Fall 2022

Improving Intravenous Fluid Resuscitation Compliance of Severe Septic and Septic Shock Adults in a Rural Emergency Room

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DNP Manuscript Defense Approval

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Date: * 06/26/2022

Choose your DNP program: *
- (•) Adult-Gerontology Acute Care Nurse Practitioner (Doctor of Nursing Practice)
- ( ) Family Nurse Practitioner (Doctor of Nursing Practice)
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Manuscript Title: * Improving Intravenous Fluid

Date of Manuscript Approval: * 06/26/2022

Student Signature	Electronically signed by Alison Douglas on 06/26/2022 4:20:21 PM
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Improving Intravenous Fluid Resuscitation Compliance of Severe Septic and Septic Shock Adults in a Rural Emergency Room

A DNP Project Submitted to the
Graduate Faculty
of Jacksonville State University
in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Nursing Practice

By

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Jacksonville, Alabama

August 5, 2022

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Abstract

Background: The Doctor of Nursing Practice (DNP) project focused on the delay in intravenous fluid (IVF) resuscitation of sepsis and septic shock patients in the emergency room (ER) before inpatient admission.

Purpose: The purpose of this project was to improve the time-sensitive administration of IVF resuscitation of adult patients diagnosed with sepsis or septic shock by enhancing ER nurses' end-user knowledge of and adherence to evidence-based sepsis treatment recommendations over approximately six weeks (42 days).

Methods: Retrospective chart reviews were performed in December 2021 and focused on IVF resuscitation times. Pre-intervention questionnaires were completed, assessing baseline nursing knowledge. Nurse education focused on rapid IVF initiation and the importance of minimizing delays in IVF resuscitation treatment. Participating nurses were educated on the Surviving Sepsis Campaign's hour-1 bundle protocol. Post-intervention questionnaires were completed, followed by retrospective post-intervention chart reviews in February through March 2022 to evaluate interventional impact.

Results: Pre-intervention retrospective chart reviews revealed 37.3% fallout of sepsis cases regarding IVF resuscitation times compared to 36.8% fallout of sepsis cases post-intervention, a difference of 0.5%. Fisher's exact test was utilized to test for statistical significance, revealing no statistical significance (*p-value = 1.0000*).

Conclusion: This project emphasizes the importance of nurse adherence to the sepsis hour-1 bundle protocol of decreasing IVF resuscitation times in hypoperfused sepsis and septic shock patients.

Keywords: sepsis, septic shock, fluid resuscitation, emergency room

Acknowledgments

Completing this Doctor of Nursing Practice (DNP) project and graduate program is dedicated to my husband, Patrick. You light up my life and are one of the most selfless people I know. Thank you from the bottom of my heart for all you do and for being my most significant source of strength. I love you. I would also like to acknowledge my family, including my sister Rachael, mother, Jocelyn, and father, Stan. It is hard to describe the love shown and the meaningful impact these three people have made on my life. I am forever grateful for them, as their love for one another has been a beautiful example on which to build my life. I offer my deepest gratitude for all of your encouragement throughout my nursing journey, and I promise to emulate each of your beautiful souls throughout my professional career.

I want to express tremendous gratitude to three phenomenal nurses and colleagues I am privileged to work alongside, my preceptor Dr. Stephanie Jones, and mentor, Dr. Brian Keith Brooks, for being great cheerleaders during my continued growth and development as a nurse, and the hospital Sepsis Coordinator, Emily Rakestraw, for assisting me in data collection during this project. I also want to express my sincere appreciation and heartfelt thanks to my DNP faculty chair, Dr. Timothy Blake Booth, professor Dr. Lori McGrath, and the Jacksonville State University nursing faculty and staff. The fundamental foundation provided throughout this DNP program was challenging, yet I am forever grateful for being part of such an esteemed experience. As I progress in my professional career, I will carry all I have learned and accomplished, applying it in clinical practice to provide high-quality, evidence-based patient care. Thank you for giving me the tools necessary to be a difference-maker, as your personal and educational impact will be forever invaluable.

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Improving Intravenous Fluid Resuscitation Compliance of Severe Septic and Septic Shock Adults in a Rural Emergency Room

Sepsis is dangerously characterized by an interruption in host deviation from normal physiological, biological, and metabolic states due to infection. The body produces an inflammatory response during sepsis, resulting in multiple organ dysfunction syndromes (MODS) and potential death if left untreated (Neviere, 2021). The term sepsis is generalized and presents on the following severity scale: (a) varying infection to bacteremia, (b) bacteremia to sepsis, (c) sepsis to septic shock, and (d) septic shock to MODS and death. Since the 1990s, sepsis and septic shock terminology has evolved (Neviere, 2021).

The Center for Medicare and Medicaid Services (CMS) utilizes definitions of Systemic Inflammatory Response Syndrome (SIRS), sepsis, and severe sepsis. The Society of Critical Care Medicine (SSCM) and the European Society of Intensive Care Medicine (ESICM) generally do not accept the definitions used by CMS regarding sepsis. The Infectious Disease Society of America (IDSA) does not support the 2016 guidelines set by the SCCM and the ESICM, as the IDSA disagrees with the notion that a universal or standardized approach left out a clear delineation between sepsis and septic shock to appropriately treat and save the lives of patients in a state of shock. However, as discussed by the IDSA, using the definitions listed above poses risks in over-treatment with broad-spectrum antibiotics and aggressive intravenous fluid (IVF) resuscitation therapy for those in lesser severe conditions of sepsis (Schmidt & Mandel, 2021). The Doctor of Nursing Practice (DNP) project focused on intravenous fluid (IVF) resuscitation delays in patients diagnosed with severe sepsis and septic shock before transferring from the Emergency Room to inpatient status. The overarching, purposeful goal was

to improve IVF resuscitation through increased nurse awareness and productive adherence to sepsis treatment implementation.

Background

Sepsis continues to be a rampant diagnosis in hospitals across the United States (U.S.), affecting upwards of 750,000 patients yearly and killing nearly 210,000 annually (Dugar et al., 2020). A septic patient's average hospital length of stay (LOS) is 75% greater than other medical diagnoses in the U.S. In 2013, the average LOS for patients with sepsis substantially increased, with the following averages specific to each severity category of sepsis: (a) sepsis 4.5 days, (b) severe sepsis 6.5 days, and (c) septic shock 16.5 days (Paoli et al., 2018). Georgia ranked 8th in the U.S. for sepsis-related deaths in 2017, with a mortality rate of 15.2% (1,611 deaths per 100,000 total population) (Centers for Disease Control and Prevention [CDC], 2021). The national percentage of septic and septic shock patients who receive appropriate care is 57%, with Georgia at 56% (Center for Medicare and Medicaid Services [CMS], 2021).

Needs Analysis

The DNP project was conducted at a rural Northwest Georgia hospital. The facility houses approximately 230-beds and is a level III trauma center with national recognition in stroke (certified advanced primary stroke center) and cardiovascular care (heart failure and myocardial infarction) through the Joint Commission. The hospital also provides advanced cardiac surgical services, including open-heart surgery, with additional services including cancer, diabetes, digestive, and imaging care. Other services include orthopedic care, specifically robotic-assisted joint replacement, general surgical services, occupational health services, sports medicine, rehabilitation, and wound care. The hospital recently added a residency program, becoming a teaching facility in 2017.

The rural Northwest Georgia hospital reports an average of 75% sepsis and septic shock appropriate care (CMS, 2021). Current hospital protocol guidelines fall under the Centers for Medicare and Medicaid Services (CMS) SEP-1 bundle protocol, where "SEP-1" stands for "The Severe Sepsis and Septic Shock Management Bundle." The bundle includes antibiotic and IVF administration, blood cultures, lactic acid measurement, use of vasopressors for hypotension, and evaluation of the patient's response to therapy. Hospitals must report compliance with bundle factors within three and six hours (Barbash, Davis, & Kahn, 2019). Due to the Coronavirus (COVID-19) pandemic, hospitals are experiencing higher volumes of patients. As a result, patients often experience a lengthy delay between the Emergency Room (ER) and admission to an inpatient unit. Evidenced-based research education is needed to enhance ER nurses' understanding of hospital protocol and sepsis bundle implementation as a pathway to decreasing patients' hospital LOS.

The Emergency Room

The ER houses 24 beds, two of which are trauma rooms. The nursing staff consists of 38 nurses, including 19 staff nurses and 19 travel agency nurses. Hospital-employed nurses on dayshift include seven full-time, one part-time, and three per diem nurses with ten more contracted agency travel nurses. Mid-shift has zero employees for full-time, part-time, and per diem positions. Nightshift nurse staffing consists of eight full-time employees, zero part-time, zero per diem hospital employees, and nine contracted through travel agencies.

SWOT Analysis

The principal investigator (PI) performed an analysis of strengths, weaknesses, opportunities, and threats (SWOT) to assess internal and external characteristic threats related to the project's interest (Moran et al., 2020). Inner strengths included monitoring sepsis treatment

initiation by the quality department, including monitoring sepsis tracers, and the hospital's employment of a nurse serving as the sepsis coordinator to oversee all aspects of sepsis monitoring. CMS (2021) reports an average of 77% appropriate care regarding sepsis and septic shock within the hospital. The principal investigator piqued interest in this DNP project because sepsis is a monitored quality process; therefore, data exists regarding the treatment of sepsis.

A major internal and external weakness was selling the hospital to a new company. This event affected the ability to conduct the DNP practice project; it also affected the staff (internally) and the patients and community (externally) through positive or negative change. Internally, the challenge of changing to a new company is a difficult transition period. Externally, merging hospitals will likely benefit the organizational goals; however, the local city's potential revenue loss through taxes exists. The hospital change has gone from profit to non-profit with the removal of county property tax, which could impact city and county schools through budget cuts. The COVID-19 pandemic may have also contributed to the repositioning of hospitals.

Internal weaknesses included the lack of staff buy-in. The ER consists of a mixture of novice and seasoned staff, making a difference in the respective knowledge base regarding sepsis treatment. As with other hospitals during the COVID-19 pandemic, nurses are burnout due to increasing demands for higher nurse-patient ratios. The hospital utilizes more travel nurses who may be unaware of the hospital's treatment standards regarding sepsis and septic shock. Gaps in care exist as delays in treatment times occur due to high census demands. Before the merge, the Sepsis Prediction and Optimization of Therapy (SPOT) Alert System was utilized to notify necessary parties to initiate sepsis treatment protocols immediately. However, this system will no longer be accessible after transitioning to the operating standards of the new healthcare company.

Since CMS reports an average of 75% appropriate care regarding sepsis and septic shock within the hospital, timely and effective care delineates how rapidly hospitals provide care. Evidence-based research reveals the best outcomes for patients with sepsis (CMS, 2021). Furthermore, there are still opportunities for improvement in this number. The education of ER nurses will aid in quality improvement regarding sepsis treatment initiation. The principal investigator (PI) administered pre- and post-questionnaires to assess ER nurses' general knowledge regarding the initiation of sepsis treatment (pre), with follow-up questionnaires evaluating knowledge gained through educational intervention (post). Due to the dangerous and rapid threat of sepsis consequences, the need for continual assessment of staff knowledge is vital in maintaining high-quality patient care outcomes if left untreated.

Problem Statement (PICOT)

The purpose of this DNP project was to address the following question: among adult patients with severe sepsis/septic shock admitted to the Emergency Room (P), does timely IVF resuscitation (I), as compared to the current Centers for Medicare and Medicaid Services (CMS) SEP-1 bundle protocol (C), affect hospital length of stay (O)?

Aims and Objectives

The overarching aims of this project were to:

1. Improve timely intravenous fluid (IVF) resuscitation administration in severe sepsis and septic shock patients.
    a. Improve IVF resuscitation administration times by 5% post-nurse education over six weeks (42 days)
2. Enhance nurse knowledge of sepsis and septic shock treatment through evidence-based practice guideline awareness.

a. Improve nurse understanding and education of IVF resuscitation through post-test scores with a minimal 10% increase in post-test scores compared to pre-test scores.

Review of Literature

The databases used in searching for evidence-based literature include Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, Google Scholar, and Cochran Library, using various combinations of the following key terms and phrases: (a) sepsis, (b) SIRS, (c) severe sepsis, (d) septic shock, (e) infection, (f) emergency room, (g) sepsis guideline management, (h) iv fluid resuscitation, (i) early goal-directed therapy, (j) nurse care guidelines, (k) protocol compliance, (l) care bundle, (m) barriers, (n) quality of health care, (o) nursing perceptions, (p) nursing knowledge, (q) sepsis survival, (r) sepsis outcomes, and (s) Surviving Sepsis Campaign. Results were narrowed within the past ten years using peer-reviewed academic journals. The elimination of articles included irrelevant content that did not discuss the project's purpose. Other search limiters included full text, English language, and adult-specific patient populations. Several articles in the literature incorporated randomized control trials, systematic reviews, cross-sectional studies, and benchmark guidelines for sepsis. The methodology of this project was developed through critical findings of the literature search and is further discussed below.

The overall goal of sepsis care is to reduce the time to treatment initiation. Nurses must acknowledge prompt care for septic and septic shock patients amid life-threatening situations. The hour-1 bundle fosters the need for nurses to act swiftly in retrieving blood cultures, initiating broad-spectrum antibiotics, initiating intravenous fluid (IVF) resuscitation, obtaining lactate measurements, and administering vasopressors if patients are hemodynamically unstable

(Society of Critical Care Medicine [SCCM] & European Society of Intensive Care Medicine [ESICM], 2021). Early recognition, including a clear understanding of pathological sepsis findings and clinical manifestation, aids in prompt diagnosis and treatment.

Although less favorable SIRS criteria continue to be used in the DNP project's hospital, the hospital has undergone a buy-out from a new company, potentially changing the current sepsis assessment tool. Since SIRS criteria are utilized at the facility, it is worth mentioning that it tends to be less favored as evidence shows it may or may not be associated with infection. The criterion for the assessment tool measures two or more of the following (one of which must include temperature or abnormal leukocytes): (a) a core temperature of greater than 101.3 degrees Fahrenheit or less than 96.8 degrees Fahrenheit; (b) tachycardia greater than 90 beats per minute; (c) tachypnea greater than 20 breaths per minute; and (d) leukocytosis greater than 1,200/mm3, leukopenia less than 4,000/mm3, or greater than 10% immature band formation (Neviere, 2021).

Early Sepsis

Early sepsis lacks a formal definition. Eventually, infection and bacteremia lead to sepsis if left undetected and untreated. Patient monitoring is the key to prevention. Infection pertains to the attack of organisms on healthy body tissue resulting in infectious processes. Bacteremia relates to the presence of bacteria in the blood. Two popular scoring tools used to help identify early sepsis are the quick Sequential (sepsis-related) Organ Failure Assessment Score (qSOFA) and the Nation Early Warning Score (NEWS) (Neviere, 2021).

The qSOFA score assesses the mortality risk in patients outside intensive care settings. A qSOFA score greater than or equal to two (2) indicates the potential for adverse sepsis outcomes. The qSOFA scores the following three parameters, each worth one point: (a) a respiratory rate

greater than or equal to 22 per minute, (b) altered mentation, and (c) systolic blood pressure of less than or equal to 100 millimeters of mercury (mm Hg) (Neviere, 2021). The NEWS is a cumulative scoring system of six parameters, with the following ranges identifying the overall risk of sepsis death: (a) zero to four, low risk; (b) five to six, medium risk; and (c) seven or higher, high risk. The parameters assessed include respiration rate (RR), oxygen (O2) saturation, systolic blood pressure (SBP), heart rate (HR), changes in the level of consciousness (LOC), and temperature (Neviere, 2021).

Sepsis (Severe Sepsis)

In 2016, the Society of Critical Care Medicine (SCCM) and European Society of Intensive Care Medicine (ESICM) task forces described sepsis as dysregulation of the host response to an infection, causing organ dysfunction and associated high risk for mortality. CMS continues to utilize the terminology of SIRS, sepsis, and severe sepsis. Severe sepsis worsens due to decreased tissue perfusion resulting from increasing lactate levels and a state of oliguria. Noninfectious disease processes are associated with a state of SIRS, with qualifying criteria, including the following: (a) autoimmune diseases, (b) pancreatitis, (c) vasculitis, (d) thromboembolic states, (e) burns, and (f) surgical procedures (Neviere, 2021). Tools such as the qSOFA score of two or more points identify organ dysfunction. The qSOFA does not diagnose sepsis or if the cause of organ dysfunction is an infective organism but aids in assessing mortality risk. To diagnose infection, the provider must rely on infection signs and symptoms and supporting evidence from imaging, lab data, and the patient's response to treatment (Neviere, 2021).

Septic Shock

Septic shock is classified as a distributive shock state and implies dangerous circulatory, cellular, and metabolic aberrations resulting in increased patient death. As a sequela of severe sepsis, septic shock may ensue despite treatment of adequate IVF resuscitation. Patients in septic shock meet sepsis parameters, developing a mean arterial pressure (MAP) less than or equal to sixty-five millimeters of mercury and have lactate levels greater than two mmol/Liter requiring vasopressor support. Patients with septic shock have a 40% or greater chance of mortality than patients with early sepsis or sepsis (severe sepsis) with a 10% greater mortality rate (Neviere, 2021).

Multiple Organ Dysfunction Syndrome (MODS)

Multiple Organ Dysfunction Syndrome (MODS) is a life-threatening acute state where the body no longer maintains homeostasis without medical intervention. MODS is the terminal state of severe body dysregulation caused by sepsis and septic shock, classified into primary and secondary MODS terminal states. Primary MODS is a specific organ insult directly related to injury (i.e., renal failure after developing rhabdomyolysis). Secondary MODS is an organ insult not directly related to damage but rather the body's reaction due to injury (i.e., respiratory distress syndrome after developing pancreatitis). In the case of MODS, the more organs involved, the greater the patient's mortality risk, especially if a patient requires mechanical ventilation (Neviere, 2021).

COVID-19 Special Considerations

COVID-19 poses new issues as it often fulfills the criteria for sepsis as the virus possesses phenotypical traits and disease processes that align with sepsis's diagnostic criteria. Multiple Organ Dysfunction Syndrome (MODS) is a common issue in cases of severe COVID-

19 that characteristically mimic sepsis (Neviere, 2021). A German health care system noted high initial SOFA scoring for sepsis likely related to admission delays during the pandemic. The COVID-19 pandemic took a significant toll on health care globally, leading to mortality increases in different diseased states such as myocardial infarctions and strokes. Delays in care also seem to place disadvantages on the time-sensitive recognition of sepsis. Higher rates of sepsis during the pandemic are likely attributed to three causes: (a) amplified work demand of patient to nurse ratio (a factor that influences mortality), (b) the isolation of COVID-19 positive patients lowering chances of survival in emergencies, and (c) patients avoiding medical care during the pandemic out of fear (Unterberg et al., 2022).

Management of Sepsis and Septic Shock

A 2021 Surviving Sepsis Campaign retrospective analysis revealed increased in-hospital mortality of adult patients presenting to the ER with sepsis or septic shock not receiving the initiation of 30 mL/kg of crystalloid intravenous fluid resuscitation within three hours of sepsis onset (Evans et al., 2021). In a race against time, salvaging viable tissue occurs when IVF resuscitation is prompt and prioritized for all patients. The recommended hour-1 bundle of IVF resuscitation is ideal for patients who are in critical states of sepsis or septic shock, as both are considered medical emergencies (Society of Critical Care Medicine [SCCM], 2021; European Society of Intensive Care Medicine [ESICM], 2021).

Dugar et al. (2020) recommended that early sepsis detection, rapid implementation of appropriate antimicrobial therapy, and adequate fluid resuscitation were equivalent to protocol care regarding outcomes and were ultimately more cost-effective. The management of IV fluid resuscitation occurs through rescue, optimization, stabilization, and de-escalation phases. This study applies to the DNP project as a benchmark recommendation, providing diagnosis and

management guidance based on the Surviving Sepsis Campaign, CMS recommendations, the Sepsis-3 Committee, and international consensus studies (Dugar et al., 2020).

Early IVF fluid resuscitation is essential in stabilizing tissue hypoperfusion (Levy, Evans, & Rhodes, 2018). IVF resuscitation should occur immediately upon detection of severe sepsis/septic shock with the goal of completion within three hours. Recommended guidelines discuss that resuscitation efforts should involve 30 mL/kg of crystalloid IVF. However, this recommendation is left for interpretation as a specific patient assessment plays a crucial role in treatment, as there is a lack of literature to support an exact volume. Volume guidelines vary because some evidence discusses an increased mortality risk for ICU patients with a positive fluid balance (Levy, Evans, & Rhodes, 2018). Assessment of fluid status should remain ongoing beyond initial resuscitation concerning how fluid responsive the patient remains (Levy, Evans, & Rhodes, 2018).

Concerning the role of nursing in recognizing and timely treatment of sepsis and septic shock, another study completed by Burney et al. (2012) performed a quantitative cross-sectional study, which discussed evidence around early goal-directed therapy (EGDT) of sepsis treatment implementation. The study identified and addressed barriers in sepsis protocol initiatives and nurse baseline assessment of knowledge, attitudes, and behaviors about sepsis treatments (Burney et al., 2012). The study's nurses and physicians identified a critical nurse staffing shortage as one of the most significant weaknesses in implementing protocols around early sepsis resuscitation (Burney et al., 2012).

Screening for sepsis is essential, and initial resuscitation should begin immediately upon recognition (Evans et al., 2021). In a retrospective analysis of ER adult patients, Evans et al. discuss that failure to receive the recommended 30 mL/kg of IV resuscitation within three hours

of sepsis onset was related to increased hospital mortality. Moreover, IV fluid resuscitation aims of 30mL/kg have been adopted into routine clinical practice to reduce serum lactate and improve perfusion. New guidelines also suggest that patients who need medical attention in an intensive care unit (ICU) be transferred within six hours (Evans et al., 2021).

Leisman et al. (2016) reviewed a prospective observational cohort regarding severe sepsis and septic shock patients in an ER. The study revealed that IVF resuscitation initiation time within 30 minutes of sepsis presentation was associated with improved hospital length of stay and patient mortality, resulting in an easier performance predictor of sepsis and septic shock time management than IVF completion time (Leisman et al., 2016). This study may be valuable to the DNP project as its key findings support hastening treatment times for IVF therapy. A study by Gaieski et al. (2017) concluded that the impact of ER crowding plays a significant role in the follow-through of protocolized sepsis care. The study revealed that as ER crowding surges occurred, time to critical sepsis therapy significantly increased while protocolized care decreased. As crowding occurs, emphasizing quality improvement plans to enhance time-sensitive therapy is vital for proper sepsis treatment. Overflowing ERs are directly associated with reducing quality performance measures (Gaieski et al., 2017).

Concluding the literature review, implementing nursing and provider education is warranted to maintain high-quality care regarding sepsis treatment modalities and timely IVF resuscitation. Therefore the DNP project focused on improving the initiation of IVF resuscitation in septic and septic shock adults in the ER. This literature review aided in developing the project PICO(t) question and the study's methodology construction.

Theoretical Framework

Kurt Lewin's theory of planned change guided the development of this DNP project. Translating transformations within groups, systems, or health initiatives, Lewin recognized change as constant stemming from driving and opposing forces. These forces evolve into three stages: unfreezing, moving, and refreezing. Unfreezing assesses the need to educate teams to move towards improvement in practice (Zaccagnini & White, 2017). Moving motivates teams to accept and implement improvement, minimizing barriers to change. Refreezing provides safeguards to allow for the continuation and maintenance of desired change. Lewin believed individuals could reform their perceptions by conflict resolution and understand processes through planned change and learning (Zaccagnini & White, 2017).

Methodology

The DNP project aimed to improve nurse adherence and timely IVF resuscitation in septic adults in a rural ER. Retrospective chart reviews were performed of sepsis data in December 2021 and again in mid-February through mid-March 2022. The project's intervention included staff education about the importance of rapid initiation and minimizing delays in IVF resuscitation treatment. Nurses in the ER were provided a pre-test questionnaire and educated on the Hour-1 bundle protocol from the Surviving Sepsis Campaign. The emphasis of teaching was placed on minimizing delays in starting IVF resuscitation. After educational instruction, a post-test questionnaire was completed, followed by a retrospective chart review post-intervention to evaluate the impact of the teaching intervention. A return folder was placed in the break room and secretary station to maintain anonymity. Education sessions were provided mid-shift as a conversation between the nurses and the principal investigator (PI). Nurses were provided an educational flyer on the Hour-1 Initial Resuscitation for Sepsis and Septic Shock Surviving

Sepsis Campaign (Society of Critical Care Medicine & European Society of Intensive Care Medicine, 2019).

Setting

The DNP project occurred in an acute care ER at a non-profit hospital in rural northwest Georgia. The hospital is designated a Level III trauma center and a Level I emergency cardiac center for care. Including the triage area, the ER has 24 beds, two of which are designated as trauma bays. The ER also provides a functioning helipad to assist in air ambulance transport of critically ill patients. Over the past two years, the ER has treated approximately 700 to 800 patients weekly.

Population

The population of interest was ER nurses caring for adult sepsis and septic shock patients. Participants included full-time, part-time, and per diem day shift nurses holding permanent and travel positions. Of the 21-dayshift nurses, 13 participated in the study and were included in the project's sample size.

Inclusion and Exclusion Nursing Criteria

Inclusion criteria for this DNP project included day shift registered nurses working in the ER as permanent hospital employees or contract agency nurses. During the post-implementation chart review, severe septic and septic shock patient charts were not eliminated from the analysis based on whether the nurse participated in the teaching session. The analysis included patient chart reviews that met severe septic and septic shock parameters. Exclusion criteria included nightshift nurses. Also excluded from the study were physicians, advanced practice providers, unit administrators, and ancillary staff.

Recruitment and Consent

ER nurses were asked to participate in an anonymous DNP student-led project and informed of the consent, pre-assessment questionnaire, and teaching, followed by a post-assessment questionnaire. Consent forms were attached to the questionnaires and completed before participation (see Appendix A). The consent forms emphasized the DNP project as student-led to improve IVF resuscitation treatment time in septic and septic shock patients. The consent form further explained the privacy and confidentiality of collected data, maintained in a secured folder with only the principal investigator having access.

Design

The design of this DNP project was for quality improvement of sepsis treatment through nursing education based on evidence. Institutional Review Board (IRB) approval was obtained before the start of the student lead DNP project (see Appendix J). This DNP project utilized ER dayshift nurses who took a pre- and post-questionnaire through convenience sampling and retrospective data sampling to evaluate IVF resuscitation times of sepsis and septic shock patients. Nurses were provided a pre-assessment questionnaire to determine a baseline of knowledge based on Likert scale-designed questions. Nurses were educated face-to-face after pre-assessment questionnaires were collected. The post-test questionnaires were administered to evaluate data pre- and post-intervention.

The PI conducted teaching sessions and provided nurses with a Surviving Sepsis Campaign flyer that coincided with the concepts of questionnaires. The questionnaires included the following questions about the nurse's ability to: (a) identify all five (5) Surviving Sepsis Campaign (SSC) hour-1 care bundle elements, (b) identify SIRS criteria, (c) identify the timeframe in which IVF resuscitation should begin and end once sepsis is identified, and IVF

resuscitation ordered, (d) identify the correct amount of IVF to administer per individual patient based-off set criteria of at least 30mL/kg once sepsis-induced hypoperfusion or septic shock has occurred, and (e) understand the importance of acting quickly and minimizing delay in treatment of sepsis and septic shock patients (Society of Critical Care Medicine [SCCM] & European Society of Intensive Care Medicine [ESICM], 2021).

DNP project committee members evaluated the questionnaire. The PI developed a Likert-style questionnaire with content based on the Surviving Sepsis Campaign flyer, which was discussed with the prior Sepsis Coordinator, who is now an assistant manager in the Emergency Room (ER). Evaluation and vetting also included discussions with the DNP project chair and preceptor. Nurse practice timing was assessed through an additional retrospective sampling of patients for approximately five weeks (37 days) in February and March post-intervention to compare IVF resuscitation initiation times.

Chart Reviews

Upon IRB and hospital approval, a retrospective pre-intervention chart review commenced in the sepsis coordinator's office utilizing sepsis protocol data from December 2021. The study reviewed 142 charts with 67 septic and septic shock patients identified. Charts were identified by a consult order placed to the sepsis coordinator when SIRS criteria alerted a patient that may be septic. Chart reviews determined the time of patient arrival, triage time, sepsis-coordinator consult time, and time of IVF fluid resuscitation administration. This data was compared against the recommended evidence-based practice by CMS for hospital fallouts. Twenty-five out of 67 (37.3%) fallouts were identified.

Data was collected from the rural Northwestern Georgia acute care hospital using Meditek; this was the only electronic medical record (EMR) system utilized in data collection for

this DNP project. Emergency Room (ER) post-intervention retrospective data collection started the week after teaching sessions in mid-February and continued for approximately five (5) weeks (37 days) into March 2022. Age and sex were the only identifiable patient data collected from the EMR, as all other patient data was un-identified for this study. No identifiable data was included in the analysis or contents of this DNP manuscript. The PI and hospital quality control personnel who aided in data collection were the only researchers involved in data retrieval. The PI created pre- and post-intervention tables (see Appendix B and E). Both pre- and post-intervention tables of patient chart review included information about: (a) patient age/sex, (b) type of sepsis, (c) time of arrival, triage, and sepsis coordinator consult, (d) pertinent labs or vitals, (e) IVF start time, (f) admission and discharge date, (g) reason for admission, (h) weight, the total volume of IVF received, (i) miscellaneous information or reason for fallout, (j) minutes until IVF start time, and (k) length of stay.

Risks and Benefits

Observance of autonomy, beneficence, non-maleficence, and justice were applied to uphold fundamental ethical standards for protecting patient and nurse data. Maintaining the confidentiality of retrospective, interventional, and prospective data was the most significant concern for the PI. A potential breach of confidentiality was mitigated by the PI's assurance of data security by preserving anonymity. Benefits included improved patient outcomes by implementing high-quality nursing care standards in treating sepsis and septic shock patients. Enhanced patient care will benefit the hospital by minimizing costly admissions, improving hospital length of stay, and decreasing patient mortality.

Timeline

IRB approval was granted on December 9, 2021. Pre-intervention chart reviews occurred in December 2021, followed by initial data organization and analysis. Project intervention followed, including questionnaires with education in mid-February 2022. Post-intervention chart reviews occurred from the last week of February through March 2022, including final data organization and analysis (see Appendix C).

Budget and Resources

The DNP project received no external funding to aid in project completion, with expenses costing the PI under one hundred dollars to complete (see Appendix D). The PI budgeted costs between five-nine hundred dollars for anticipated project completion. However, the only cost to the PI was the material printing at an estimated cost of ten dollars.

Evaluation Plan

Statistical Considerations

Pre-intervention retrospective data collection included calculating descriptive statistics by frequency (%) of proper IVF resuscitation times. Post-intervention data collection included calculating descriptive statistics by frequency (%) of appropriate IVF resuscitation times. Fisher's exact statistical test was utilized to compare IVF resuscitation times before and after the educational intervention for nurses. Efficacy was analyzed through pre-and post-questionnaires using the Wilcoxon signed-rank test to compare data using Likert scale style question results of nurses who consented to participate in the DNP project. The principal investigator coded all data to maintain confidentiality and analyzed using a statistical software package.

Data Maintenance and Security

Nurse questionnaires were differentiated by permanent hospital staff and travelers identified by the participant. A comparison of pre- and post-questionnaire responses was then performed. Questionnaires were maintained confidentially by excluding identifying information and kept in a closed survey collection folder. Nurse questionnaires and patient data were kept on-site in a locked office to maintain confidentially. Upon final manuscript completion, all data used in the analysis remained un-identified in the manuscript to maintain the confidentiality of participants and patients. According to the recommended Jacksonville State University (JSU) ethical study guidelines and the Collaborative Institutional Training Initiative (CITI) program completion (see Appendix I), all DNP project data was destroyed. Nurse participation and patient data did not leave the hospital campus in compliance with the ethical standards of hospital policy of student study conduct and per national HIPAA guidelines.

Results

This section will highlight data collection and analysis results, including quantitative data from pre and post-intervention retrospective chart reviews and pre- and post-intervention nurse assessment questionnaires. Specific highlights will include: (a) pre-intervention IVF resuscitation time results for sepsis and septic shock patients versus post-intervention and (b) pre-intervention nurse knowledge of sepsis and septic shock treatment versus post-intervention.

Results of Chart Reviews

Pre-intervention retrospective chart reviews revealed 142 consults for sepsis. Of those 142 consults, 67 reviewed cases included the following: (a) 41 severe sepsis cases, (b) 19 septic shock cases, and (c) seven (7) cases unable to be specified due to incomplete patient results. The additional 75 consults of the 142 were excluded from data analysis as they did not meet the

project study criteria. Of the 142 consulted and reviewed cases, 37.3% (25) fell out of evidence-based practice criteria in meeting IVF resuscitation treatment time for severe sepsis and septic shock. To further examine and highlight project data results, IVF resuscitation delay was further divided into cases of severe sepsis (16/41 = 39%), septic shock (5/19 = 26.3%), and unspecified (4/7 = 57.1%) (see Appendix B).

The retrospective post-intervention chart reviews revealed 38 consults for sepsis. Of those 38 consults, 19 reviewed cases included the following: (a) 13 severe sepsis cases, four (4) septic shock cases, and two (2) cases unable to be specified due to incomplete patient results. The additional 19 consults of the 38 were excluded from data analysis due to only meeting SIRS sepsis criteria. Of the 38 consulted and reviewed cases, 36.8% (7) fell out of evidence-based practice recommendations in meeting IVF resuscitation treatment times for severe sepsis and septic shock. Severe sepsis (6/13 = 46.2%) and septic shock (1/4 = 25%) cases continued to present a delay in IVF resuscitation as noted (see Appendix E). There was minimal improvement in IVF resuscitation initiation times, with pre-intervention at 37.3% and post-intervention at 36.8%, a minimal difference of 0.5% time improvement.

Due to a relatively small number of participants, Fisher's exact test was utilized to determine a nominal variable's nonrandom proportions compared to another nominal variable's value (Weisstein, 2022). The resulting probability (p-value) corresponded to the number of variables assumed to be greater than or equal to the observed results (Bind & Rubin, 2020). Fisher's exact test was performed, revealing results not statistically significant with a p-value = 1.00 (higher than the significance level ≥ 0.05). Comparison groups included IVF administered on time versus IVF administered outside a 60-minute time frame in pre- and post-intervention teaching outcomes. Appendix B and E include information on timely IVF administration times

(denoted in black in the charts) versus fallouts of more than 60 minutes (denoted in red in the charts). The following Fisher's Exact Test table was completed using the statistical package for the social sciences (SPSS) software:

Table 1: ***Fisher's Exact Test***

	Pre-Intervention Teaching	**Post-Intervention Teaching**	***TOTALS***
CHART AUDIT of Timely IVF Resuscitation Initiation	42	12	*54*
CHART AUDIT of Fallout IVF Resuscitation > 60 Minutes	25	7	*32*
TOTALS	*67*	*19*	*86*

Results of Questionnaire Responses

Thirteen dayshift nurses were surveyed through convenience sampling with one hundred percent of pre-and post-intervention questionnaires completed. One hundred percent of questionnaires were completed by participants consenting to participate in the study. All five questionnaire statements were Likert-style rated questions, assessing nurses' knowledge of sepsis-related treatment topics.

After pre-intervention questionnaires were completed (see Appendix F), nurses were educated face-to-face using the Hour-1 Bundle Surviving Sepsis Campaign Flyer (Society of Critical Care Medicine & European Society of Intensive Care Medicine, 2019) and an educational teaching session form (see Appendix H). After education, a post questionnaire (see Appendix G) was administered. Questionnaire answers were compared and analyzed to differentiate the scored ranks of ER nurses using non-parametric statistical hypothesis testing

through the Wilcoxon signed-rank test (Sylvia & Terhaar, 2018). The following Wilcoxon signed-rank test table was completed using SPSS software:

Table 2: ***Wilcoxon Signed-Rank Test***

Question	Scale	W- (- Sum rank)	W+ (+ Sum rank)	*p-value*
1. I can identify all five (5) Surviving Sepsis Campaign (SSC) hour-1 care bundle elements.	1 (Never) to 5 (Always)	0	45	*0.004*
2. I can identify SIRS criteria.	1 (Never) to 5 (Always)	0	3	*0.003*
3. Once an initial screening for sepsis is complete and IVF resuscitation orders have been received, I can identify the timeframe in which IVF resuscitation should begin and end?	1 (Never) to 5 (Always)	0	0	*0.317*
4. Once sepsis-induced hypoperfusion or septic shock occurs, I can identify the correct amount of IVF to administer per individual patient based on the set criteria of at least 30 mL/kg?	1 (Never) to 5 (Always)	0	15	*0.037*
5. I understand the importance of acting quickly and minimizing delays in treating sepsis and septic shock patients?	1 (Never) to 5 (Always)	0	1	*0.037*

Questionnaire response one evaluated the nurses' ability to identify all five Surviving Sepsis Campaign (SSC) hour-1 care bundle elements, including the following: (a) measuring lactate levels, (b) obtaining blood cultures before antibiotic administration, (c) administering broad-spectrum antibiotics, (d) beginning rapid administration of 30 mL/kg of crystalloid IVF for hypotension or lactate levels greater than or equal to 4 mmol/, and (e) the administration of

vasopressors if hypotension during or after IVF resuscitation occurs to maintain a mean arterial pressure (MAP) of greater than 65 mmHg. Using the Wilcoxon signed-rank test, response one revealed a positive-sum rank of 45 compared to the negative sum rank of 0, with a *p-value = 0.004*. Scores were higher post-intervention, indicating an increase in nurses' ability to identify hour-1 care bundle elements.

Questionnaire response two evaluated nurses' ability to identity SIRS criteria, including the following: (a) fever > 100.4 or hypothermia < 96.8; (b) tachypnea > 20 breaths per minute; (c) tachycardia > 90 beats per minute; and (d) leukocytosis > 12,000, leukopenia < 4,000, or bandemia > 10% bands. Using the Wilcoxon signed-rank test, response two revealed a positive-sum rank of 3 compared to the negative sum rank of 0, revealing a *p-value = 0.003*. Scores were higher post-intervention, indicating an increase in nurses' ability to identify SIRS criteria.

Questionnaire response three evaluated nurses' ability to identify the timeframe in which IVF resuscitation should begin (within one hour or as soon as possible) and end (three hours). Using the Wilcoxon signed-rank test, response three revealed a positive-sum rank of 0, equal to the negative sum rank of 0 with a *p-value = 0.317*. Scores were the same pre- and post-intervention, indicating no significant increase in nurses' ability to recognize IVF resuscitation timeframes.

Questionnaire response four evaluated nurses' ability to identify the correct amount of IVF to administer per individual septic patient based on the set criteria of 30 mL/kg. Using the Wilcoxon signed-rank test, response four revealed a positive-sum rank of 0 compared to a negative-sum rank of 15, with a *p-value = 0.037*. Scores were higher post-intervention, indicating an increase in nurses' ability to identify the correct amount of IVF to administer per individual septic patient based on the set criteria of 30 mL/kg.

Questionnaire response five evaluated nurses' ability to identify and recognize the importance of rapid severe sepsis and septic shock treatment through the hour-1 bundle recommendations. Using the Wilcoxon signed-rank test, question five revealed a positive-sum rank of 0 compared to a negative-sum rank of 1, with a resulting *p-value = 0.037*. Scores were higher post-intervention, indicating an increase in nurses' ability to identify and recognize the importance of rapid severe sepsis and septic shock treatment. Examples of the hour-1 bundle include: (a) measuring lactate level (re-measuring if initial lactate elevated >2 mmol/L), (b) obtaining blood cultures before antibiotic administration, (c) administering broad-spectrum antibiotics, (d) beginning rapid administration of 30 mL/kg crystalloid for hypotension or lactate greater than or equal to 4 mmol/L, and (e) utilizing vasopressors if hypotension ensues during or after IVF resuscitation to maintain a mean arterial pressure (MAP) greater than or equal to 65 mmHg (Society of Critical Care Medicine & European Society of Intensive Care Medicine, 2021).

Discussion

This DNP project sought to improve the time-sensitive administration of IVF resuscitation in adult patients diagnosed with sepsis or septic shock. The project's overall aim was to enhance ER nurses' end-user knowledge of and adherence to evidence-based sepsis treatment recommendations over approximately five (5) weeks (37 days). Quantitative data was utilized to measure the project's capacity to meet the overall aim.

Statistically significant findings included survey questions 1, 2, 4, and 5, with *a p-value <0.05* revealing proper understanding and increased knowledge after teaching for appropriate sepsis treatment times regarding IVF resuscitation. In the literature review, IVF resuscitation times were not studied as comprehensively as the 'golden hours' of antibiotic administration

despite agreements on the adverse effects of sepsis disease progression regarding hypoperfusion and hypoxemic states as a result of delayed IVF resuscitation (Leisman et al., 2016). Many studies suggest a decrease in mortality when IVF resuscitation is initiated rapidly. Although generalizable, adherence to rapid IVF initiation time and decreasing delays in treatment likely play a significant role in patient survival (Leisman et al., 2016). Study results from Leisman et al. (2016) also suggested that conservative intervention times like the 3-hour and 6-hour bundle guidelines are delayed timeframes for proper treatment of sepsis, with evidence leaning more towards a 30-minute IVF resuscitation initiation timeline (Leisman et al., 2016).

Nurses were extremely busy in the ER. Therefore, education was performed quickly to decrease interruptions with unit tasks. The majority of nurses included in the study were open and accepting of teaching but did not keep the educational material provided and did not ask many questions or offer opinions on how to improve IVF resuscitation times regarding the protocol. The DNP project revealed that chart reviews were not statistically significant, with a p-value = 1.0; however, to determine the effect of the sample size, a power analysis would need to be conducted, but an analysis of power to detect an effect was not performed in this study. The pre- and post-intervention retrospective chart review revealed a difference in IVF resuscitation start times of 0.5%, which improved initiation. Although not statistically significant, the PI inferred that more time and in-depth education for ER nurses would yield a more substantial difference in IVF resuscitation times, signifying treatment improvement and further minimizing delays.

Implications

The retrospective chart review did not yield the desired delay decrease in IVF resuscitation times. Regardless, variations in recommended clinical practice guidelines on

treatment standards create potential risks or, in worse cases, harm to the patient (Bradshaw & Vitale, 2021). IVF resuscitation initiation time within 30 minutes of sepsis presentation is associated with improved hospital length of stay and patient mortality, resulting in an easier performance predictor of sepsis and septic shock time management than IVF completion time (Leisman et al., 2016). Mortality was decreased by 5%, and length of stay decreased by one day in IVF resuscitation times less than 30 minutes (Leisman et al., 2016). The Surviving Sepsis Campaign standardization of bundle completion advocates for lactic acid, blood cultures, broad-spectrum IV antibiotics, and IVF resuscitation (30mL/kg) within 180 minutes of sepsis recognition (Leisman et al., 2016).

Though hospital policies exist for sepsis treatment protocols, diligence is necessary to maintain high proper treatment standards for patients suffering from sepsis. There is room for improvement in sepsis bundle components, particularly in initiating treatment times across bundle components (IVF resuscitation and antibiotic start times, drawing cultures before IV antibiotics). Quality implications for safety are also imperative for proper patient care. Rapid treatment of the body's inflammatory cascade is known to improve patient outcomes of mortality and length of stay, shedding light on sepsis as an emergency (similar to myocardial infarction or stroke) that prioritizes decreasing treatment time to improve a patient's chance of survival.

Limitations

This DNP project has several limitations. For one, the size of this project is relatively small. Relating to the size of the project, the hospital is relatively small, and the unit of study was small to include a small sampling of nurses. The project's timeline was also a limiting factor, spread over five weeks. The study also only looked at the time of initiation as a factor of interest; it did not consider the volume of fluid resuscitation patients received.

Additionally, chart reviewing (as mentioned in the inclusion and exclusion) included severe sepsis and septic shock patients post-intervention during the specified time frame. Charts were not eliminated from the analysis based on whether a nurse participated in the study questionnaire and teaching. The IVF resuscitation timing chart review included severe sepsis and septic shock patients.

Other limitations included significant hospital changes during the study, selling to another company with transitions to new tracking systems for core measures. The Sepsis Coordinator position also had changed with new personnel to the role that then resigned followed by a period of absence, followed by the rehiring of new personnel, which affected the original plans for data collection.

During the initial chart review, the hospital saw a significant increase in the patient census with the additional wave of COVID-19 variants. The ER felt the stress of higher census straining the nursing staff. The ER also has seen an increase in travel agency nurses, although this did not affect the survey as none of the travelers opted to participate in the DNP project. The PI was employed as a bedside nurse at the facility and worked alongside the staff in the ER, which may have contributed to bias in participation and filling out survey questions.

Dissemination

The dissemination of this research study and DNP project titled: Improving Intravenous Fluid Resuscitation Compliance of Sepsis and Septic Shock Adults in a Rural Emergency Room is available in the Jacksonville State University (JSU) Digital Commons repository. The DNP project was completed through a written manuscript, presented via poster, and through the University's Virtual Dissemination Day.

Plans for Future Scholarship

This project was conducted to add continuing data to support and stress the importance of following evidence-based research in treatment and protocol development for patient care. Further research is needed to expand and continue to shed light on the importance of minimizing delay in severe sepsis and septic shock treatment. Future studies need to identify reasons for treatment delay times and address each fallout that occurs in the bundle, such as administration of antibiotics before drawing blood cultures, delay in initiation of antibiotics, lack of documentation, and delay in initiation of vasopressors if needed. Tracking specific trends with each nurse may also be beneficial in future studies to pinpoint exactly where a delay occurs and offer further education to individuals needing specific support. Efforts to study the purpose of delays may aid in minimizing issues surrounding sepsis care and could also be beneficial in helping nurses streamline and increase treatment time.

The organization should also conduct efforts to maintain good staffing ratios during pandemic times and retain the position of Sepsis Coordinator. This coordinator provides the benefits of continuous surveillance and monitoring of issues surrounding treatment for sepsis protocol. Increasing the size of the project/study to include the initial triage of sepsis patients and involving physicians and management could also yield more significant results in the future. Implementation longevity is another area to address, as this DNP project was limited to a semester (three to four months). Larger sample sizes with a more extensive timeframe would likely yield more significant results.

Sustainability

Since sepsis is a monitored quality measure through the CMS, the sustainability of protocol implementation for sepsis continues to be monitored and surveyed by hospital

personnel. Future nurses can aid in implementing hour-1 or fewer bundles to improve sepsis treatment times. Prospective studies similar to the DNP project could also be addressed in other hospital care areas to evaluate initiation times across the organization.

Conclusion

Early IVF resuscitation is imperative in stabilizing tissue hypoperfusion induced by severe sepsis or septic shock. Due to the urgent and emergent nature of the body's rapid decline from sepsis, initial treatment of sepsis bundles, including IVF resuscitation, should begin immediately upon identification of hypotension and lactic acidosis when sepsis is suspected or diagnosed (Levy, Evans, & Rhodes, 2018). Fallouts from inadequate sepsis protocol bundles still occur, as evidenced by the assessment of IVF resuscitation times during this project. This study sought to bring awareness to the need for improvement, especially during pandemic times when ERs see higher volumes of patients. Nurses play a crucial role in the timing and coordination of care regarding sepsis treatment. Standardization through sepsis bundle protocol can aid in life-saving measures; however, they must be followed accordingly. More in-depth research should be conducted in the ER and other patient care areas to identify and eliminate barriers preventing proper care to avoid future failures in sepsis protocol treatment.

References

Barbash, I. J., Davis, B., & Kahn, J. M. (2019). National performance on the Medicare SEP-1 sepsis quality measure. *Crit Care Med 47*(8), 1026-1032. https://doi.org/10.1097/CCM.0000000000003613

Bind, M.-A. C., & Rubin, D. B. (2020). When possible, report a Fisher-exact and display its underlying null randomization distribution. *Proceedings of the National Academy of Sciences of the United States of America [PNAS]*, *117*(32), 19151-19158. https://doi.org/10.1073/pnas.1915454117

Burney, M., Underwood, J., McEvoy, S., Nelson, G., Dzierba, A., Kauari, V., & Chong, D. (2012). Early detection and treatment of severe sepsis in the emergency department: Identifying barriers to implementation of a protocol-based approach. *Journal of Emergency Nursing, 38*(6), 512-517. http://dx.doi.org/10.1016/j.jen.2011.08.011

Bradshaw, M. J., & Vitale, T. R. (2021). *The DNP project workbook: A step-by-step process for success*. Springer Publishing Company.

Centers for Disease Control and Prevention. (2021). *Septicemia mortality by state*. U.S. Department of Health and Human Services. https://www.cdc.gov/nchs/pressroom/sosmap/septicemia_mortality/septicemia.htm

Centers for Medicare and Medicaid Services. (2021). *Timely and effective care: Percentage of patients who received appropriate care for severe sepsis and septic shock.* U.S. Department of Health and Human Services. https://www.medicare.gov/care-compare/compare?providerType=Hospital&providerIds=110168,110054&city=Rome&state=GA&zipcode=30165

Dugar, S., Choudhary, C., & Duggal, A. (2020). Sepsis and septic shock: Guideline-

based management. *Cleveland Clinic Journal of Medicine, 81*(1), 53-64. https://doi.org/10.36949/ccjm.87a.18143

Evans, L., Rhodes, A., Alhazzani, W., Antonelli, M., Coopersmith, C. M., French, C., Machado, F. R., Mcintyre, L., Ostermann, M., Prescott, H. C., Schorr, C., Simpson, S., Joost Wiersinga, W., Alshamsi, F., Angus, D. C., Arabi, Y., Azevedo, L., Beale, R., Beilman, G., & Belley-Cote, E. (2021). Executive summary: Surviving sepsis campaign: International guidelines for the management of sepsis and septic shock 2021. *Critical Care Medicine*, *49*(11), 1974-1982. https://doi.org/10.1097/CCM.0000000000005357

Gaieski, D. F., Agarwal, A. K., Mikkelsen, M. E., Drumheller, B., Cham Sante, S., Shofer, F. S., Goyal, M., & Pines, J. M. (2017). The impact of ED crowding on early interventions and mortality in patients with severe sepsis. *American Journal of Emergency Medicine, 35*(7), 953-960. https://doi.org/10.1016/j.ajem.2017.01.061

Leisman, D., Wie, B., Doerfler, M., Bianculli, A., Ward, M. F., Akerman, M., D, A. J. K., Zemmel D, A. J. A., D'Angelo, J. K., & Zemmel D'Amore, J. A. (2016). Association of fluid resuscitation initiation within 30 minutes of severe sepsis and septic shock recognition with reduced mortality and length of stay. *Annals of Emergency Medicine*, *68*(3), 298-311. https://doi.org/10.1016/j.annemergmed.2016.02.044

Levy, M. M., Evans, L. E., & Rhodes, A. (2018). The surviving sepsis campaign bundle: 2018 update. *Critical Care Medicine*, *46*(6), 997-1000. https://doi.org/10.1097/CCM.0000000000003119

Moran, K., Burson, R., & Conrad, D. (2020). *The doctor of nursing practice project: A framework for success* (3rd ed.). Jones & Bartlett Learning.

Neviere, R. (2021). Sepsis syndromes in adults: Epidemiology, definitions, clinical

presentation, diagnosis, and prognosis. *UpToDate*. Retrieved December 1, 2021, from https://www.uptodate.com/contents/sepsis-syndromes-in-adults-epidemiology-definitions-clinical-presentation-diagnosis-and-prognosis?search=Severe%20sepsis%20and%20septic%20shock&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1

Paoli, C. J., Reynolds, M. A., Sinha, M., Gitlin, M., & Crouser, E. (2018). Epidemiology and costs of sepsis in the United States: An analysis based on timing of diagnosis and severity level. *Critical Care Medicine*, *46*(12), 1889-1897. https://doi.org/10.1097/CCM.0000000000003342

Schmidt, G. A., & Mandel, J. (2021). Evaluation and management of suspected sepsis and septic shock in adults. *UpToDate*. Retrieved August 28, 2021, from https://www.uptodate.com/contents/evaluation-and-management-of-suspected-sepsis-and-septic-shock-in-adults?search=fluid%20resuscitation%20sepsis&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1#H465649907

Society of Critical Care Medicine & European Society of Intensive Care Medicine. (2019). *Hour-1 bundle: Initial resuscitation for sepsis and septic shock* [Infographic]. Surviving Sepsis Campaign. https://www.sccm.org/getattachment/SurvivingSepsisCampaign/Guidelines/Adult-Patients/Surviving-Sepsis-Campaign-Hour-1-Bundle.pdf?lang=en-US

Society of Critical Care Medicine & European Society of Intensive Care Medicine.

(2021). *The surviving sepsis campaign: Hour-1 bundle of care elements*. The Society of Critical Care Medicine. https://www.sccm.org/SurvivingSepsisCampaign/Guidelines/Adult-Patients

Sylvia, M. L., & Terhaar, M. F. (2018). *Clinical analytics and data management for the DNP*. Springer Publishing Company.

Unterberg, M., Rahmel, T., Rump, K., Wolf, A., Haberl, H., von Busch, A., Bergmann, L., Bracht, T., Zarbock, A., Ehrentraut, S. F., Putensen, C., Wappler, F., Köhler, T., Ellger, B., Babel, N., Frey, U., Eisenacher, M., Kleefisch, D., Marcus, K., & Sitek, B. (2022). The impact of the COVID-19 pandemic on non-COVID induced sepsis survival. *BMC Anesthesiology*, *22*(1), 1-8. https://doi.org/10.1186/s12871-021-01547-8

Weisstein, E. (2022). Fisher's Exact Test. Wolfram MathWorld. https://mathworld.wolfram.com/FishersExactTest.html

Zaccagnini, M. E., & White, K. W. (2017). *The doctor of nursing practice essentials: A new model for advanced practice nursing* (3rd ed.). Jones and Bartlett Learning.

Appendix A

Participant Consent Form

Title of Project Study:
Improving Intravenous Fluid Resuscitation Compliance of Sepsis and Septic Shock Adults in a Rural Emergency Room

This form provides informed consent for a doctor of nursing practice (DNP) student-led project. This consent form provides project information to help you decide whether you wish to participate voluntarily or opt out. If you wish to participate, please complete the attached pre-intervention questionnaire and participate in the associated educational session to be provided.

Why is this project being implemented?
This project aims to improve timely IVF resuscitation in septic patients through increased nurse adherence to sepsis treatment through Hour-1 evidence-based practice.

What will project participation entail?
The project will survey nurse knowledge regarding sepsis Hour-1 bundle protocols regarding IVF resuscitation through the administration of pre-intervention questionnaires and the implementation of educational teaching sessions. Education will be face-to-face, with participants completing post-intervention questionnaires after educational implementation.

What are the potential risks involved with project participation?
No harm or cost will incur from project participation. This project will have no influence from or involvement of upper management. Again, participation is entirely voluntary.

What measures will be taken to ensure privacy and confidentiality?

Each participation questionnaire will have a randomized ID code with no other identifiable personal information. Questionnaires will remain in a locked office within the project setting through project completion.

What are the stipulations for project withdrawal?

You may choose to withdraw participation at any time. If you have any questions about the project participation, please call the principal investigator (PI), Alison Douglas, at (407) 782-7139 (cell). Withdrawal of consent must be completed in writing to Alison Douglas (PI) at adouglas3@stu.jsu.edu.

Signature:_____ Date:_____

Appendix B

Pre-Intervention Retrospective Chart Reviews (December 2021)

#	Age Sex	Sepsis Type	Arrival time **Triage time** Consult time	Labs Vitals	IVF start time	Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.	Min. to IVF	LOS (Days)
1	39 M	Severe	1304 **1325** 1452	LA: 2.35 @1429 0.5 @1645 HR 133 Hypotension?	**1448**	12/23 – 12/27 Abscess 108.9 kg/NS 4300mL	**83 m**	4 D
2	61 M	Severe	0100 **0111** 0109	LA: 1.34 @0130 1.08 @0326 Crt 8.66 T: 103.3 HR 91 RR 21 Hypotension?	**0333**	12/7 – 12/25 AMS/PNA/ESRD/Hypoxia/on HD No weight/NS 500mL	**142 m**	18 D
3	54 M	Severe	1730 **1745** 2012	LA: 1.22 @ 0048 WBC 22.3 Crt 2.76 HR 98 Hypotension?	**1807**	12/7 – 12/25 AKI/UTI 113.6 kg/NS 2000mL FALLOUT: ON ALL OTHER BUNDLE TIMES	22 m	18 D
4	66 F	Severe	2007 **2045** 2112	LA: 2.61 @2033 2.6 @2219 WBC 19.4	**2112**	12/22 – 12/25 Ax. Cholecystitis No weight/NS 500mL	27 m	3 D
5	89 M	Severe	0907 **0915** 0931	LA: 1.91 @0941 WBC 14.9 Crt 2.27 HR 108 RR 24	NA	12/9 – 12/23 Respiratory failure w/ hypoxia, CHF/COPD Exacerbation/BIPAP 82.5 kg/No IVF FLUID OVERLOADED	NA	14 D
6	56 F	Severe	1908 **1916** 1930	LA: 2.9 @1920 1.5 @0506 HR 93	**2015**	12/14 – 12/23 COVID/PNA/hypoxemia 109.1 kg/NS 3330ml (received 2L) ANTIBIOTICS BEFORE CNS	59 m	9 D
7	66 F	Severe	1632 **1635** 1654	LA: 2.41 @1651 1.2 @1855 HR 99 RR 28	NA	12/19 – 12/23 Pulmonary edema/Acute hypoxic respiratory failure 138.6 kg/NO IVF	NA	4 D
8	66 M	Severe	0056 **0101** 0255	LA: 1.41 @0246 Crt 5.81 HR 113 RR 20	**0255**	12/18 – 12/22 Severe esophagitis/SIRS 75 kg/NS 500 mL	**114 m**	4 D
9	78 F	Severe	1615 **1623** 2005	LA: 2.18 @2023 2.6 @2159	NA	12/16 – 12/22 Cellulitis/Hypoxia 69 kg/NO IVF FALLOUT: NO MENTION OF SEPSIS/NO 1 OR 3 HR. BUNDLE	**NA**	6 D
10	88 F	Severe	0852 **0915** 0921	LA: 2.76 @0937 2.0 @1150	**0946**	12/18 – 12/21 AMS/Acute lactic acidosis/Acute, chronic respiratory failure 79.6 kg/NS 1000mL	31 m	3 D
11	76 F	Severe	0430 **0432** NA	LA: 3.01 @0450 1.5 @0655 HR 101 RR 36	NA	12/19 – 12/21 Acute on Chronic respiratory failure w/ hypoxia 68.2 kg/NO IVF	**NA**	2 D
12	67 F	Severe	1025 **1037** 1211	LA: 2.59 @1114 1.8 @1348	NA	12/17 – 12/21 AMS/UTI/Hx. Kidney transplant 100 kg/NO IVF	**NA**	4 D
13	74 M	Severe	0847 **0854**	LA: 1.64 @ 0930 WBC 13.2	NA	12/19 – 12/21 PNA/ESRD on HD	NA	2 D

			0921	Crt 5.92 T 100.0, HR 91		76.8 kg/NO IVF		
#	**Age Sex**	**Sepsis Type**	**Arrival time Triage time Consult time**	**Labs Vitals**	**IVF start time**	**Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.**	**Min. to IVF**	**LOS (Days)**
14	88 M	Severe	1111 **1117** 1215	LA: 3.68 @1220 3.4 @1429 WBC 21.8 Crt 2.10 HR 109	**1205**	12/14 – 12/21 Vomiting/RUQ inflammation/GIB 84 kg/NS 2000 mL FALLOUT ANTIBIOTICS BEFORE CULTURE	48 m	7 D
15	63 F	Severe	1130 **1141** 1311	LA: 1.72 @1358 WBC 45.2 Crt 2.14 RR 20	**1338**	12/4 – 12/20 Acute Rhabdo s/p fall/AKI 104.5 kg/NS 500 mL	**117 m**	16 D
16	70 F	Severe	1331 **1336** 1349	LA: 2.40 @1359 1.4 @1549 WBC 15.5 Crt 3.09 HR 146	**1411**	12/14 – 12/19 AMS/AKI/NSTEMI/Afib RVR 78.9 kg/NS 2400 mL	35 m	5 D
17	65 M	Severe	2359 **0002** 0019	LA: 2.34 @0019 1.7 @0215 HR 129	**0039**	12/13 – 12/18 PNA/Hypokalemia/Fever 81.8 kg/NS 2500 mL	37 m	5 D
18	64 M	Severe	2132 **2152** 0041	LA: 2.04 @2337 1.49 @0015 HR 94 RR 20	**2225**	12/15 – 12/18 Acute pancreatitis 91.4 kg/NS 2000 mL	33 m	3 D
19	56 F	Severe	1624 **1627** 1630	LA: 2.8 @1639 1.1 @1825 WBC 18.9 HR 104 RR 30	NA	12/15 – 12/18 Hypoxia/Pneumonitis/COPD No weight/No IVF	**NA**	3 D
20	65 M	Severe	1507 **1514** 1520	LA: 2.18 @1536 1.4 @1744 Bili 5.4 HR 128 RR 20	**1602**	12/12 – 12/17 Pancreatitis/elevated LFTs 110.4 kg/NS 3400 mL	48 m	5 D
21	82 M	Severe	1823 **1828** 1930	LA: 2.09 @1941 1.9 @2200 WBC 19.8 HR 100	**1946**	12/14 – 12/17 Acute diverticulitis/Sepsis/ Generalized weakness/Fall 92.3kg/NS 2800 mL	**78 m**	3 D
22	64 M	Severe	1721 **1730** 2344	LA: 2.69 @0006 1.7 @0100 HR 108	**2342**	12/14 – 12/17 Acute right foot cellulitis/ Lactic acidosis 81.8 kg/NS 2000 mL Triage time to IVF, all times greater than 3 hours	**360 m**	3 D
23	20 F	Severe	1729 **1732** 1737	LA: 3.41 @1740 T 100.3 HR 166	**1907**	12/12 – 12/16 SIRS/Tachycardia/Hypotension/ Lactic acidemia No weight/NS 1000 mL	**95 m**	4 D
24	51 F	Severe	1658 **1702** 1720	LA: 0.52 @1832 HR 102 RR 30	NA	12/9 – 12/16 Hypercapnic respiratory failure/ PNA requiring BIPAP 151 kg	NA	7 D
25	69 F	Severe	1910 **1922** 1924	LA: 2.02 @1937 2.2 @2113 T 102.0 HR 111	**2036**	12/12 – 12/16 SIRS/Lactic academia No weight/NS 1900 mL	74 m	4 D
26	77 M	Severe	1232 **1239** 1306	LA: 2.68 @1257 2.6 @1455	NA	12/5 – 12/15 Acute CHF exacerbation 88 kg/NO IVF	NA	10 D
27	90 F	Severe	1603 **1608** 1617	LA: 2.21 @1625 1.6 @1802 Bili 2.7 @1610 HR 138	NA	12/8 – 12/14 CHF exacerbation/new onset Afib RVR 62.6 kg/No IVF	NA	6 D

#	Age Sex	Sepsis Type	Arrival time Triage time Consult time	Labs Vitals	IVF start time	Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.	Min. to IVF	LOS (Days)
28	62 M	Severe	2007 **2013** 0051	LA: 2.89 @0110 3.4 @0325 WBC 19.6 HR 104 RR 22	NA	12/8 – 12/13 Ax on cx hypoxic respiratory failure/COPD/CAPNA WBC 19.6 @ 2035 59.1 kg/No IVF	**NA**	5 D
29	46 M	Severe	1018 **1022** 1031	LA: 2.31 @1030 1.7 @1230 WBC 18.3 HR 138 RR 47	**1037**	12/6 – 12/13 Acute respiratory failure w/ hypoxia/multifocal PNA/COPD 48.1 kg/NA 1500 mL	15 m	7 D
30	62 F	Severe	0913 **0913** 0922	LA: 2.72 @0935 2.7 @1125 HR 119 RR 20	**0939**	12/13 – 12/13 Orthostatic hypotension No weight/NS 2000 mL	26 m	1 D
31	73 M	Severe	2236 **2242** 2346	LA: 2.27 @2335 1.6 @0205 T 103.2 HR 93 RR 24	**2357**	12/8 – 12/13 Sepsis/BLL PNA 122.7 kg/NS 50 mL ORDERED NS 3700 ML	**75 m**	5 D
32	47 F	Severe	1425 **1430** 1436	LA: 2.69 @1439 0.9 @1654 HR 100 RR 24	**1710**	12/10 – 12/13 UTI/septic shock 86.3 kg/NS 1600 mL	**160 m**	3 D
33	77 F	Severe	2143 **2200** 2319	LA: 2.78 @2346 1.6 @0147 WBC 15.0 RR 20	**2244**	12/7 – 12/10 Sepsis/AKI/ABD pain 89.1 kg/NS 1000 mL	44 m	3 D
34	75 M	Severe	0942 **0947** 1205	LA: 2.3 @1213 1.9 @1344 WBC 3.8 HR 110 RR 24	NA	12/6 – 12/8 Sepsis/PNA/New Afib RVR 70.9 kg/No IVF ON CHEMO FALLOUT: ANTIBIOTIC TIME	NA	2 D
35	71 F	Severe	1721 **1817** 1826	LA: 3.96 @1852 2.9 @2142 WBC 12.6 HR 118 RR 30	NA	12/1 – 12/7 Flash pulmonary edema/NSTEMI Required intubation 84.1 kg/No IVF	NA	6 D
36	41 M	Severe	1506 **1532** 1556	LA: 2.35 @1610 1.4 @1528 Crt 9.38 HR 101	**1612**	12/1 – 12/7 ESRD on HD/Fluid Overload 59.1 kg/NS 500 mL	40 m	6 D
37	29 M	Severe	0243 **0251** 0555	LA: 2.6 @ 0618 1.3 @0833 WBC 12.3	**0701**	12/5 – 12/6 Overdose 113.6 kg/NS 1000 mL	**250 m**	1 D
38	76 F	Severe	1828 **1838** 1841	LA: 2.07 @1859 1.2 @2057 HR 126 RR 30	**2322**	12/2 – 12/6 UTI/tachycardia No weight/NS 1000 mL @ 85mL/H	**234 m**	4 D
39	64 F	Severe	1300 **1311** 1316	LA: 2.24 @1326 1.2 @1513 WBC 12.5 HR 136 RR 24	**1329**	12/3 – 12/6 Severe sepsis/PNA/Acute respiratory failure 41.7 kg/NS 1300 mL	18 m	3 D
40	84 M	Severe	2338 **2344** 0004	LA: 1.65 @0004 WBC 16.9 HR 96	**0016**	12/2 – 12/5 Resp failure/CAP WBC 16.9 @ 0053 81.1 kg/NS 2500 mL	32 m	3 D
41	68 M	Severe	1124 **1128** 1154	LA: 2.49 @1147 2.1 @1323 WBC 12.2 T 101.3	**1154**	12/1 – 12/4 Sepsis/PNA/CHF exacerbation 81.8 kg/NS 1000 mL ORDERED 2500 mL	26 m	3 D
42	74 M	Shock	2223 **2228** 2239	LA: 2.98 @2303 2.5 @0146 Crt 3.27	**2243**	12/14 – 12/28 Severe sepsis/Respiratory distress/UTI/Hypoxemia	15 m	14 D

				T 104.1 HR 102 RR 44 BP 65/50		90.8 kg/NS 500 mL LEVOPHED @2354		
#	**Age Sex**	**Sepsis Type**	**Arrival time Triage time Consult time**	**Labs Vitals**	**IVF start time**	**Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.**	**Min. to IVF**	**LOS (Days)**
43	53 F	Shock	0958 **1004** 1225	LA: 1.47 @1106 BP 76/47 @1004 BP 88/48 @1125 BP 88/56 @1322	**1235**	12/21 – 12/28 L. sternoclavicular osteomyelitis/ Hx. of cardiomyelitis 62.7 kg/NS 3000mL LEVOPHED @?	**151 m**	7 D
44	68 M	Shock	0232 **0235** 0300	LA: 1.61 @0243 1.05 @0900 WBC 18.2 Crt 3.02 BP 91/61 @0235 BP 83/66 @0300 BP 88/68 @0330 BP 89/56 @0420	**0317**	12/17 – 12/27 Sepsis/Complicated UTI/Ureteral stone/AKI No weight/NS 1000 mL LEVOPHED @0445	42 m	10 D
45	64 M	Shock	1020 **1028** 1053	LA: 1.62 @1051 Crt 3.65 RR 22 BP 80/43 @1028 BP 67/40 @1109 BP 91/68 @1149 BP 96/44 @1730	**1102**	12/20 – 12/25 Acute Encephalopathy 163.6 kg/NS 500 mL LEVOPHED @?	34 m	5 D
46	63 M	Shock	1317 **1320** 1328	LA 6.49 @1331 5.1 @1532 T 100.0 HR 106 RR 26	**1625**	12/14 – 12/25 (DECEASED) COVID+/Respiratory failure No weight/NS 1000 mL **FALLOUT: NO IVF GIVEN W/I 3 HOURS**	**185 m**	11 D
47	29 M	Shock	1152 **1206** 1216	LA: 10.78 @1203 HR 117 RR 20	**1221**	12/22 – 12/25 ABD pain/N/V 81.8 kg/NS 1000 mL	15 m	3 D
48	78 M	Shock	1157 **1201** 1230	LA: 13.64 @1210 12.1 @1415 WBC 15.1 Crt 2.10 RR 30	**1307**	12/20 – 12/23 DKA 57 kg/NS 2000 mL	**66 m**	3 D
49	64 M	Shock	1110 **1115** 1151	LA 2.44 @1143 T 100.6 HR 117 RR 28	**1203**	12/22 – 12/22 CP/COPD/SOB 121.9 kg/NS 1000 mL ORDERED 3700 mL	48 m	1 D
50	54 F	Shock	1327 **1332** 2030	LA: 5.35 @2104 5.34 @0036 HR 133 No BPs	**1352**	12/18 – 12/20 (DECEASED) Resp Failure/Metastatic breast CA 66.4 kg/NS 2000 mL LEVOPHED @1935 FALLOUT: ANTIBIOTIC TIME, POOR TIME (@1841) 2ND IVF	20 m	2 D
51	63 F	Shock	1701 **1708** 1931	LA: 6.59 @2035 9.0 @2224 Crt 2.30 T 103.6 HR 99 RR 24 BP 82/43 @1708 BP 74/38 BP 74/40 BP 75/41 BP 68/35 @1849	**1730**	12/6 – 12/18 (DECEASED, DC TO HOSPICE) AMS/Hepatic encephalopathy/Pancytopenia 81 kg/NS 3000 mL LEVOPHED @1708 FALLOUT: LATE LA	22 m	12 D
52	45 F	Shock	0920 **0927** 0926	LA: 4.73 @0927 4.1 @1151 WBC 20.5 HR 120	**1006**	12/11 – 12/18 Resp failure w/ hypoxia/Pulmonary edema/PNA	39 m	7 D

				RR 40		No weight/NS 500 mL		
#	**Age Sex**	**Sepsis Type**	**Arrival time Triage time Consult time**	**Labs Vitals**	**IVF start time**	**Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.**	**Min. to IVF**	**LOS (Days)**
53	49 F	Shock	1726 **1801** 2257	LA: 4.04 @2118 2.7 @2345 WBC 14.7 RR 22	**2213**	12/13 – 12/16 Sepsis 126.6 kg/NS 3800 mL FALLOUT: ALL TIMES, TERMED SEPSIS IN ED NOTHING ORDERED, ALL TX ORDERED BY HOSPITALIST	**252 m**	3 D
54	46 M	Shock	0652 **0652** 0659	LA: 9.85 @0700 4.6 @0907 WBC 14.5 HR 93 RR 20	**0750**	12/9 – 12/16 Cardiac arrest/Respiratory failure/PNA/Lactic acidosis No weight/NS 2400 mL	58 m	7 D
55	79 F	Shock	0955 **1000** 1010	LA: 6.76 @1013 3.7 @1218 HR 123 RR 31	**1328**	12/12 – 12/16 Sepsis/PNA/Respiratory failure w/ Hypoxia No weight/NS 250 mL FALLOUT: NO IVF FOR SHOCK	**208 m**	4 D
56	80 M	Shock	0914 **0915** 1230	LA: 4.14 @0930 2.5 @1205 Crt 4.25 T 101.9 HR 130 RR 26	**0940**	12/8 – 12/14 Septic shock PNA 69.3 kg/NS 1000 mL LEVOPHED @?	25 m	6 D
57	64 M	Shock	1938 **1950** 1957	LA: 1.21 @2001 0.60 @0433 Crt 4.25 RR 26 BP 72/36 @1950 BP 72/37 @2011	**2002**	12/4 – 12/13 AMS/Hypotensive/Severe anemia 190.1 kg/NS 1000 mL LEVOPHED @2033	12 m	9 D
58	62 M	Shock	0727 **0730** 0736	LA: 7.65 @0737 5.3 @0946 WBC 12.0 Crt 2.78 HR 115 RR 30 BP 91/54 @0730 BP 75/43 @0745 BP 88/47 @0800 BP 92/50 @0830 BP 80/42 @0845	**0747**	12/9 – 12/13 Resp failure w/ hypoxia/Septic shock/Persistent hypotension No weight/NS 2400 mL LEVOPHED @0904	17 m	4 D
59	84 F	Shock	1409 **1412** 1424	LA: 4.50 @1425 2.9 @1603 HR 152 RR 36	**1430**	12/7 – 12/9 (DECEASED, HOSPICE) New-onset Afib RVR/Lung METS/Respiratory failure w/ hypoxia 52.7 kg/NS 1600 mL	18 m	2 D
60	75 F	Shock	1529 **1552** 1814	LA: 3.58 @1552 3.5 @1759 WBC 14.6 Crt 3.30 Bili 3.4 HR 138 RR 32	**1650**	12/2 – 12/5 (DECEASED) Bil. PNA/Septic shock/Hypotension 95.9 kg/NS 1000 mL LEVOPHED @1904 FALLOUT: ANTIBIOTIC TIMES	58 m	3 D
61	36 M	Unspecified	0144 **0151** 0202	LA: 2.12 @0156 @0.7 @0415 T 102.5 HR 101	**0219**	12/23 – 12/29 Sepsis/UTI 63.6 kg/NS 1900 mL	28 m	6 D
62	75 F	Unspecified	0855 **0902** 0912	LA: 3.70 @0931 4.7 @1123 WBC 22.1 HR 93 RR 22	**0911**	12/24 – 12/29 Hypotension/PNA/Severe sepsis/Septic shock 72.8 kg/NS 1000 mL ORDERED: 2200 mL,	9 m	5 D

				BP 75/51 @0900 BP 78/51 @0915 BP 83/50 @0930 BP 95/55 @1015		NO VASOPRESSORS		
#	**Age Sex**	**Sepsis Type**	**Arrival time Triage time Consult time**	**Labs Vitals**	**IVF start time**	**Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.**	**Min. to IVF**	**LOS (Days)**
63	73 M	Unspecified	1752 **1759** 2102	LA: 5.27 @2123 5.4 @2303 BP 94/48 @1828 BP 75/53 @1859 BP 86/59 @1946	**1918**	12/25 – 12/26 (DECEASED) Pneumoperitoneum/Sepsis/Ascites/Malignant neoplasm 77.2 kg/NS 2000 mL FALLOUT ANTIBIOTICS BEFORE CULTURES	**79 m**	1 D
64	47 F	Unspecified	0607 **0610** 0626	LA: 3.56 @0625 1.9 @0831 RR 40	NA	12/2 – 12/4 CHF/ESRD/Morbid obesity 185.9 kg/No IVF	NA	2 D
65	80 M	Unspecified	1035 **1035** 1343	No LA T 100.2	NA	12/25 – 12/26 Sepsis/PNA/Hypoxia 85.4 kg/No IVF NO LACTIC ACID	**NA**	1 D
66	73 F	Unspecified	2110 **2115** 2331	No LA	**0151**	12/6 – 12/13 AKI/PNA/Hypoxia/Hyperkalemia 88.6 kg/NS 1000 mL FALLOUT NO LA, ANTIBIOTICS, & IVF, NO 1H/3H BUNDLE	**276 m**	7 D
67	45 M	Unspecified	2104 **2106** 0058	No LA RR 27	NA	12/7 – 12/8 Bronchitis/Hypoxia 166.8 kg FALLOUT NO LA, ANTIBIOTICS, & IVF, NO 1H/3H BUNDLE	**NA**	1 D

Appendix C

Doctor of Nursing Practice (DNP) Project Timeline

Proposal Develop.														
Proposal Approval														
Support Letter														
IRB(s)														
Implementation														
Data Collection														
Data Analysis														
Final Writing														
Final Presentation														GOAL!
	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
	2021							2022						

Appendix D

Budget

PROGRAM EXPENSE	PROJECTED COST	ACTUAL COST
Salaries, wages *(Admin support, practitioners, statistics, or writing consultation)*	Up to $500.00	$0.00
Start-up costs *(copies, charts, displays)*	$100.00	$10.00
Poster printing	$100.00	TBD
Final bound copy of the manuscript	$200.00	TBD
Other: (*Refreshments/incentive for teaching and participation)*	$100.00	$0.00
Total Project Expenses	**$500.00 - $900.00**	**$10.00**

Appendix E

Post-Intervention Retrospective Chart Reviews (February-March 2022)

#	Age Sex	Sepsis Type	Arrival time Triage time Consult time	Labs Vitals	IVF start time	Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.	Min. to IVF	LOS (Days)
1	68 F	Shock	1433 **1435** 1453	LA: 2.48 @1453 0.8 @1637 HR 117 RR 22 BP 69/44 @1530 BP 99/67 @1545	**1459**	3/19 – 3/22 (HOSPICE) Sepsis unknown source/Hypotension 59.1 kg/NS 1700 mL	24 m	3 D
2	? F	Severe	1923 **1924** 1938	LA: 3.09 @1933 2.1 @2117 Crt 2.45 T 102.0 HR 96	**2147**	3/19 – 3/21 Sepsis unknown source/Fever/Hypoxia/Lactic acidosis/AKI No weight/LR 1000 mL	**143 m**	2 D
3	? M	Severe	1137 **1139** 1313	LA: 2.9 @1322 3.3 @1552 WBC 19.0 Crt 4.19	**1602**	3/11 – 3/21 AKI/Hyperkalemia/Sepsis/UTI/ Decubitus No weight/NS 1000 mL **? DELAY DUE TO GOAL OF CARE CONVERSATION, DC TO HOSPICE**	263 m EXC.	10 D
4	79 M	Severe	0911 **0916** 0923	LA: 4.73 @0933 3.47 @1115 T 94.6 Crt 2.36 BP 74/35	0945	3/15 – 3/20 Severe sepsis/Hypovolemic shock No weight/NS 2250 mL LEVOPHED IN ED	29 m	5 D
5	? M	Severe	1023 **1025** 1139	LA: 2.08 @1148 1.47 @1330 WBC 20.7 HR 138	**1040**	3/16 – 3/18 Sepsis/Pneumonia/Afib RVR No weight/NS 500 mL bolus	15 m	2 D
6	? F	Severe	0426 **0430** 0433	LA: 3.79 @0433 6.4 @0630 WBC 16.4 Crt 13.20 RR 20	**0445**	3/7 – 3/18 Metabolic & lactic acidosis//ESRD/Hypokalemia 37 kg/NS 1500 mL ANTIBIOTICS BEFORE CULTURES	15 m	11 D
7	? M	Severe	0826 **0842** 0846	LA 12.58 @1000 11.27 @1125 WBC 13.6 Crt 3.17 T 92.7 HR 122 RR 24	**1010**	3/13 – 3/17 (DECEASED) Afib RVR (Cardioversion x2) Hypotension/Hyponatremia/ARF 66.8 kg/NS & ½ NS volume?	**88 m**	4 D
8	? F	Severe	1209 **1221** 1304	LA 4.62 @1345 1.65 @1529 WBC 17.9 HR 125 RR 24	**1305**	3/12 – 3/17 Lactic acidosis/Leukocytosis/ Meningitis/Headache 120 kg/NS 2000 mL	44 m	5 D
9	? F	Shock	0954 **1003** 1030	LA: 2.18 @1050 1.6 @1233 WBC 28.1 Crt 7.34 HR 105 RR 24	**1305**	2/25 – 3/10 AKI 2/2 septic shock No weight/NS 2100 mL DC TO REHAB	**182 m**	14 D
10	? F	Shock	1857 **1900** 1911	LA 4.03 @1933 1.9 @2247 BP 75/42	**1857**	2/25 – 3/17 Septic shock/Hypovolemic/ Peritoneal dialysis/Recent COVID No weight/NS 1400 mL DC to REHAB	3 m	21 D
11	79 M	Severe	1203 **1209** 1237	LA: 2.14 @1225 1.17 @1412 HR 123	**1350**	3/15 – 3/17 COPD Exacerbation/New A-fib 64.1 kg/NS 2000 mL	**101 m**	2 D

				RR 30				
#	**Age Sex**	**Sepsis Type**	**Arrival time Triage time Consult time**	**Labs Vitals**	**IVF start time**	**Admit date – DC date Admission Reason Weight/IVF total (mL) Misc.**	**Min. to IVF**	**LOS (Days)**
12	30 M	Unspec.	0720 **0731** 0730	LA: 8.62 @0730 5.82 @0942 WBC 18.3 HR 95 RR 26	**0822**	3/15 – 3/16 (DECEASED) Overdose/Poly-substance abuse/GCS 3 No weight/NS 1800 mL	51 m	1 D
13	? M	Severe	1943 **1959** 2028	LA: 12.53 @2010 10.4 @2237 WBC 25.7 HR 140 RR 27	**2054**	3/7 – 3/15 DKA/AKI/Sepsis/Uremic acidosis No weight/NS 2500 mL	55 m	8 D
14	? F	Severe	1543 **1621** 1638	LA: 2.12 @1649 WBC 16.5 RR 25	**1731**	2/16 – 3/14 (DECEASED) Acute on chronic respiratory failure/COPD exacerbation/COVID 60 kg/NS 2000 mL	**70 m**	27 D
15	? M	Severe	1013 **1030** 1101	LA: 2.46 @1055 1.9 @1314 HR 117 RR 28	**1156**	2/22 – 3/14 COPD/Sepsis/PNA/COVID/Acute respiratory failure w/ hypoxia 56 kg/NS 250 mL	**86 m**	21 D
16	? M	Shock	0817 **0820** 0842	LA: 2.07 @0858 2.3 @1044 WBC 22.1 T 99.1 BP 80/53	**0904**	2/28 – 3/14 Sepsis/UTI/Acute cystitis No weight/NS 3400 mL	44 m	15 D
17	? M	Unspec.	0927 **0932** 0942	LA: 9.1 @0944 16.3 @1122 HR 138 RR 24 BP 72/32 BP 59/24	**0953**	3/3 – 3/14 Anaphylactic shock 2/2 to Rocephin for bronchitis PNA No weight/NS 3200 mL LEVOPHED & EPINEPHRINE	21 m	11 D
18	? F	Severe	1425 **1440** 1514	LA 2.3 @1445 3.5 @1720 WBC 12.5 T 99.4 HR 127 RR 24	**1528**	3/9 – 3/14 Sepsis/Pyelonephritis/ Hyperglycemia 92 kg/NS 2800 mL	48 m	5 D
19	? M	Severe	1050 **1103** 1134	LA: 2.22 @1117 1.2 @1309 WBC 12.8 T 100.8 HR 132 RR 27	**NA**	3/10 – 3/14 Pneumonia/Sepsis No weight/NO IVF IVF NOT SCANNED, HOSP. NOTE SAYS 1L IN ED?	**NA**	4 D

Appendix F

Quality Improvement Evaluation Pre-Intervention Questionnaire

ID Number: _____ Name: _____

Instructions: *This questionnaire will evaluate individual nurses' knowledge of sepsis and septic shock treatment. Completion of this questionnaire will take approximately five (5) minutes. Please read and answer each question. Answers will remain anonymous.*

Please indicate one with a mark:

☐ I work as a hospital employee.

☐ I work as an agency employee.

1. **I can identify all five (5) Surviving Sepsis Campaign (SSC) hour-1 care bundle elements.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

2. **I can identify SIRS criteria.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

3. **Once an initial screening for sepsis is complete and initial IV fluid (IVF) resuscitation orders have been received, I can identify the timeframe in which IVF resuscitation should begin and end.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

4. **Once sepsis-induced hypoperfusion or septic shock occurs, I can identify the correct amount of IVF to administer per individual patient based on the set criteria of at least 30mL/kg.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

5. **I understand the importance of acting quickly and minimizing delays in treating sepsis and septic shock patients.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

Appendix G

Quality Improvement Evaluation Post-Intervention Questionnaire

ID Number: _____ Name: _____

Instructions: *This questionnaire will evaluate individual nurses' knowledge of sepsis and septic shock treatment. Completion of this questionnaire will take approximately five (5) minutes. Please read and answer each question. Answers will remain anonymous.*

Please indicate one with a mark:

☐ I work as a hospital employee.

☐ I work as an agency employee.

1. **I can identify all five (5) Surviving Sepsis Campaign (SSC) hour-1 care bundle elements.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

2. **I can identify SIRS criteria.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

3. **Once an initial screening for sepsis is complete and IV fluid (IVF) resuscitation orders have been received, I can identify the timeframe in which IVF resuscitation should begin and end.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

4. **Once sepsis-induced hypoperfusion or septic shock occurs, I can identify the correct amount of IVF to administer per individual patient based on the set criteria of at least 30mL/kg.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

5. **I understand the importance of acting quickly and minimizing delays in treating sepsis and septic shock patients.**

1	2	3	4	5
Never	Seldom	Sometimes	Usually	Always

Appendix H

Educational Session Resource

In December 2021, preliminary results of a retrospective chart review of severe sepsis and septic shock patients in the emergency room (ER) revealed that 25 out of 67 (37.3%) patients had a delay in initiation of IVF resuscitation.

1. **Surviving Sepsis Campaign (SSC) hour-1 care bundle elements include the following:**
    a. Measure lactate level.
    b. Obtain blood cultures before administering antibiotics.
    c. Administer broad-spectrum antibiotics.
    d. Begin rapid administration of 30 mL/kg intravenous (IV) crystalloid for hypotension or lactate level $\geq$ 4 mmol/L - **DO NOT DELAY**.
    e. Vasopressors if hypotension occurs during or after IV fluid (IVF) resuscitation to maintain MAP > 65 mmHg.

2. **SIRS criteria include at least two (2) of the following:**
    a. Fever > 100.4 or hypothermia < 96.8.
    b. Tachypnea > 20 bpm.
    c. Tachycardia > 90 bpm.
    d. Leukocytosis > 12,000, leukopenia < 4,000, or bandemia > 10% bands.

3. **Once sepsis screening is complete and initial IVF resuscitation orders are received, treatment should begin:**
    a. As soon as possible.

4. **Once sepsis-induced hypoperfusion or septic shock ensues, at least 30 mL/kg of IV crystalloid should be administered:**
    a. Within 1 hour.

5. **Acting quickly and minimizing delays in treating sepsis and septic shock patients saves lives.**
    a. True.

Appendix I

Citi Program Certificate

CITI PROGRAM

Completion Date 11-Sep-2021
Expiration Date 10-Sep-2024
Record ID 44744183

This is to certify that:

Alison Douglas

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Social and Behavioral Responsible Conduct of Research
(Curriculum Group)
Social and Behavioral Responsible Conduct of Research
(Course Learner Group)
1 - RCR
(Stage)

Under requirements set by:

Jacksonville State University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w0f0f0af4-16bd-47af-ae27-2fdcded13c67-44744183

Appendix J

Jacksonville State University IRB Letter of Approval

JSU | INSTITUTIONAL REVIEW BOARD
JACKSONVILLE STATE UNIVERSITY

Institutional Review Board for the Protection of Human Subjects in Research
203 Angle Hall
700 Pelham Road North
Jacksonville, AL 36265-1602

December 9, 2021

Alison Douglas
Jacksonville State University
Jacksonville, AL 36265

Dear Alison:

Your protocol for the project titled Improving Intravenous Fluid Resuscitation Compliance of Severe Septic and Septic Shock Adults in a Rural Emergency Room" 120920201-03 has been granted exemption by the JSU Institutional Review Board for the Protection of Human Subjects in Research (IRB). If your research deviates from that listed in the protocol, please notify me immediately. One year from the date of this approval letter, please send me a progress report of your research project.
Best wishes for a successful research project.

Sincerely,

Lynn Garner
Associate Human Protections Administrator, Institutional Review Board