

IMPROVING SEPSIS RECOGNITION AND TREATMENT  
IN A MONTANA CRITICAL ACCESS HOSPITAL:  
A QUALITY IMPROVEMENT INITIATIVE

by

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## TABLE OF CONTENTS

1. REVIEW OF THE LITERATURE .....	1
Introduction.....	1
Background and Significance .....	1
Mortality .....	2
Cost .....	3
Standards of Care .....	3
Literature Synthesis .....	5
Search Strategy .....	5
Eligibility .....	6
Results.....	6
Discussion .....	7
Barriers to Sepsis Recognition.....	7
Early Sepsis Recognition Through Education .....	7
Early Sepsis Recognition Through Screening Tools.....	8
Sepsis Interventions .....	9
Nurse-driven Protocols .....	10
Performance Improvement Programs .....	11
Conclusion .....	11
2. QUALITY IMPROVEMENT PROPOSAL.....	13
Introduction.....	13
Problem Statement.....	14
Organization Microsystem Assessment .....	15
Quality Improvement Model.....	16
Purpose Statement.....	17
Methods.....	18
Intervention and Implementation.....	18
Evaluation and Analysis.....	21
Safety and Confidentiality .....	28
3. QUALITY IMPROVEMENT MANUSCRIPT .....	29
Contribution of Authors and Co-Authors .....	29
Manuscript Information .....	30
Clinical Problem .....	31
Literature Review.....	33
Conceptual Framework.....	35
Initiative Aims.....	35
Methods.....	36
Context.....	36

## TABLE OF CONTENTS CONTINUED

Interventions .....	36
Data Collection and Analysis.....	39
Ethical Considerations .....	39
Results.....	40
Discussion.....	44
Limitations .....	45
Recommendations.....	45
Conclusion .....	46
4. ADVANCED NURSING ESSENTIALS REFLECTION .....	48
Personal Reflection .....	48
Knowledge for Nursing Practice.....	48
Person-Centered Care .....	49
Quality and Safety.....	51
Interprofessional Partnerships.....	51
Informatics and Healthcare Technology .....	52
Conclusion .....	53
REFERENCES CITED.....	54
APPENDICES .....	59
APPENDIX A: PRISMA DIAGRAM OF LITERATURE REVIEW .....	60
APPENDIX B: SEPSIS TREATMENT CHECKLIST.....	62
APPENDIX C: SEPSIS CHART REVIEW FORM .....	64

LIST OF TABLES

Table	Page
1. Table 1. Smart Goal 1 .....	22
2. Table 2. Time to Intervention. Times are in minutes.....	42

LIST OF FIGURES

Figure	Page
1. Figure 1. Modified Early Warning Score (MEWS).....	19
2. Figure 2. Weekly Timeliness of Sepsis Intervention and Patient Count. ....	43

## ABSTRACT

**Background:** Sepsis is an illness caused by body dysregulation in response to an infection, and it affects 30 million people globally each year. In the United States, sepsis accounts for nearly one-third of all hospital deaths, and 1.7 million Americans are treated for sepsis and septic shock annually.

**Local Problem:** Rurality is associated with higher sepsis mortality rates. Nearly one-half of Montana's population lives in rural areas. Rural hospitals often fall behind in sepsis care delivery due to insufficient resources and limited knowledge related to low case volumes. A rural critical access hospital (CAH) in Montana experienced delays in treatment and a 15% case fatality rate over a 2-year period.

**Methods:** To reduce delays in sepsis recognition and treatment, evidence-based screening tools and published standards of care for the treatment of sepsis were implemented.

**Interventions:** In-person education was provided for all CAH staff. The modified early warning score (MEWS) and systemic inflammatory response syndrome (SIRS) criteria were implemented into practice and the electronic health record (EHR). A nurse-driven protocol and provider order set were created and implemented to promote early diagnostic evaluation.

**Results:** Education improved overall confidence and competence in providing sepsis care. 12 sepsis cases were identified in a 7-week period using MEWS/SIRS. The nurse-driven protocol was implemented in 9 cases, which includes interventions for sepsis evaluation. All cases received antibiotics within guideline recommendations.

**Conclusion:** Implementation of staff education, sepsis screening tools, and a nurse-driven protocol improved sepsis recognition and reduced treatment delays in a CAH.

## CHAPTER ONE

### REVIEW OF THE LITERATURE

#### Introduction

Sepsis is a life-threatening illness that affects 30 million people globally each year (World Health Organization [WHO], 2024). In the United States, an estimated 1.7 million people are hospitalized annually with sepsis (Centers for Disease Control and Prevention [CDC], 2023). Early recognition of sepsis is crucial to reduce overall mortality and healthcare costs associated with a sepsis diagnosis. Sepsis accounts for one-third of all hospital deaths (CDC, 2023). Rural Americans with sepsis face higher mortality rates than their urban counterparts (Oud & Garza, 2022). Many healthcare professionals do not recognize sepsis until it becomes septic shock, which may be too late. This scoping review evaluates sepsis recognition and the guidelines for sepsis treatment.

#### Background and Significance

Sepsis is an illness caused by dysregulation of the human body in response to an infection (Evans et al., 2021). Body dysregulation leads to life-threatening multiple organ dysfunction, which includes a complex series of events launched by the immune system in the presence of a pathogen. Such a response is amplified by an uncontrolled systemic inflammatory response, resulting in massive vasodilation and increased capillary permeability (Hoffman & Sullivan, 2017). Early physical signs of sepsis include fever, warm skin, tachycardia, and bounding pulses. Confusion and decreased urine output are early signs of decreased organ perfusion and may be present despite blood pressures within normal range (Hoffman & Sullivan, 2017). When

recognized in its early stages, sepsis is easily treatable (WHO, 2024). Treatment includes administering appropriate antibiotics to combat the infection and maintaining hemodynamic stability with fluids, if necessary (Evans et al., 2021; Hoffman & Sullivan, 2017). Unrecognized and untreated sepsis rapidly turns to septic shock (Moore et al., 2019). In septic shock, hypotension and hypothermia result from profound circulatory and metabolic abnormalities (Hoffman & Sullivan, 2017). Tachycardia remains present, blood pressure drops, and the skin becomes cool and pale (Hoffman & Sullivan, 2017). Treatment includes vasopressors to increase blood pressure, steroids to reduce inflammation, fluids, antibiotics, and supportive care (Evans et al., 2021; Hoffman & Sullivan, 2017). Supportive care may include blood products and mechanical ventilation.

### Mortality

The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) prioritize sepsis recognition and treatment (CDC, 2023; WHO, 2024). Yet sepsis often remains undetected and untreated until its later stage of shock. For each hour that there is a delay in sepsis treatment, mortality risk increases by eight percent (Bray & Kennedy, 2021). Nationally, sepsis mortality rates have remained unchanged for the past 20 years (Horton et al., 2020; Prest et al., 2021). Sepsis accounts for one-third of all hospital deaths, roughly 350,000 annually, and accounted for 6.7% of deaths from the years 2005 to 2018 (Buchman et al., 2020; Desposito & Bascara, 2024; Prest et al., 2021).

Rural American communities, areas of less than 50,000 people, experience higher sepsis mortality rates (Health Resources & Services Administration [HRSA], 2024; Oud & Garza, 2022). An estimated twenty percent of Americans live in a rural setting, yet less than eight

percent of physicians practice in rural areas (Oud & Garza, 2022; Sepassi et al., 2024). Rural communities—including those in Montana—experience unique barriers to accessing healthcare, including low numbers of healthcare providers, being un- or underinsured, and traveling long distances for primary healthcare (Chang et al., 2023; Sepassi et al., 2024; Watanabe-Galloway et al., 2022). Rural residents, when compared to urban residents, are typically older with multiple comorbidities, increasing not only their risk of sepsis and sepsis-related death but mortality in general (Chang et al., 2023; Oud & Garza, 2022). Due to the numerous barriers to healthcare access, rural residents are more likely to seek medical care at later stages of sepsis (Chang et al., 2023).

### Cost

Sepsis is reported as the most expensive reason for hospitalization in the United States, costing roughly twenty thousand dollars per case and over 62 billion dollars annually (Bolte et al., 2022; Horton et al., 2020). Even after treatment, sepsis increases hospital readmission rates and risks of developing long-term adverse health outcomes, further increasing healthcare costs (CDC, 2023). Within a six-year span, the total cost incurred for Medicare beneficiaries for both inpatient and skilled nursing care rose from 28 billion dollars to 41.5 billion annually (Buchman et al., 2020). Early recognition and treatment of sepsis improves mortality while reducing healthcare costs (Buchman et al., 2020; Horton et al., 2020).

### Standards of Care

The best practice for sepsis care is early identification and treatment. Early identification of sepsis can be accomplished through validated screening tools. Two such tools are the modified early warning score (MEWS) and the systemic inflammatory response syndrome (SIRS) criteria.

MEWS is a bedside screening tool used to predict patient condition deterioration based on physiological parameters and has been validated for sepsis screening (Desposito & Bascara, 2024; Horton et al., 2020; Subbe et al., 2001). The score is calculated based on patient heart rate, respiratory rate, systolic blood pressure, body temperature, and mental status (Bray & Kennedy, 2021; Roney et al., 2020). Higher scores indicate worsening patient condition and MEWS scores equal to or greater than 5 indicate the need for urgent evaluation for sepsis (Desposito & Bascara, 2024; Horton et al., 2020; Roney et al., 2020). The systemic inflammatory response syndrome (SIRS) criteria were first used for sepsis identification in 1991 and continue to be used today (Dugar et al., 2020). SIRS criteria include serum leukocyte levels along with physiologic signs of deterioration that include temperature (greater than 38C or less than 36C), heart rate (greater than 90 beats/minute), and respiratory rate (greater than 20 breaths/minute) (Desposito & Bascara, 2024). Serum leukocyte levels greater than 12,000/microliter or less than 4,000/microliter indicate an inflammatory response (Desposito & Bascara, 2024; Semanco et al., 2022). The provider must consider further evaluation for infection when patients exhibit at least two of the four SIRS criteria (Desposito & Bascara, 2024; Horton et al., 2020; Nieves et al., 2021; Threatt, 2020).

The current treatment guidelines produced by the Society of Critical Care Medicine Surviving Sepsis Campaign (SSC) are considered the gold standard for the management of sepsis (Evans et al., 2021; Moore et al., 2019; Prescott & Ostermann, 2023). SSC began publishing sepsis care guidelines in 2004, and has made several updates since, with the most recent in 2021, to improve sepsis treatment and outcomes (Evans et al., 2021; Prescott & Ostermann, 2023). SSC guidelines recommend obtaining serum lactate and blood cultures within a specific

timeframe to identify sepsis. Administration of broad-spectrum antibiotics within one hour is ideal, but within three hours is acceptable. Previously published guidelines have recommended fluid resuscitation within one hour as well, but the most current SSC guidelines have changed this to a weak recommendation unless patients are hypotensive or have serum lactate above 4.0 mmol/Liter (Desposito & Bascara, 2024; Evans et al., 2021; Prescott & Ostermann, 2023).

This scoping review aims to examine ways to improve early sepsis recognition and treatment. For more than twenty years, sepsis has been recognized as one of the most frequent causes of hospitalization and death worldwide (WHO, 2024). However, sepsis mortality rates remain stable despite being a national and global priority (Horton et al., 2020; Prest et al., 2021). Improvement in recognition of sepsis improves mortality while reducing healthcare costs, and healthcare systems need to adopt programs to improve early intervention in treating sepsis.

### Literature Synthesis

Utilizing the Montana State University Library databases in September 2024, a search for evidence-based literature on sepsis recognition and treatment was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis for scoping reviews (PRISMA-ScR) recommendations (Tricco et al., 2018).

### Search Strategy

The databases searched included Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cat Search and Google Scholar. Other sources included websites for the CDC, the WHO, and the SSC. Key terms used in the search included: “sepsis” in combination with the Boolean connector “AND” “critical access and rural hospitals”, “economic impact”,

“cost”, “nursing protocol”, “quality improvement”, “early detection”, “standard of care or best practice”, and “mortality” An initial total of 17,823 articles were identified (See Appendix A).

### Eligibility

Criteria for exclusion of further evaluation included studies of pediatric populations, studies that explored specific disease processes, those occurring outside the hospital setting, full text not available online, and duplications. Inclusion criteria for further review were peer-reviewed articles published in English, based in the United States, and used MEWS and/or SIRS criteria for screening. Since the SSC guidelines were updated in 2021, initially articles published after 2021 were considered. To further expand knowledge on sepsis, screening tools, and nursing protocol, articles published within the last five years (2019-2024) were included. No articles addressing sepsis in Montana were identified.

### Results

Overall, sixteen articles are utilized in this scoping review. This includes the SSC 2021 sepsis management guidelines, as well as two articles reviewing the evidence behind the recommendation changes. Other articles include seven quality improvement projects, two systematic reviews, and four cost and mortality analyses. One systematic review from Canada was included, as it is specifically focused on public and healthcare provider sepsis awareness (Fiest et al., 2022). The included articles focused on rural (n=5) and urban populations (n=8). Healthcare settings included acute care settings (n=4) and emergency departments (n=4). The use of nurse-driven protocols (n=3) and education (n=6), as well as the MEWS (n=6), SIRS criteria (n=5), and sepsis intervention bundles, (n=4) were reviewed.

## Discussion

### Barriers to Sepsis Recognition

Sepsis is not widely recognized by the public and gaps in knowledge continue to exist among healthcare professionals (Fiest et al., 2022). Fiest et al. (2022) found in their scoping review that the public has low knowledge of what sepsis is and when to seek medical care. While healthcare providers have a higher amount of sepsis knowledge, six articles demonstrated barriers to the early recognition of sepsis in the healthcare setting. Barriers include limited awareness and knowledge, inadequate training, lack of a sepsis definition, and the inability to recognize the symptoms of sepsis (Fiest et al., 2022; Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021; Prest et al., 2021; Threatt, 2020). Additionally, three articles illustrated that rural hospitals nationwide have limited resources and often fall behind when recognizing sepsis and providing the appropriate sepsis care (Chang et al., 2023; Oud & Garza, 2022; Prest et al., 2021).

### Early Sepsis Recognition Through Education

The early recognition and treatment of sepsis is essential for improving patient outcomes and reducing sepsis mortality (CDC, 2023). Education on the signs and symptoms of sepsis improves recognition and leads to early intervention. Educational interventions implemented in six of the articles demonstrated improvement in clinical knowledge, leading to earlier recognition of sepsis (Bolte et al., 2022; Bray & Kennedy, 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Threatt, 2020). Education included the SSC definition of sepsis, its signs and symptoms, the importance of early recognition and treatment, and mortality rates, and most often occurred in person (Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021;

Roney et al., 2020; Threatt, 2020). The accuracy of sepsis screening improved in a California hospital after Nieves et al. (2021) implemented a 30-minute in-person education intervention on the pathophysiology of sepsis, signs and symptoms, and sepsis mortality rates.

### Early Sepsis Recognition Through Screening Tools

Implementing sepsis screening tools in healthcare settings is recommended to reduce delays in treatment (Desposito & Bascara, 2024; Evans et al., 2021; Roney et al., 2020). While screening tools have limitations, their use alerts clinicians to consider further evaluation of a patient's condition (Evans et al., 2021). Implementation of MEWS as a sepsis screening tool was identified in six articles. While the MEWS is not specific to sepsis but indicates deterioration of a patient's condition, its use provides valuable insight for early recognition of sepsis and is associated with decreased length of hospitalization and reduction of healthcare costs (Chua et al., 2024; Horton et al., 2020; Kangas et al., 2021). MEWS scores are calculated based on the physiological presentation of the patient (Bray & Kennedy, 2021; Chua et al., 2024; Desposito & Bascara, 2024; Roney et al., 2020). Chua et al. (2024) report that the MEWS can easily be used in triage and is an ideal tool for simple bedside assessment. Implementing a MEWS sepsis screening tool in an acute care setting in Texas showed an immediate improvement in patient mortality, and five years after implementation showed a 24% reduction in mortality rates (Roney et al., 2020).

The common use of the SIRS criteria in healthcare settings was explored in five of the sixteen articles reviewed. In addition to physiologic parameters, the SIRS criteria consider serum leukocyte levels in identifying sepsis (Desposito & Bascara, 2024). Chua et al. (2024) found the SIRS highly sensitive for sepsis detection in their systematic review. Three articles found that

using SIRS improves accuracy of sepsis identification and reduces the time to treatment (Nieves et al., 2021; Semanco et al., 2022; Threatt, 2020). The SSC guidelines recognize the importance of screening tools in the early recognition of sepsis and suggest that using multiple tools may be appropriate (Evans et al., 2021). The MEWS and SIRS together can improve sepsis recognition (Chua et al., 2024; Horton et al., 2020; Kangas et al., 2021; Semanco et al., 2022).

Additionally, MEWS and SIRS screening tools can be implemented into the electronic health record (EHR) to improve sepsis recognition. EHR implementation was evaluated in four articles. Implementing screening tools into the EHR improves the accuracy of sepsis screening (Kangas et al., 2021; Nieves et al., 2021). MEWS in the EHR provides an alert that a patient may be decompensating and has been validated across multiple healthcare settings, including emergency and acute care (Horton et al., 2020; Semanco et al., 2022). Horton et al. found that automated alerts warning of possible sepsis reduce time to intervention, hospital length of stay, and overall costs. Two studies noted alert fatigue as a possible negative aspect of EHR alerts and recommend alerts be created to address each healthcare settings specific needs (Kangas et al., 2021; Semanco et al., 2022).

### Sepsis Interventions

The SSC recommendations have specific interventions for sepsis and septic shock, referred to as bundles (Desposito & Bascara, 2024; Evans et al., 2021). Intervention bundles are reviewed in four of the sixteen articles. Intervention bundles are intended to improve patient outcomes and include obtaining serum lactate, blood cultures, and administering broad-spectrum antibiotics within three hours of arrival at a healthcare facility or identification of sepsis if already hospitalized (Bolte et al., 2022; Bray & Kennedy, 2021; Desposito & Bascara, 2024;

Moore et al., 2019; Semanco et al., 2022). In addition, crystalloid fluids and vasopressors are utilized to maintain mean arterial blood pressure (MAP) greater than 65mmHg if patients are hypotensive, and repeat serum lactate levels are obtained if the initial measurement is greater than 2mmol/L (Bray & Kennedy, 2021; Desposito & Bascara, 2024; Evans et al., 2021; Semanco et al., 2022). While the Centers for Medicare and Medicaid (CMS) require reporting of bundle compliance, Bolte et al. (2022) note that hospitals with low patient volume are not required to report bundle compliance, meaning rural healthcare settings are less likely to follow bundle recommendations and report sepsis outcomes. However, hospitals that adhere to bundle compliance reporting are more likely to have sepsis quality improvement processes in place (Bolte et al., 2022).

### Nurse-driven Protocols

Nurse-driven protocols that include sepsis screening tools and intervention checklists allow for early sepsis recognition and treatment, significantly improving patient outcomes (Bray & Kennedy, 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Semanco et al., 2022; Threatt, 2020). Seven articles show evidence supporting the benefits of nurse-driven protocols for sepsis recognition and treatment (Bray & Kennedy, 2021; Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Semanco et al., 2022; Threatt, 2020). Kangas et al. (2021) recognize that a nurse is often the first person that patients encounter and nurses need to be the leaders in sepsis recognition and treatment. Two articles report that when nurses are empowered to perform sepsis screening using tools the time to intervention is reduced (Nieves et al., 2021; Roney et al., 2020). Nurse-driven protocols implemented in emergency departments demonstrate improvements in the timeliness of sepsis care (Bray & Kennedy, 2021;

Moore et al., 2019). Bray and Kennedy (2021) reduced the time to sepsis treatment in a rural emergency department by 67% with the implementation of a nurse-driven protocol and intervention bundle, thus improving patient outcomes. Semanco et al. (2022) demonstrated that a nurse-driven team-based approach reduced the time to obtain serum lactate levels and blood cultures and significantly improved timely antibiotic administration.

### Performance Improvement Programs

Healthcare facilities with sepsis performance improvement programs that include education, screening tools, and protocols for intervention have better patient outcomes (Bolte et al., 2022; Bray & Kennedy, 2021; Chang et al., 2023; Horton et al., 2020; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Semanco et al., 2022; Threatt, 2020). While no standardized improvement program exists, the SSC 2021 guidelines note that the presence of a program is more important than the components (Evans et al., 2021). Bolte et al. (2022) and Nieves et al. (2021) found that structured sepsis programs reduce mortality and hospital costs. Seven articles on performance improvement programs demonstrated the benefits of structured sepsis programs (Bray & Kennedy, 2021; Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Semanco et al., 2022; Threatt, 2020). The cost of sepsis treatment per patient in a rural emergency department went from \$8,000 to \$5,400 with the implementation of a sepsis performance improvement program (Bray & Kennedy, 2021).

### Conclusion

Sepsis is a globally recognized preventable life-threatening illness and is the most expensive illness to treat (CDC, 2023; WHO, 2024). Early recognition of sepsis reduces the time

to treatment, as well as hospital length of stay, and reduces the likelihood of developing long-term complications, reducing overall healthcare costs, even in rural healthcare settings (Bray & Kennedy, 2021; Buchman et al., 2020; Horton et al., 2020). Without early recognition and treatment, sepsis significantly increases mortality risk. This scoping review acknowledges several barriers to early sepsis recognition, including lack of sepsis knowledge even among healthcare providers. While SSC recommends healthcare facilities have a structured sepsis program, there are no set standards for what a sepsis improvement program entails. Successful programs reviewed in the literature tend to have components of education, screening tools, and protocols for intervention. Nurse-driven protocols lead to early recognition and intervention in sepsis treatment and reduce sepsis mortality.

Implementing a structured sepsis improvement program in a rural, critical access hospital (CAH) that includes a combination of screening tools can improve sepsis recognition and reduce time to treatment. Since nurses are the front line of defense in sepsis recognition, a nurse-driven protocol that includes collection of serum lactate, serum leukocyte levels, and blood cultures, as well as appropriate fluid resuscitation if needed, is imperative to improving patient outcomes.

## CHAPTER TWO

## QUALITY IMPROVEMENT PROPOSAL

Introduction

Early recognition and treatment of sepsis is a global concern (WHO, 2024). Each year an estimated 30 million people are affected by sepsis globally (WHO, 2024). Hospitals in the United States treat 1.7 million Americans for sepsis and septic shock annually (CDC, 2023). Sepsis accounts for nearly one-third of hospital related deaths, approximately 350,000 fatalities annually (Desposito & Bascara, 2024; Prest et al., 2021). Furthermore, sepsis mortality rates are higher in rural areas and increase with age (Kramarow, 2021). Although existing literature on sepsis mortality rates in Montana is limited, nearly half of the state's population resides in rural communities, which increases their vulnerability to health risks (World Population Review, 2024b). Montana has 69 hospitals statewide, with 50 of these located in rural regions (Rural Health Information Hub, 2024). This rural infrastructure poses unique challenges for patients seeking timely and effective health care, especially in critical situations. Sepsis hospitalizations in the United States come with a significant cost: an estimated twenty thousand dollars per case, totaling an annual 62 billion dollars (Bolte et al., 2022; Horton et al., 2020).

Rural communities, such as those in Montana, experience unique barriers in accessing healthcare services, including limited availability of healthcare providers, higher rates of individuals who are uninsured or underinsured, and traveling long distances to access primary healthcare (Chang et al., 2023; Sepassi et al., 2024; Watanabe-Galloway et al., 2022). Due to these barriers, rural residents experience higher rates of sepsis mortality (Oud & Garza, 2022).

According to Chang et al. (2023), rurality is associated with increased hospital mortality rates related to sepsis. Often, rural residents are older, have multiple comorbidities, and when compared to urban residents, tend to seek medical care at later stages of illness (Chang et al., 2023; Oud & Garza, 2022). Additionally, rural healthcare settings often fall behind in delivering appropriate sepsis care due to insufficient resources and limited sepsis knowledge (Chang et al., 2023; Fiest et al., 2022).

Rural hospitals often experience low patient volumes and are not required to report sepsis quality outcomes (Bolte et al., 2022). Furthermore, these hospitals are less likely to implement quality improvement programs addressing sepsis recognition and treatment (Bolte et al., 2022). However, sepsis quality improvement initiatives in rural settings have shown improved positive results, leading to improved sepsis treatment and a decrease in sepsis associated mortality rates (Bray & Kennedy, 2021; Roney et al., 2020). Hospitals that incorporate sepsis quality improvement programs have reported improved intervention times and a decrease in overall hospital costs (Bolte et al., 2022; Bray & Kennedy, 2021; Nieves et al., 2021).

### Problem Statement

Rural hospitals often struggle to deliver adequate sepsis care, which may result in poor patient outcomes (Chang et al., 2023). Since most of Montana is designated rural, the majority of hospitals in the state provide care for underserved rural communities (Rural Health Information Hub, 2024). A lack of knowledge related to sepsis may contribute to delays in its recognition, subsequently delaying appropriate treatment. In 2023, a total of eighteen sepsis cases were identified at the designated critical access hospital (CAH) site, with only eleven of those cases

receiving the currently recommended treatment. Additionally, the case fatality rate was 15% over a two-year period.

A practice problem arises in rural settings with delays in adequate sepsis treatment and a higher risk of sepsis mortality (Chang et al., 2023). Providing education to healthcare staff on the definition of sepsis, the signs and symptoms, and the use of sepsis screening tools can enhance early recognition of sepsis. Therefore, by implementing validated sepsis screening tools and a nurse-driven protocol aligned with the Surviving Sepsis Campaign (SSC) guidelines, rural healthcare staff will improve sepsis recognition, decrease treatment delays, and ultimately decrease mortality in a rural CAH.

### Organization Microsystem Assessment

Located in south-central Montana, the project site is a CAH serving a rural community of approximately 2,000 residents and is the sole hospital within a county of nearly 9,000 people (World Population Review, 2024a & 2024c). This CAH operates under a not-for-profit organization and comprises a five-bed emergency department and a sixteen-bed acute care unit. To be designated as a CAH, a hospital must maintain fewer than 25 acute care beds, provide 24-hour emergency services, and be in a rural location greater than 35 miles away from another hospital (Rural Health Information Hub, 2024). Additionally, the CAH must also exist in a state that participates in the Medicare Rural Hospital Flexibility program and must be owned by either a public or not-for-profit organization (Rural Health Information Hub, 2024).

The stakeholders involved in this initiative include one Director of Nursing (DON), one Doctor of Nursing Practice student (DNP-S), two physicians, two physician assistants, one nurse

practitioner, sixteen registered nurses (RNs), two licensed practical nurses (LPNs), sixteen certified nurse assistants (CNAs), and one member of the information technology (IT) team. All stakeholders, other than the IT representative, provide direct patient care within the emergency and acute care departments of the CAH.

### Quality Improvement Model

A quality improvement framework is essential for guiding the quality improvement process and ensuring the successful implementation of evidence-based interventions. This project will utilize the CDC Replicating Effective Programs (REP) framework to guide its quality improvement efforts. The REP framework facilitates the implementation of interventions within community-based healthcare settings by integrating evidence-based practices with community input, allowing for the adaptation of interventions to align with local needs (Kilbourne et al., 2007). The four phases of the REP framework enable quality improvement by introducing evidence-based interventions at a local level, while fostering long-lasting and sustainable change (Kilbourne et al., 2007).

The initial phase of REP involves establishing pre-conditions (Kilbourne et al., 2007). Two key components of these pre-conditions include identifying the need for change and the effective interventions (Kilbourne et al., 2007). At the designated CAH, the urgent need to enhance early sepsis recognition and intervention was identified. The CAH had eighteen sepsis cases in 2023, with delayed recognition of sepsis found in seven cases. Of those incidents, only eleven received the recommended treatment. A scoping review identified the modified early warning score (MEWS) and the systemic inflammatory response syndrome (SIRS) criteria as

validated tools for early detection of sepsis. The current SSC guidelines outline the recommended interventions for sepsis treatment.

The pre-implementation phase, which is the subsequent step in REP, involves input from stakeholders and preparing for the implementation of the interventions (Kilbourne et al., 2007). A sepsis committee has been formed, consisting of four RNs, one DNP-S, and one physician. Committee members reviewed the current SSC guidelines and early sepsis recognition screening tools to inform the development of the nurse-driven protocol. Education on sepsis will be provided to all stakeholders during the pre-implementation phase.

The implementation and evaluation of the nurse-driven protocol will occur in the third phase of REP (Kilbourne et al., 2007). During this phase, the protocol will be implemented with weekly assessments of data related to its implementation. Key factors to evaluate the protocol's effectiveness include adherence to the protocol, the time taken to deliver interventions, and patient outcomes. Adjustments may be made during this phase to enhance the use of the protocol and improve treatment timelines and patient outcomes.

The final phase of REP is maintenance and evolution (Kilbourne et al., 2007), wherein the intervention is customized to ensure sustainability. According to Kilbourne et al. (2007), this phase is often the most challenging, as the nurse-driven protocol requires long-term adoption to enhance the recognition and treatment of sepsis. Sustained adoption will likely involve ongoing education for stakeholders regarding sepsis and the effectiveness of the nurse-driven protocol.

#### Purpose Statement

This quality improvement project aims to improve the recognition of sepsis, reduce treatment delays, and improve sepsis outcomes in a CAH. The project will involve the

implementation of validated sepsis screening tools, a nurse-driven protocol, and an order set in accordance with the current SSC guidelines for sepsis treatment. The specific aims of the project include obtaining the recommended laboratory diagnostics within one hour of suspected sepsis identification and administering broad-spectrum antibiotics within three hours of recognized sepsis. The purpose of this sepsis quality improvement project is to improve sepsis outcomes in a CAH.

## Methods

### Intervention and Implementation

At the designated CAH site, all stakeholders will receive education on the significance and impact of sepsis during the pre-implementation phase. This education will occur prior to the implementation date of January 15, 2025. A group education session and sepsis simulation will occur on January 8, 2025. For stakeholders who are unable to attend, individual meetings with the DNP-S will be arranged to provide sepsis education prior to January 15, 2025. The education curriculum will cover the SSC sepsis definition, signs and symptoms of sepsis, and the critical importance of early recognition, including both national and local sepsis mortality rates. Additionally, the effectiveness of the MEWS and SIRS criteria screening tools will be discussed during education. The education sessions will also include a review of the current SSC sepsis recognition and treatment guidelines.

Members of the nursing team, including RNs and CNAs, often engage with patients first and should feel empowered to take the lead in recognizing and treating sepsis (Kangas et al., 2021). Utilizing screening tools can facilitate early recognition of sepsis. In accordance with the

current SSC recommendations, both MEWS and SIRS criteria will be utilized together to improve recognition of sepsis. The implementation of these tools will begin January 15, 2025. The MEWS is calculated based on several patient vital signs: heart rate, respiratory rate, systolic blood pressure, body temperature, and mental status (Bray & Kennedy, 2021; Roney et al., 2020). A MEWS of equal to or greater than 5 indicates an increased risk of mortality and necessitates urgent clinical evaluation (Desposito & Bascara, 2024; Horton et al., 2020; Roney et al., 2020; Subbe et al., 2001). Since MEWS is a simple bedside assessment, the initial score should alert the nurse to initiate the nurse-driven protocol. Patients with a score of at least 3 often also meet SIRS criteria.

Figure 1. Modified Early Warning Score (MEWS).

	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
Systolic BP (mmHg)	<70	71-80	81-100	101-199		≥200	
Heart rate (bpm)		<40	40-51	51-100	101-110	111-129	≥130
Respiratory rate		<9		9-14	15-20	21-29	≥30
Temperature (C°)		<35		35-38.4		≥38.5	
Mental Status				Alert	Responds to voice	Responds to pain	unresponsive

The SIRS criteria will also be utilized to further assess suspected cases of sepsis. The SIRS criteria includes: temperature (either below 36°C or above 38°C), heart rate (greater than 90 beats per minute), respiratory rate (greater than 20 breaths/minute), and serum leukocyte levels (below 4,000/microliter or above 12,000/microliter) (Desposito & Bascara, 2024). Sepsis is suspected when a patient meets at least two of these four criteria, prompting the initiation of the nurse-driven protocol (Desposito & Bascara, 2024; Evans et al., 2021; Horton et al., 2020; Nieves et al., 2021; Threatt, 2020).

Screening tools are an essential component of early recognition of sepsis and have been shown to decrease the time to intervention (Bray & Kennedy, 2021; Desposito & Bascara, 2024; Evans et al., 2021; Horton et al., 2020; Roney et al., 2020). Since both MEWS and SIRS rely on patient vital signs, assessment happens for every patient in the emergency and acute care departments at each vital sign interval. Patients in the emergency department receive vital sign assessments every fifteen to thirty minutes, and patients in the acute care department receive assessments at least every four hours. The integration of MEWS and SIRS criteria into the electronic health record (EHR) is scheduled to be completed by IT prior to January 15, 2025. MEWS will be displayed in the vital signs section of the EHR, appearing in blue for scores greater than or equal to 3 and less than 5, and in red for scores of 5 or higher. When a patient meets two of the four SIRS criteria, a sepsis alert will activate in the EHR, prompting the nurse to review the patient's chart further. Subsequently, the nurse will complete a Sepsis Treatment Checklist (Appendix B).

A nurse-driven sepsis protocol, aligned with current SSC recommendations, will be implemented beginning January 15, 2025. This protocol includes blood collection that encompasses a complete metabolic panel (CMP), complete blood count (CBC), serum lactate levels, blood cultures obtained from two different sites, and the administration of a 500 mL crystalloid fluid bolus of normal saline (NS). Nurses will promptly notify the designated provider of the day upon identifying a patient with suspected sepsis and document the time of contact in the EHR. All parts of the nurse-driven protocol will be implemented within one hour of suspected sepsis.

The recommendations for treatment of sepsis outlined in the current SSC guidelines will guide provider orders for managing sepsis treatment. For patients who meet the MEWS and/or SIRS criteria but do not display signs of septic shock, the three-hour treatment bundle recommendations will apply. This includes conducting investigations for potential causes, such as urinalysis, wound cultures, or point-of-care testing for influenza and SARSCoV2, and administering broad-spectrum antibiotics within three hours from the time sepsis is suspected (Desposito & Bascara, 2024; Evans et al., 2021). Additionally, if the initial serum lactate level exceeds 2mmol/L, it should be repeated after six hours (Desposito & Bascara, 2024; Evans et al., 2021). Since the designated site is a CAH, patients presenting with septic shock require a higher level of care. Patients categorized as having septic shock are those with a mean arterial blood pressure (MAP) of less than 65mmHg or a serum lactate level of greater than or equal to 4mmol/L (Evans et al., 2021). In such cases, broad-spectrum antibiotics should be administered, and a crystalloid fluid bolus of 30mg/kg should be started within one hour of suspected sepsis recognition (Desposito & Bascara, 2024; Evans et al., 2021). Additionally, vasopressors may be utilized to maintain a MAP greater than or equal to 65mmHg during fluid resuscitation. While vasopressors can be started at the CAH, these patients should be transferred to a nearby hospital that can provide a higher level of care as soon as possible.

### Evaluation and Analysis

Data collection will be conducted weekly from January 15, 2025, to March 3, 2025. A sepsis chart review form will be utilized for the analysis of each sepsis case (Appendix C). The review of sepsis care will be performed by a member of the sepsis committee. Data from the chart review form will be subsequently transferred to an electronic spreadsheet for tracking and

analysis. The data analysis phase is scheduled to take place between March 3, 2025, and March 24, 2025. The results will determine whether the implementation of validated screening tools has facilitated earlier recognition of sepsis. Ideally, the nurse-driven protocol will reduce the time to sepsis treatment by collecting additional necessary diagnostics to confirm sepsis. Additionally, the results will reveal an increased number of patients receiving care aligned with the current SSC guidelines for sepsis management.

Staff engagement and participation are crucial for the success of the quality improvement project. The sepsis committee will convene monthly throughout the duration of the quality improvement project and continue these meetings through June 2025. Improvements in the recognition and treatment of sepsis will be communicated to all stakeholders, along with any barriers identified. Identified barriers will be addressed, leading to necessary modifications in the nurse-driven protocol and sepsis treatments to improve outcomes. Should the project's goals be achieved and maintained through June 2025, the sepsis committee will transition to quarterly meetings.

Table 1. Smart Goals

<p><b>SMART Goal #1</b></p> <p>By January 15, 2025, 100% of included stakeholders will be educated on:</p> <ul style="list-style-type: none"> <li>• Surviving Sepsis Campaign (SSC) definition of sepsis</li> <li>• Signs and symptoms of sepsis</li> <li>• Importance of early recognition and treatment</li> <li>• MEWS &amp; SIRS criteria as sepsis screening tools</li> <li>• SSC 2021 treatment guidelines</li> </ul>
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Table 1 Continued

<ul style="list-style-type: none"> <li>○ DNP-S will provide in-person education for all stakeholders</li> <li>○ Education will occur during a group staff meeting and simulation session</li> <li>○ Staff unable to attend group education will receive individual education by DNP-S</li> </ul>		
Data to be collected	Collection Process	Planned data analysis
<p>(Numerator) staff received training education before implementation</p> <p>(Denominator) All CAH staff</p>	<p>DNP-S organizes meetings and presents to staff.</p>	<p>Sign in sheet at each education session indicates attendees.</p> <p>Number of staff needing individual education.</p> <p>Which discipline staff belong to: RN, LPN, CNA, provider.</p>

<p><b>SMART Goal # 2</b></p> <p>The MEWS and SIRS will aid staff to recognize sepsis or suspected sepsis for all patients.</p> <ul style="list-style-type: none"> <li>• MEWS appear in EHR under vital signs (VS)</li> <li>• SIRS criteria alert in EHR</li> </ul>
<p>IT will add MEWS to EHR vital signs tab by January 15, 2025</p> <p>IT will implement SIRS criteria alert into EHR by January 15, 2025</p>

Table 1 Continued

Data to be collected	Collection Process	Planned data analysis
<p>MEWS</p> <p>Score <math>\geq 3</math> and <math>&lt; 5</math> (blue)</p> <p>Score <math>\geq 5</math> (red)</p>	<p>Sepsis committee members will collect scores from EHR, initially on a paper form. DNP-S transfers information to electronic data storage.</p>	<p>Number of patients with MEWS <math>\geq 3</math>; time between score and nurse-driven protocol implementation. ER patients have VS assessed every 15-30 minutes. Acute care patients have VS assessed every 4 hours.</p>
<p>SIRS criteria alert</p>	<p>Sepsis committee members will collect if the criteria were met and when the alert appeared, initially on a paper form. DNP-S transfers information to electronic data storage.</p>	<p>Number or patients that met SIRS criteria; time alert appeared; time RN completed Sepsis Treatment Checklist in EHR</p>

**SMART Goal # 3**

Between January 15, 2025, and March 3, 2025, the nurse-driven protocol will be implemented for 85% of all patients with a MEWS  $\geq 3$  and/or who meet SIRS criteria.

<ul style="list-style-type: none"> <li>• Serum CBC, CMP, lactate and blood cultures x2 collected within one hour.</li> <li>• Crystalloid fluid bolus of 500 mL NS within one hour</li> <li>• Documentation of provider notification</li> </ul>		
<ul style="list-style-type: none"> <li>○ RN will collect CBC, CMP, lactate and blood culture x1 while starting patient IV</li> <li>○ RN will begin fluid bolus</li> <li>○ Lab staff will collect blood culture x1</li> <li>○ RN or CNA will notify provider of suspected sepsis patient – documentation in EHR will occur under <i>Provider Notification</i> tab</li> </ul>		
Data to be collected	Collection Process	Planned data analysis
<p>Time to labs collected: CBC, CMP, lactate, blood cultures x2</p> <p>Time to fluids</p> <p>Time to provider notification</p>	<p>Sepsis committee member collects case information, times MEWS/SIRS and times of interventions from EHR</p>	<p>All data will be displayed on run charts for each individual intervention.</p> <p>Time zero is the time a patient meets MEWS/SIRS. Protocol use will be evaluated weekly.</p> <p>If the protocol is not being used, further evaluation will be done to determine why and how to improve use.</p>

Table 1 Continued

<p><b>SMART Goal #4</b></p> <p>Between January 15, 2025, and March 3, 2025, there will be a reduction in time to sepsis treatment when compared to times of the past 2 years (2023 &amp; 2024).</p> <ul style="list-style-type: none"> <li>Broad spectrum antibiotics are administered within 3 hours of nurse-driven protocol implementation.</li> </ul>		
<p>Which interventions do patients received after identification of sepsis</p>		
<p>Data to be collected</p>	<p>Collection Process</p>	<p>Planned data analysis</p>
<p>Type of intervention:  Antibiotics</p>	<p>Sepsis committee member collects case information, times MEWS/SIRS and times of interventions from EHR.</p>	<p>All data will be displayed on run charts for each individual intervention. Time zero is the time a patient meets MEWS/SIRS. Time to antibiotics will be collected.</p>

Table 1 Continued

<p><b>SMART Goal #5</b></p> <p>Long term goal – 95% of all patients presenting at CAH with sepsis undergo early recognition and the recommended treatment.</p>		
<ul style="list-style-type: none"> <li>○ Sepsis education for all new staff members upon hire provided by clinical coordinator or designee</li> <li>○ Early recognition of sepsis using MEWS/SIRS</li> <li>○ Nurse-driven protocol implemented</li> <li>○ SSC 2021 treatment guidelines followed</li> </ul>		
Data to be collected	Collection Process	Planned data analysis
Case review of each identified sepsis case using paper form	Sepsis committee member reviews each chart and collects relevant data, transferred to electronic data form.	Evaluation of why treatment was not performed, reviewed with each member of the care team for each specific case.
(Numerator) Number of patients that received recommended care.  (Denominator) Number of total sepsis cases	Collected by sepsis committee member from electronic data form	Evaluation of changes that may need to be made.

### Safety and Confidentiality

Ensuring confidentiality is a priority for this quality improvement project. Data collected on paper forms will be securely stored in a locked drawer in the CAH management office. Electronic data will be saved in a password-protected document, accessible only to members of the sepsis committee. No patient health information will be removed from the CAH. All data shared with faculty from Montana State University (MSU) for this project will be free of patient identifiers. Chart reviews and data collection will be conducted by sepsis committee members, all of whom have completed HIPAA training to maintain patient confidentiality in accordance with organizational employment. All collected data will be de-identified in accordance with HIPAA regulations. This quality improvement project does not pose any additional risk to patients. Sepsis screening and treatment interventions adhere to evidence-based standards of care. Therefore, while patient consent for treatment is utilized, informed consent for the project itself is not required.

The DON and the medical director of the CAH have granted site-specific approval for the project. The proposed project will be presented to the CAH medical staff on December 17, 2024. Furthermore, this quality improvement project proposal will be submitted for approval to MSU's Institutional Review Board (IRB) by December 11, 2024.

CHAPTER THREE

QUALITY IMPROVEMENT MANUSCRIPT

Contribution of Authors and Co-Authors

Manuscript in Chapter 3: 1

Author: Amy J. Ahlin, BSN, RN, DNP-FNP Candidate

Contributions: Evaluation and analysis of the clinical problem, literature review, project and intervention development, project implementation, data collection, analysis, and results dissemination.

Co-Author: Anne Brown, PhD, MSN, RN

Contributions: Content review, data analysis and display support, feedback.

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Contributions: Content review, feedback.

Manuscript Information

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- Published in a peer-reviewed journal

### Clinical Problem

Sepsis is an illness caused by dysregulation of the human body in response to an infection (Evans et al., 2021). Dysregulation from sepsis includes a complex series of events launched by the immune system in the presence of a pathogen, leading to life-threatening multi-organ dysfunction. Such a response is amplified by an uncontrolled systemic inflammatory response, resulting in massive vasodilation and increased capillary permeability (Hoffman & Sullivan, 2017). Early physical signs of sepsis include fever, warm skin, tachycardia, and bounding pulses. Confusion and decreased urine output are early signs of decreased organ perfusion and may be present before blood pressure drops in response to vasodilation (Hoffman & Sullivan, 2017). When recognized in its early stages, sepsis is easily treatable (World Health Organization [WHO], 2024).

The early recognition and treatment of sepsis is a global concern, as each year an estimated 30 million people are affected by sepsis (WHO, 2024). In the United States, sepsis accounts for nearly one-third of all hospital deaths, and 1.7 million Americans are treated for sepsis annually (Centers for Disease Control [CDC], 2023; Desposito & Bascara, 2024; Prest et al., 2021). Nationally, sepsis mortality rates have remained unchanged for the past 20 years (Horton et al., 2020; Prest et al., 2021). Furthermore, Americans living in rural areas face unique barriers to healthcare and higher sepsis mortality rates when compared to their urban counterparts (Kramarow, 2021; Oud & Garza, 2022).

While the existing literature on sepsis mortality rates in Montana is limited, Chang et al. (2023) found that rural living is associated with higher hospital mortality rates related to sepsis. Nearly one-half of Montana's population resides in rural communities (World Population

Review, 2024b). Montana has 69 hospitals statewide, and 50 of them are in rural regions (Rural Health Information Hub, 2024). The barriers to healthcare that rural residents experience include limited availability of healthcare providers, higher rates of un- or under- insured individuals, and traveling long distances to access healthcare (Chang et al., 2023; Sepassi et al., 2024; Watanabe-Galloway et al., 2022). Rural residents often have multiple comorbidities, are older in age, and tend to seek medical care at later stages of illness (Chang et al., 2023; Oud & Garza, 2022). Rural healthcare settings often fall behind in delivering appropriate sepsis care due to insufficient resources, low case volumes, and limited sepsis knowledge (Chang et al., 2023; Fiest et al., 2022).

A practice problem arises in rural settings with delays in adequate sepsis treatment and a higher risk of sepsis mortality (Chang et al., 2023). Sepsis is not widely recognized by the public and gaps in knowledge continue to exist among healthcare professionals (Fiest et al., 2022). The inability to recognize the symptoms of sepsis due limited awareness and knowledge, inadequate training, and lack of a sepsis definition are all notable barriers to the early recognition of sepsis (Fiest et al., 2022; Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021; Prest et al., 2021; Threatt, 2020). Additionally, rural hospitals nationwide fall behind when recognizing sepsis and providing appropriate sepsis care, often related to having limited knowledge and resources (Chang et al., 2023; Oud & Garza, 2022; Prest et al., 2021). A rural critical access hospital (CAH) in south-central Montana experienced 18 cases of sepsis in 2023 and 22 cases of sepsis in 2024, with a 15% case fatality rate over 2 years. The early recognition and treatment of sepsis is crucial to reducing overall mortality associated with a sepsis diagnosis.

### Literature Review

The early recognition and treatment of sepsis is essential for improving patient outcomes and reducing sepsis mortality (CDC, 2023). The current guidelines produced by the Society of Critical Care Medicine Surviving Sepsis Campaign (SSC) are considered the gold standard for the recognition and management of sepsis (Evans et al., 2021; Moore et al., 2019; Prescott & Ostermann, 2023). Sepsis education, including the SSC definition of sepsis, the signs and symptoms of sepsis, importance of early recognition and treatment, and mortality rates, improves recognition and leads to early intervention (Kangas et al., 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Threatt, 2020). Educational interventions for healthcare professionals demonstrate improvement in clinical knowledge, leading to the early recognition of sepsis (Bolte et al., 2022; Bray & Kennedy, 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Threatt, 2020).

The SSC guidelines recognize the importance of screening tools in the early recognition of sepsis and the use of multiple tools may be appropriate (Evans et al., 2021). Implementing sepsis screening tools in healthcare settings is recommended to reduce delays in treatment, as their use will alert clinicians to consider further evaluation of a patient's condition (Desposito & Bascara, 2024; Evans et al., 2021; Roney et al., 2020). The modified early warning score (MEWS) is a bedside screening tool used to predict patient deterioration based on physiological parameters and has been validated for sepsis screening (Desposito & Bascara, 2024; Horton et al., 2020; Subbe et al., 2001). A score is calculated based on patient heart rate, respiratory rate, systolic blood pressure, body temperature, and mental status (Bray & Kennedy, 2021; Roney et al., 2020). Higher scores indicate worsening patient condition, and  $MEWS \geq 5$  indicate the need

for urgent sepsis evaluation (Desposito & Bascara, 2024; Horton et al., 2020; Roney et al., 2020). MEWS can easily be used in triage and is an ideal bedside assessment tool (Chua et al., 2024).

The systemic inflammatory response syndrome (SIRS) criteria were first used for sepsis identification in 1991 and are highly sensitive for the detection of sepsis (Chua et al., 2024; Desposito & Bascara, 2024; Dugar et al., 2020). The SIRS criteria indicate an inflammatory response based on serum leukocyte levels ( $>12,000/\mu\text{L}$  or  $<4,000/\mu\text{L}$ ) along with physiological signs of deterioration that include temperature ( $> 38\text{C}$  or  $< 36\text{C}$ ), heart rate ( $>$  than 90 beats/minute), and respiratory rate ( $> 20$  breaths/minute) (Desposito & Bascara, 2024; Dugar et al., 2020). Further evaluation for infection must be considered when patients exhibit at least two of the four SIRS criteria (Desposito & Bascara, 2024; Horton et al., 2020; Nieves et al., 2021; Threatt, 2020).

Nurse-driven protocols that include sepsis screening tools and intervention checklists allow for early sepsis recognition and treatment, significantly improving patient outcomes (Bray & Kennedy, 2021; Moore et al., 2019; Nieves et al., 2021; Roney et al., 2020; Semanco et al., 2022; Threatt, 2020). Kangas et al. (2021) recognize that a nurse is often the first person that patients encounter, and nurses need to be leaders in sepsis recognition and treatment. Multiple studies have shown that when nurses are empowered to perform sepsis screening, the time for sepsis interventions is notably reduced (Nieves et al., 2021; Roney et al., 2020). The time to recognition, diagnostic intervention, and treatment of sepsis is reduced when nurse-driven protocols are implemented (Bray & Kennedy, 2021; Semanco et al., 2022).

### Conceptual Framework

The CDC Replicating Effective Programs (REP) framework guided this quality improvement (QI) initiative. The REP framework facilitates change within community-based healthcare settings by integrating evidence-based practices that align with local needs (Kilbourne et al., 2007). The four phases of the REP framework include: 1) the establishment of preconditions that identify the need for change and effective interventions, 2) a pre-implementation process that involves input from stakeholders and preparation for change, 3) implementation and evaluation of the identified interventions, and 4) maintenance and evolution to ensure sustainability. The use of the REP framework during this QI initiative allowed for a straightforward project process and adaptation of the interventions to meet the CAH's needs to ensure sustainable improvement.

### Initiative Aims

The overall aims of this QI initiative were to improve the recognition of sepsis and reduce sepsis treatment delays in a CAH. The project includes the implementation of validated sepsis screening tools, a nurse-driven protocol, and an order set in accordance with the current SSC guidelines for sepsis treatment. The project's specific aims included obtaining the recommended laboratory diagnostics within one hour of suspected sepsis identification and administering broad-spectrum antibiotics within three hours of recognized sepsis to improve sepsis outcomes in a CAH, with the goal to ensure all patients who present with sepsis receive the recommended treatment.

## Methods

### Context

The QI initiative took place in a rural CAH in south-central Montana. To be designated as a CAH, a hospital must maintain fewer than 25 acute care beds, provide 24-hour emergency services, be in a rural location greater than 35 miles away from another hospital, must participate in the Medicare Rural Hospital Flexibility program, and be owned by either a public or not-for-profit organization (Rural Health Information Hub, 2024). The project site is comprised of a five-bed emergency department and a sixteen-bed acute care unit and operates within a not-for-profit organization. The stakeholders involved include one Director of Nursing (DON), one Doctor of Nursing Practice student (DNP-S), two physicians, two physician assistants, one nurse practitioner, sixteen registered nurses (RNs), two licensed practical nurses (LPNs), sixteen certified nurse assistants (CNAs), and one member of the information technology (IT) team. All stakeholders, other than the IT representative, provide direct patient care within the emergency and acute care departments of the CAH.

### Interventions

Stakeholder education was a key feature of this QI initiative. All stakeholders were educated on the significance and impact of sepsis during the pre-implementation phase. The education curriculum covered the SSC sepsis definition, the signs and symptoms of sepsis, and the critical importance of early recognition, including national and local sepsis mortality rates. Additionally, education on the effectiveness of the MEWS and SIRS criteria screening tools and the SSC sepsis treatment guidelines were provided. Education occurred in person at the project site. Along with the group education, a sepsis simulation was provided by Simulation in Motion

Montana, an organization that provides simulation scenarios to reduce preventable medical errors and improve outcomes (Simulation in Motion Montana, 2025). This training was made possible through sponsorship and funding by the Montana Health Research and Education Foundation and the Montana Healthcare Preparedness Program grant. Stakeholders that were unable to attend the group session and simulation were provided one-on-one education by the DNP-S.

Members of the nursing team, including RNs and CNAs, often engage with patients first and should feel empowered to take the lead in recognizing and treating sepsis (Kangas et al., 2021). Screening tools are an essential component of early recognition of sepsis and are shown to decrease the time to intervention (Bray & Kennedy, 2021; Desposito & Bascara, 2024; Evans et al., 2021; Horton et al., 2020; Roney et al., 2020). In accordance with the current SSC recommendations, both MEWS and SIRS criteria were implemented into practice to improve the early recognition of sepsis. The MEWS is a simple bedside assessment; a score of three is an early indicator of patient deterioration, and a score of five or greater indicates an increased risk of mortality and necessitates urgent clinical evaluation (Desposito & Bascara, 2024; Horton et al., 2020; Roney et al., 2020; Subbe et al., 2001). Many patients with a MEWS  $\geq 3$  will also meet SIRS criteria. The SIRS criteria are met when a patient meets at least two of the four criteria and were utilized for further assessment of suspected sepsis (Desposito & Bascara, 2024; Evans et al., 2021; Horton et al., 2020; Nieves et al., 2021; Threatt, 2020).

Since both MEWS and SIRS rely on patient vital signs, screening for sepsis occurs for every emergency and acute care department patient at each vital sign interval. Patients in the emergency department receive vital sign assessments every fifteen to thirty minutes, and patients in the acute care department receive assessments at least every four hours. The MEWS and SIRS

criteria screening tools were integrated into the electronic health record (EHR). MEWS were displayed in the vital signs section of the EHR, appearing in blue for scores  $\geq 3$  or  $< 5$ , and in red for scores  $\geq 5$ . When a patient in the acute care department met two of the four SIRS criteria, a sepsis alert was activated in the EHR, prompting the nurse to review the patient's chart further. Subsequently, the nurse completed a Sepsis Treatment Checklist (Appendix B). The sepsis alert and treatment checklist does not activate for patients in the emergency department.

A nurse-driven protocol was implemented and initiated when patients were found to have a MEWS  $\geq 3$  or met two of four SIRS criteria. This protocol included blood collection of a complete blood count (CBC), complete metabolic panel (CMP), serum lactate level, blood cultures obtained from two different sites, and the administration of a 500 mL crystalloid fluid bolus of normal saline (NS). As part of the protocol, the provider of the day was promptly notified by the nursing staff upon identifying a patient with suspected sepsis, and the time of contact was documented in the EHR.

The sepsis treatment recommendations outlined in the current SSC guidelines were used to guide the order set for managing sepsis treatment. The three-hour treatment bundle recommendations were applied for patients who meet the MEWS and/or SIRS criteria. The three-hour bundle recommendations include investigating for potential sepsis causes, such as urinalysis, wound cultures, or point-of-care testing for influenza and SARSCoV2. Additionally, patients with leukocytosis (leukocyte levels  $< 4,000/\mu\text{L}$  or  $> 12,000/\mu\text{L}$ ) and/or serum lactate greater than 2mmol/L require the administration of broad-spectrum antibiotics within three hours from the time sepsis is suspected (Desposito & Bascara, 2024; Evans et al., 2021).

### Data Collection and Analysis

Data was collected on the number of stakeholders who attended the in-person group education and simulation session, as well as the number who received one-on-one education from the DNP-S. The perceived effectiveness of the simulation was assessed through surveys conducted both before and after the simulation.

Weekly case reviews were performed by the DNP-S, involving a thorough examination of all charts for patients admitted to the emergency department and acute care department. Vital signs were reviewed for each case, and a comprehensive case review was performed for those cases with a MEWS  $\geq 3$  or who met two of the four SIRS criteria, utilizing the designated sepsis chart review form (Appendix C). The data collected included the time from MEWS/SIRS identification to provider notification, along with details on whether the nurse-driven protocol was initiated and adhered to. If the protocol was not followed, stakeholders involved in the specific case were interviewed to identify barriers and explore ways to improve protocol compliance. Additionally, the time taken for blood collection (CBC/CMP, lactate, blood cultures) and the administration of fluid bolus was recorded. If sepsis treatment was deemed necessary, the time of antibiotic administration was recorded.

### Ethical Considerations

The QI initiative underwent review by Montana State University's Institutional Review Board prior to its implementation and was classified as a QI project, as it did not meet the federal definition of Human Subjects Research. In a CAH setting evidence-based interventions and established standards of care were implemented. The data collected was devoid of patient

identifiers in compliance with HIPAA regulations, and all data collected was securely stored at the project site.

### Results

For the education conducted at the project site, 57.5% of stakeholders (n=23) participated in the in-person group education and simulation session, while 42.5% (n=17) received individualized education from the DNP-S. To assess perceived effectiveness, a survey was administered both prior to and following the simulation activities. The pre-simulation survey was completed by 19 attendees, comprising 11 RNs and LPNs, three providers, and five CNAs. The post-simulation survey received responses from 14 participants, including seven RNs and LPNs, two providers, and 5 CNAs. The reasons for the incomplete responses to the post-simulation survey remain unclear.

Prior to the simulation intervention, stakeholder confidence levels were assessed as follows: 5% of attendees (n=1) categorized their confidence as unsatisfactory, 16% (n=3) as poor, 32% (n=6) as adequate, 42% (n=8) as good, and 5% (n=1) as excellent. Additionally, perceptions of competence prior to the simulation were reported, with 16% (n=3) identifying themselves as unsatisfactory, 42% (n=8) as adequate, 37% (n=7) as good, and 5% (n=1) as excellent.

Following the simulation, a marked improvement in confidence levels was observed. Specifically, 21% (n=3) of participants reported adequate confidence, 50% (n=7) indicated good confidence, and 29% (n=4) rated their confidence as excellent. Similarly, perceptions of competence also improved post-stimulation, with 21% (n=3) rating themselves as adequate, 50% (n=7) as good, and 29% (n=4) as excellent.

These findings suggest a notable increase in confidence and perceived competence following the simulation intervention. However, it is pertinent to note that the number of participants who provided feedback in the post-simulation survey was lower compared to the pre-simulation survey, potentially impacting the overall assessment of the intervention's effectiveness.

During a seven-week data collection period, twelve patients were identified with a MEWS of  $\geq 3$  and/or who met the criteria for SIRS. Among these cases, nine were identified in the emergency department, either exhibiting a MEWS of  $\geq 3$  or fulfilling SIRS criteria. The remaining three cases were identified within the acute care department, based on SIRS criteria and notifications generated by EHR sepsis alerts.

The sepsis checklist was completed for one case at 93 minutes post-sepsis alert. In all identified cases, healthcare providers were notified by nursing staff within 30 minutes or less following the identification of possible sepsis, with a mean notification time of 10.5 minutes. The nurse-driven protocol was implemented in nine out of twelve cases (75%). The time from initial recognition to protocol activation ranged from two to 65 minutes, with an average activation time of 17 minutes. Notably, in cases where the nurse-driven protocol was initiated, activation occurred in less than 30 minutes in 78% of cases (n=7). In scenarios where the protocol was not initiated, the primary barrier noted was the nursing staff's reliance on providers to initiate intervention and treatment orders.

In accordance with the SSC guidelines for sepsis management, comprehensive laboratory investigations were conducted, which included CBC, CMP, serum lactate level, and blood cultures obtained from two separate sites. The interval from the initiation of the MEWS or SIRS

criteria to the collection of CBC and CMP samples ranged from three to 38 minutes, with an average duration of 10.5 minutes. In contrast, the time from MEWS/SIRS identification to serum lactate level varied between three to 98 minutes, with an average duration of 30 minutes. Notably, three cases did not have serum lactate levels collected within the recommended one-hour timeframe, with collection times of 67, 86, and 98 minutes, respectively.

Blood cultures were obtained in only 50% of identified sepsis cases, highlighting a gap in compliance with the established guidelines. The average time to collect blood cultures was 69 minutes, with a range spanning from 12 to 129 minutes. According to the current SSC recommendations, blood culture collection should occur within one hour of recognition. However, only two cases successfully met this critical timeframe.

Additionally, fluid bolus administration was performed in nine out of the 12 cases, with an average administration time of 62 minutes. Only four identified sepsis cases received fluid bolus administration within the critical one-hour post-diagnosis timeframe, yielding a compliance rate of just 25%. Notably, challenges in obtaining intravenous (IV) access were identified as contributing factors to delays in fluid bolus administration in two cases. These findings underscore the need for improved adherence to SCC guidelines and highlight the need to address barriers to timely interventions in the management of sepsis.

Table 2. Time to Intervention. Times are in minutes.

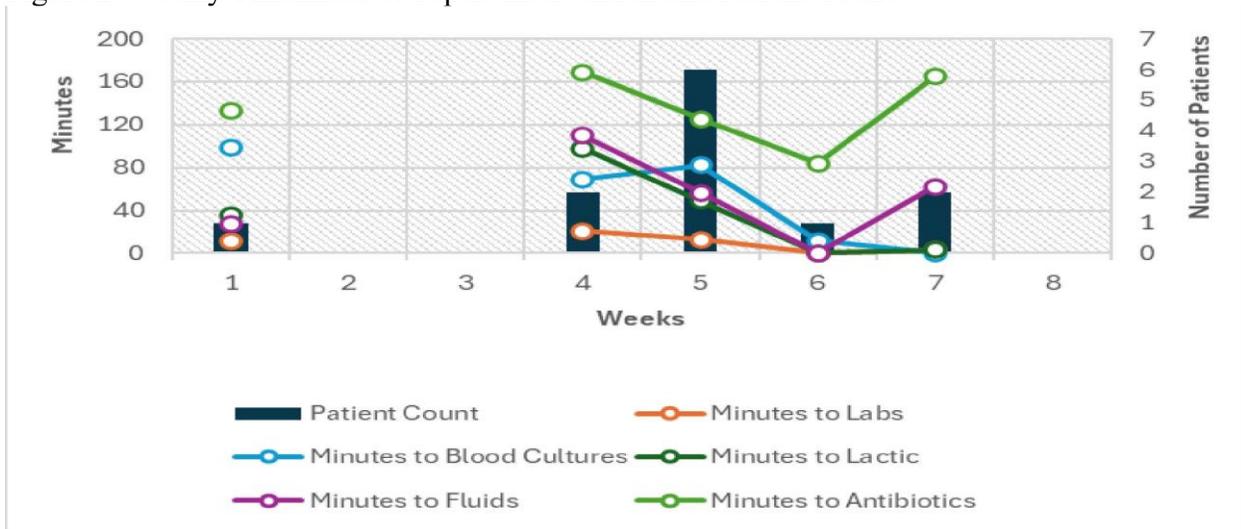
Patient	CBC/CMP	Serum lactate	Blood cultures	Fluid bolus
1	11	36	99	28
2	21	98	-	110
3	-	-	69	-
4	18	-	-	40
5	0	24	25	26
6	11	86	129	22
7	18	19	-	78

Table 2 Continued

8	38	-	-	80
9	10	67	92	93
10	0	0	12	-
11	7	-	-	-
12	3	3	-	62

In this study, we analyzed ten cases in which antibiotics were administered, all within the three-hour timeframe recommended by the SSC. Two cases did not receive antibiotic treatment due to viral infections and the absence of a definitive source of infection. The average time for antibiotic administration across all cases was 122 minutes, with a range of 74 to 170 minutes.

Figure 2. Weekly Timeliness of Sepsis Intervention and Patient Count.



In the cohort of patients treated in 2023, the average time to antibiotic administration was found to be 166 minutes, with a range from 65 to 420 minutes. Within this cohort, 11 out of 18 cases (61%) received antibiotics within the recommended three-hour timeframe. In contrast, the 2024 cohort demonstrated a decrease in average time to antibiotic administration to 138 minutes,

ranging from 30 to 420 minutes. In this group, 18 out of 22 (82%) cases received antibiotics within the three-hour timeframe.

Overall, these findings indicate a reduction in the time to antibiotic administration, with an overall decrease of 16 minutes compared to the preceding two years. Importantly, all identified sepsis cases adhered to the SSC guideline recommendations for timely antibiotic delivery. This quality improvement initiative underscores the progress made in optimizing antibiotic administration practices in sepsis management.

### Discussion

This QI initiative was conducted to enhance the recognition and treatment of sepsis in a CAH located in Montana. Evidence from this initiative, along with existing literature, indicates that targeted sepsis education for healthcare staff improves the identification of sepsis and minimizes delays in treatment. Additionally, sepsis simulation interventions improve the overall confidence and clinical competence of healthcare providers in managing patients with sepsis.

The implementation of sepsis screening tools is instrumental in reducing barriers to early detection of sepsis. The tools provide validation for suspected cases, prompting healthcare staff to provide further evaluation for sepsis in patients who demonstrate clinical deterioration. Following SSC guideline recommendations for the early recognition of sepsis has shown to improve adherence with recommended treatment protocols.

Literature supports the implementation of nurse-driven sepsis protocols, empowering nursing staff to take a proactive role in the identification and management of sepsis. Although the protocol was not utilized in every sepsis case throughout the duration of this project, there was a noticeable reduction in treatment delays at the CAH when compared to data from the previous

two years. The primary objective of this QI initiative aimed to ensure that patients presenting with sepsis to the CAH received timely recognition and received SSC recommended treatment. All patients with confirmed sepsis received the recommended broad-spectrum antibiotics within three hours, thereby meeting the overall treatment goal.

### Limitations

This QI initiative had several limitations, including low sepsis case volumes, constraints imposed by the project timeline, and challenges related to stakeholder education retention. Rural hospitals often experience low case volumes, which restricts healthcare staff's exposure to sepsis cases. Data collection for sepsis cases was conducted over a period of seven weeks; however, there were several weeks during this timeframe in which no sepsis cases were reported. Continuous sepsis education must be ongoing, as healthcare staff frequently depend on their colleagues to initiate aspects of the nurse-driven protocol.

### Recommendations

Sepsis education for healthcare staff is crucial across all healthcare settings, with a heightened importance in rural environments. The typically lower incidence of sepsis in rural areas, combined with limited exposure, results in diminished experience and knowledge among healthcare providers regarding sepsis. Ongoing education in sepsis management can improve overall clinical knowledge. Additionally, the integration of simulation training, provided by professional simulation organizations, has shown to improve the confidence and competency of healthcare staff in rural hospitals when managing sepsis cases.

The implementation of validated sepsis screening tools within the EHR is a strategy that improves the recognition of sepsis and leads to earlier treatment interventions, a vital

recommendation for rural healthcare settings. An elevated MEWS serves as an indicator of deteriorating patient conditions, prompting healthcare staff to initiate further patient evaluations for potential sepsis. Additionally, automated sepsis alerts, triggered upon the fulfillment of SIRS criteria, further notify staff of the necessity for additional assessment and potential treatment for sepsis. The use of validated sepsis screening tools in rural healthcare settings supports early sepsis recognition and leads to early intervention.

Adopting a sepsis protocol that aligns with the SSC guidelines ensures that patients with sepsis receive the recommended evaluations and treatments necessary to improve patient outcomes and reduce mortality rates. Whether nurse- or provider-driven, such protocols deliver structured evaluation and treatment checklists that reduce treatment delays.

### Conclusion

Rural populations encounter unique barriers in accessing healthcare, resulting in higher sepsis mortality rates when compared to urban populations (Kramarow, 2021; Oud & Garza, 2022). In addition, rural healthcare settings frequently have insufficient resources and limited sepsis knowledge due to the low volume of sepsis cases, which can hinder their ability to deliver appropriate sepsis care (Chang et al., 2023; Fiest et al., 2022). This QI initiative seeks to enhance sepsis knowledge within rural healthcare settings, aiming to improve sepsis recognition and reduce treatment delays. The provision of sepsis education, coupled with opportunities for simulation-based training, has been shown to improve the confidence and competence of rural healthcare staff when managing sepsis cases, even in the context of low case volumes. Additionally, the implementation of sepsis screening tools within EHRs serves to validate the need for further clinical evaluation of patient conditions. The establishment of a standardized

protocol for the assessment and management of sepsis is expected to reduce treatment delays and, consequently, improve patient outcomes.

## CHAPTER FOUR

## ADVANCED NURSING ESSENTIALS REFLECTION

Personal Reflection

The American Association of Colleges of Nursing (AACN) publishes a set of core competencies that guide the education of nursing professionals. Within those core competencies are ten domains essential to nursing practice (AACN, 2021). The Doctor of Nursing Practice (DNP) degree at Montana State University (MSU) implements the domains of the AACN core competencies into its curriculum to ensure its graduates provide quality and effective nursing care at the highest level long after degree completion. These essentials of nursing education will guide my practice throughout my future career as a family nurse practitioner (FNP).

Knowledge for Nursing Practice

Knowledge for nursing practice forms the foundations of clinical reasoning and judgment, focusing on translating evidence into practice (AACN, 2021). MSU's doctoral program for advanced practice nursing emphasizes this domain throughout the program coursework. The evidence-based practice coursework prepared me to recognize the quality of evidence presented in peer-reviewed articles and guidelines, and the practicality of when it may be appropriate to translate evidence into practice. Applying published guidelines into practice provides a systematic approach to clinical decisions and demonstrates responsible leadership in patient care.

During my quality improvement project, the *Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021* (Evans et al., 2021) was utilized to

guide the early recognition and treatment of sepsis in a critical access hospital. Understanding the importance of the evidence presented in the guidelines was crucial for implementation. Practical application should be considered when applying evidence into practice. Clinical reasoning was used when implementing validated sepsis screening tools and guideline recommendations. The ability to recognize sepsis helps guide patient treatment based on the severity of the illness, and early recognition is important for patient outcomes. Applying evidence and guidelines to practice improved sepsis recognition in a practical manner that was feasible for use in the critical access hospital setting.

### Person-Centered Care

Respectful, individualized, holistic care is essential to advanced nursing practice and supports positive outcomes (AACN, 2021). The DNP program has enhanced my ability to provide person-centered care through coursework in evidence-based holistic care, leadership and communication, and vulnerable populations. Through the evidence-based coursework in the DNP program, I was challenged to compare allopathic and integrative treatments when caring for dementia patients, encouraging a better understanding of incorporating both into practice. While allopathic therapies, such as medications, radiation, and surgical interventions, are beneficial, integrative care is needed for the holistic approach. Integrative care considers lifestyle, socioeconomic status, environment, psychosocial needs, and spiritual and cultural beliefs during the clinical reasoning process to build a plan of care that considers the whole patient, as well as current signs and symptoms. During clinical rotations, the combination of integrative and allopathic care was applied during patient interactions to ensure shared decision-making and individualized, person-centered care.

Leadership coursework provides self-reflection and allows for the recognition of how personality style applies to communication. Effective communication is imperative as it fosters caring relationships and connection with others. The application of leadership as an advanced practice nurse includes active listening that empowers individuals to share their experiences and be an engaged member in decision making. During my clinical rotations, I witnessed my preceptors practice effective communication with patients, family members, and staff through active listening, empathy, and connection, which empowered individuals to take responsibility for themselves and their care. Witnessing clear examples of effective communication has helped me apply the principles of active listening and empathy during patient interactions to ensure shared decision-making.

The vulnerable populations coursework encouraged me to consider individual and system-based barriers to care. Barriers to care were witnessed during clinical rotations in a variety of settings. During rotations in a rural health clinic, a retired insured gentleman was prescribed medication for treating irritable bowel syndrome. However, the out-of-pocket expense for the medication was over \$900, preventing him from completing the treatment. Many people with insurance live on a fixed income and cannot afford beneficial treatments unless their insurance covers the expense. Financial concerns are a barrier to care and should be considered to ensure person-centered care. Rotations in a school-based health center on a tribal reservation demonstrated the importance of taking healthcare to a population. Children in underserved communities have poor access to healthcare for a variety of reasons. Providing a healthcare clinic within the school allows children access to preventative healthcare, such as dental cleanings, sports physicals, hearing, and vision screenings, all during school hours.

### Quality and Safety

Dissemination and implementation of current practice guidelines and evidence-based interventions ensure quality and safe care for patients (AACN, 2021). The ability to discern and apply evidence-based interventions that mitigate risk is a crucial aspect of advanced practice nursing and was necessary when planning the implementation of a quality improvement project in a critical access hospital (AACN, 2021). A culture of patient safety was enhanced when a nurse-driven protocol was implemented that combined validated tools with current practice guidelines to improve sepsis recognition and treatment. The project empowered nurses to take the lead in early recognition of a decline in patient condition and in advocating for early intervention.

### Interprofessional Partnerships

Collaboration between healthcare professionals, patients, and communities facilitates partnerships in quality care (AACN, 2021). Intentional collaboration between healthcare professionals was utilized during my quality improvement project. Stakeholder buy-ins were necessary for project success. Stakeholders included administrators, physicians, advanced practice providers, information technologists, nurses and certified nursing aides. The integration of evidence-based processes strengthened collaboration, as nursing staff felt heard when they presented patient concerns to providers, since the process provided evidence for concern. The partnership created a team-based approach for the recognition and treatment of sepsis.

Community partnerships are needed to ensure successful healthcare programs. My clinical rotations at the school-based health center solidified the importance of community partnerships. Collaboration between tribal members, school administrators, and MSU faculty and

staff is necessary to ensure the continued success of the school-based health program. Healthcare professionals of multiple disciplines come together at the school-based health center to provide care to students during school hours, including dental care, physical and occupational therapy, and nursing care. Physical presence in the community is needed to build trusting relationships. During clinical rotations, I interacted with school staff members and parents, discussing what was most important to them during each conversation. While having lunch at a local restaurant, I talked with a tribal council member. He expressed gratitude for the school-based health center and encouraged our continued presence within the community, even suggesting tribal events the MSU team could attend to build further connections.

Part of my time in the MSU DNP program was as an Area Health Education Center (AHEC) scholar. This opportunity encouraged interprofessional interaction with dietitians, social work, nursing, medical, and therapy students. Training opportunities included a collaborative approach to case studies and independent learning modules on behavioral health integration, telehealth, social determinants of health, emerging health issues, and cultural competencies. Participation in this program has offered insight into improving interprofessional relationships in rural areas, using a team-based approach to improve shared decision-making and patient outcomes.

### Informatics and Healthcare Technology

Healthcare technologies and informatics processes support the decision-making practices of advanced practitioners. The implementation of technology into practice guides care and improves outcomes. The modified early warning score (MEWS) is a validated screening tool for the early recognition of sepsis (Desposito & Bascara, 2024; Horton et al., 2020; Subbe et al.,

2001). During my quality improvement project, the MEWS was implemented into the electronic health record (EHR) at a critical access hospital. Once implemented into the EHR, the MEWS provides an automated score based on vital signs and is associated with the deterioration of a patient's condition. Implementation of the MEWS into the EHR allowed healthcare staff to quickly recognize that a patient was declining, which led to early provider notification, early patient assessment, and further diagnostic workup.

Technology in healthcare can help provide efficient and safe care to patients. During clinical rotations, automated alerts in the EHR were used when placing medication orders to prevent drug interactions or prescription duplications. Smart links in the EHR allowed easy access to current standards of care and practices for reference when developing treatment plans. Dictation software and smart phrases were utilized by preceptors to reduce documentation time and improve efficiency. Technology also promotes patient engagement, as EHRs I have used have a patient access feature that allows for review of their health records and a messaging feature for communication that promotes patient-centered care.

### Conclusion

The AACN essentials to nursing practice have provided a strong foundation throughout my nursing education at MSU. As a DNP, I will carry this foundational knowledge into my practice. Advanced practice nursing requires lifelong learning and the ability to acknowledge and understand evidence-based practice, implement new evidence and guidelines into practice, and implore new technologies to ensure safe, quality, effective healthcare. The AACN essentials and MSU have prepared me for my career as an FNP. The domains presented by the AACN will continue to guide me in my practice for many years to come.

REFERENCES CITED

- American Association of Colleges of Nursing (AACN) (2021). *The essentials: Core competencies for professional nursing education*.  
<https://www.aacnnursing.org/Portals/0/PDFs/Publications/Essentials-2021.pdf>
- Bolte, T. B., Swanson, M. B., Ahmed, A., Bolte, T. B., Swanson, M. B., Kaldjian, A. M., Mohr, N. M., McDanel, J., & Ahmed, A. (2022). Hospitals that report severe sepsis and septic shock bundle compliance have more structured sepsis performance improvement. *Journal of Patient Safety*, 18(8), E1231-E1236. <https://doi.org/10.1097/PTS.0000000000001062>
- Bray, C., & Kennedy, C. (2021). Improving timely sepsis care using the surviving sepsis campaign one-hour bundle in a rural emergency department. *Journal of the American Association of Nurse Practitioners*, 33(3), 246-253.  
<https://doi.org/10.1097/JXX.0000000000000436>
- Buchman, T. G., Simpson, S. Q., Sciarretta, K. L., Finne, K. P., Sowers, N., Collier, M., Chavan, S., Oke, I., Pennini, M. E., Santhosh, A., Wax, M., Woodbury, R., Chu, S. V., Merkeley, T. G., Disbrow, G. L., Bright, R. A., MacCurdy, T. E., & Kelman, J. A. (2020). Sepsis among Medicare beneficiaries: 1. The burdens of sepsis, 2012-2018\*. *Critical Care Medicine*, 48(3), 276-288. <https://doi.org/10.1097/ccm.0000000000004224>
- Centers for Disease Control and Prevention. (2023). Hospital sepsis program core elements. *Centers for Disease Control and Prevention*. <https://www.cdc.gov/sepsis/core-elements.html>
- Chang, J. W., Medina, M., & Kim, S. J. (2023). Is patients' rurality associated with in-hospital sepsis death in US hospitals? *Frontiers in Public Health*, 11, Article 1169209.  
<https://doi.org/10.3389/fpubh.2023.1169209>
- Chua, W. L., Rusli, K. D. B., & Aitken, L. M. (2024). Early warning scores for sepsis identification and prediction of in-hospital mortality in adults with sepsis: A systematic review and meta-analysis. *Journal of clinical nursing*, 33(6), 2005-2018.  
<https://doi.org/10.1111/jocn.17061>
- Desposito, L., & Bascara, C. (2024). Review: sepsis guidelines and core measure bundles. *Postgraduate Medicine*. <https://doi.org/10.1080/00325481.2024.2388021>
- Dugar, S., Choudhary, C., & Duggal, A. (2020). Sepsis and septic shock: Guideline-based management. *Cleveland Clinic Journal of Medicine* 87(1), 53-64.  
<https://www.ccjm.org/content/ccjom/87/1/53.full.pdf>
- 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., Wiersinga, W. J., Alshamsi, F., Angus, D. C., Arabi, Y., Azevedo, L., Beale, R., Beilman, G.,...Levy, M. (2021). Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2021. *Critical Care Medicine*, 49(11), e1063-e1143.  
<https://doi.org/10.1097/ccm.0000000000005337>

- Fiest, K. M., Fiest, K. M., Krewulak, K. D., Brundin-Mather, R., Leia, M. P., Fox-Robichaud, A., Lamontagne, F., & Leigh, J. P. (2022). Patient, public, and healthcare professional's sepsis awareness, knowledge, and information seeking behaviors: A scoping review. *Critical Care Medicine*, 50(8), 1187. <https://doi.org/10.1097/CCM.0000000000005564>
- Health Resources and Services Administration. (2024, January). *Defining rural population*. <https://www.hrsa.gov/rural-health/about-us/what-is-rural>
- Hoffman, J., & Sullivan, N. (2017). *Medical-surgical nursing: Making connections to practice*. Philadelphia: F.A. Davis Company.
- Horton, D. J., Graves, K. K., Kukhareva, P. V., Johnson, S. A., Cedillo, M., Sanford, M., Dunson, W. A., White, M., Roach, D., Arego, J. J., & Kawamoto, K. (2020). Modified early warning score-based clinical decision support: cost impact and clinical outcomes in sepsis. *Jamia Open*, 3(2), 261-268. <https://doi.org/10.1093/jamiaopen/ooaa014>
- Kangas, C., Iverson, L., & Pierce, D. (2021). Sepsis Screening: Combining Early Warning Scores and SIRS Criteria. *Clinical nursing research*, 30(1), 42-49. <https://doi.org/10.1177/1054773818823334>
- Kilbourne, A. M., Neumann, M. S., Pincus, H. A., Bauer, M. S., & Stall, R. (2007). Implementing evidence-based interventions in health care: application of the replicating effective programs framework. *Implementation science : IS*, 2(1), 42-42. <https://doi.org/10.1186/1748-5908-2-42>
- Kramarow, E. A. (2021). Sepsis-related Mortality Among Adults Aged 65 and Over: United States, 2019. *National Center for Health Statistics*. <https://dx.doi.org/10.15620/cdc:110542>
- Moore, W. R., Vermuelen, A., Taylor, R., Kihara, D., & Wahome, E. (2019). Improving 3-hour sepsis bundled care outcomes: Implementation of a nurse-driven sepsis protocol in the emergency department. *Journal of emergency nursing*, 45(6), 690-698. <https://doi.org/10.1016/j.jen.2019.05.005>
- Nieves, A. U., Love, P. J., & Estey, A. J. (2021). Improving the accuracy of sepsis screening by nurses in hospitalized older adults: A pilot interventional study. *Journal of Gerontological Nursing*, 47(6), 27-34. <https://doi.org/10.3928/00989134-20210510-01>
- Oud, L., & Garza, J. (2022). Temporal trends in rural vs urban sepsis-related mortality in the United States, 2010-2019. *Chest*, 162(1), 132-135. <https://doi.org/10.1016/j.chest.2022.02.015>
- Prescott, H. C., & Ostermann, M. (2023). What is new and different in the 2021 Surviving Sepsis Campaign guidelines. *Medizinische Klinik-Intensivmedizin Und Notfallmedizin*, 118(SUPPL 2), 75-79. <https://doi.org/10.1007/s00063-023-01028-5>

- Prest, J., Sathanathan, M., & Jeganathan, N. (2021). Current trends in sepsis-related mortality in the United States. *Critical Care Medicine*, 49(8), 1276-1284. <https://doi.org/10.1097/CCM.0000000000005017>
- Roney, J. K., Whitley, B. E., & Long, J. D. (2020). Implementation of a MEWS-Sepsis screening tool: Transformational outcomes of a nurse-led evidence-based practice project. *Nursing Forum*, 55(2), 144-148. <https://doi.org/10.1111/nuf.12408>
- Rural Health Information Hub (2024). *Critical access hospitals*. <https://www.ruralhealthinfo.org/topics/critical-access-hospitals>
- Semanco, M., Wright, S., & Rich, R. L. (2022). Improving initial sepsis management through a nurse-driven rapid response team protocol. *Critical Care Nurse*, 42(5), 51-57. <https://doi.org/10.4037/ccn2022608>
- Sepassi, A., Li, M., A Zell, J., Chan, A., Saunders, I. M., & Mukamel, D. B. (2024). Rural-urban disparities in colorectal cancer screening, diagnosis, treatment, and survivorship care: A systematic review and meta-analysis. *The Oncologist (Dayton, Ohio)*, 29(4), e431–e446. <https://doi.org/10.1093/oncolo/oyad347>
- Simulation in Motion Montana (2025). *Why simulation?* <https://www.simmt.org/>
- Subbe, C. P., Kruger, M., Rutherford, P., & Gemmel, L. (2001). Validation of a modified Early Warning Score in medical admissions. *QJM : An International Journal of Medicine*, 94(10), 521-526. <https://doi.org/10.1093/qjmed/94.10.521>
- Threath, D. L. D., MSHI, RN. (2020). Improving sepsis bundle implementation times : A nursing process improvement approach. *Journal of Nursing Care Quality*, 35(2), 135-139. <https://doi.org/10.1097/NCQ.0000000000000430>
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., Lewin, S., Godfrey, C. M., Macdonald, M. T., Langlois, E. V., Soares-Weiser, K., Moriarty, J., Tammy Clifford, T., Tunçalp, O., and Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7). <https://doi.org/10.7326/M18-0850>
- Watanabe-Galloway, S., Kim, J., LaCrete, F., Samson, K., Foster, J., Farazi, P. A., LeVan, T., & Napit, K. (2022). Cross-sectional survey study of primary care clinics on evidence-based colorectal cancer screening intervention use. *The Journal of Rural Health*, 38(4), 845–854. <https://doi.org/10.1111/jrh.12631>
- World Health Organization. (2024) *Sepsis*. <https://www.paho.org/en/topics/sepsis>

World Population Review (2024a). *Columbus, Montana*. <https://worldpopulationreview.com/us-cities/montana/columbus>

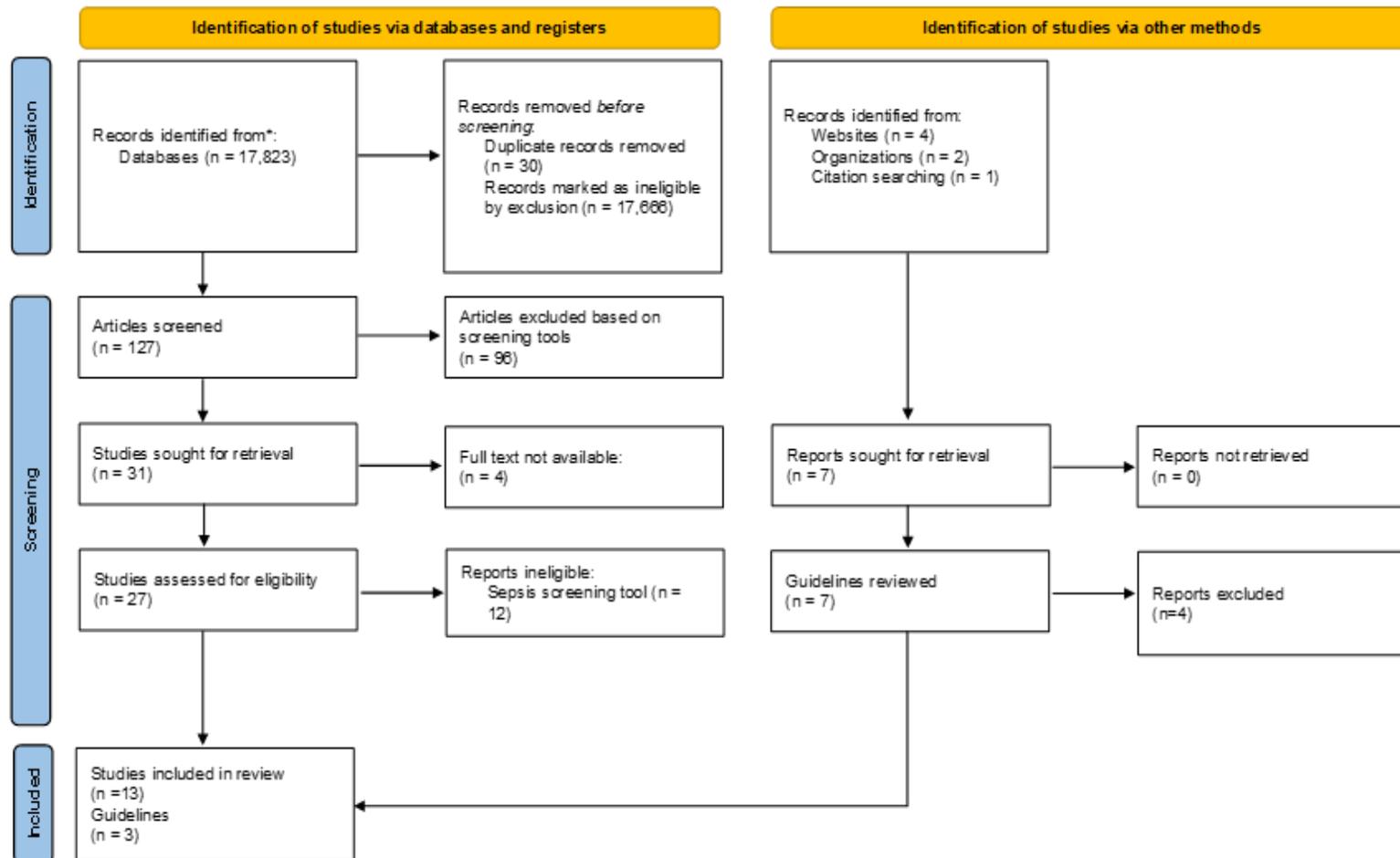
World Population Review (2024b). *Most rural states 2024*.  
<https://worldpopulationreview.com/state-rankings/most-rural-states>

World Population Review (2024c). *Stillwater county, Montana*.  
<https://worldpopulationreview.com/us-counties/montana/stillwater-county>

APPENDICES

APPENDIX A

PRISMA DIAGRAM OF LITERATURE REVIEW



Appendix A. PRISMA diagram for sepsis articles.

APPENDIX B

SEPSIS TREATMENT CHECKLIST

## Sepsis Treatment Checklist

Has this patient received IV Crystalloids >125cc/hour with 30ml/kg or targeted fluids.

- Yes  
 N/A  
 No - contacting physician

Have we had 2 consecutive MAP less than 65 mmhg?

- Yes - contact the physician  
 No

Has a repeat Lactic Acid been ordered and drawn within the past 3 hours?

- Yes  
 N/A  
 No - contacting physician

Were Blood Cultures Drawn in the 24 hours prior to meeting Severe Sepsis Time?

- Yes  
 N/A  
 No - contacting physician

Were Antibiotics ordered and administered after blood cultures?

- Yes  
 N/A  
 No - contacting physician

### Continued Sepsis Treatment

- Altered mental status  
 MAP < 60 = fluid bolus  
 Repeat cultures; new ABX  
 Repeat lactate if > 6 hours

Provider Notified



Date & Time of Notification

### Sepsis Treatment

- Begin Sepsis Treatment  
 Continue Sepsis Treatment  
 Sepsis Treatment Not Indicated

Reason Sepsis Treatment Not Indicated

- Considering Alternate Diagnosis  
 Patient/Family Request  
 Comfort Care Only

Explanation for Reason Not Indicated

Pt skin cold due to room temp. Temp recheck done and Temp WNL

Sepsis Treatments

APPENDIX C

SEPSIS CHART REVIEW FORM

**Sepsis Chart Review**

Encounter Date/Time:

Provider:

Nurse:

***Initial VS time:******MEWS:******SIRS Criteria (at least 2 of the following and suspected source of infection)***

- Temp <36 or >38
- HR > 90
- RR > 20
- WBC < 4000 or >12, 000 or >10% bands

**SIRS Alert Time:*****Provider notification time/Documented in EHR:******IV Placed and Time:***

- Fluid Bolus time/amount:
- ABX time/type:
- Vasopressors time/type:
- Document IV Difficulty if not able to establish IV access, if access available IO or IM Abx

***Lab Notification and Arrival time:***

- CBC with Diff
- CMP
- Lactate within first 3 hours, if >2 repeat in 6 hours
- PT/INR
- Blood Cultures x 2 prior to ABX 1: 2:
- UA Routine Reflex Culture
- Wound Culture if applicable
- CXR

***One or more signs of organ dysfunction***

- Lactic acid >2
- Hypotension (SBP<90 or MAP <65) x2
- Creatinine >2
- Urine output <0.5ml/kg/hr x2

- Bilirubin >2 mg/dl
- PLT count <100,000
- INR >1.5
- APTT > 60
- Acute Respiratory Failure requiring a new need for invasive or non-invasive mechanical ventilation

**Transfer Date and Time:**

**Death Date and Time:**

**Areas of Improvement:**