsis in the ICU: A	Low utilization of the tool; frequent rotation of resident	Electronic sepsis evaluation and management tool	No significant increase in bundle compliance; improved	B

	randomized controlled trial	staff resulting to unfamiliarity of the tool		clinical outcomes	
Shiramizo et al. (2011)	Decreasing mortality in severe sepsis and septic shock patients by implementing a sepsis bundle in a hospital setting	Learning curve involved among providers	Implementation of SRT and RRT	Reduced mortality	C

LOE - Level of Evidence; SRT- Sepsis Response Team; RRT- Rapid Response Team; ICU-Intensive Care Unit; LOS- Length of stay