IMPLEMENTING A NURSE-DRIVEN CLINICAL DECISION SUPPORT TOOL FOR EARLY SEPSIS RECOGNITION

by

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Sabrina M. Lucero-Jackson, titled Implementing a Nurse-Driven Clinical Decision Support Tool for Early Sepsis Recognition, and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP project are contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

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DEDICATION

To my loving brother, Jonathan Russell Lucero, who served and sacrificed everything for his family, and he passed away from sepsis at the age of 34.

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ABSTRACT

Purpose: This Doctor of Nursing Practice (DNP) project aims to increase early recognition of patients with sepsis or septic shock by implementing a nurse-driven clinical decision support tool in the Northern Cochise Community Hospital (NCCH) emergency department (ED). In addition, a secondary purpose of this project was to consolidate descriptive information about local patient population diagnosed with sepsis, to give NCCH a better understanding of the scope of problem.

Background: Sepsis is a clinical syndrome caused by an infection that becomes dysregulated host response resulting in organ dysfunction (The Society of Critical Care Medicine [SCCM], 2017, 2021). The Centers for Disease Control and Prevention (CDC) data indicates that approximately 1.7 million adults in America develop sepsis each year. Nearly 270,000 die from it, which is approximately 1 in 3 patients. Health care expenditures related to sepsis totaled $23.7 billion in 2013 (CDC, 2016, 2019).

Methods: The method that guided this DNP project was FOCUS - Plan-Do-Check-Act (PDCA) four-cycle model to problem-solve for early sepsis recognition. The FOCUS process helped the sepsis team to identify root causes by analyzing acts from a retrospective chart review, pre-intervention. PDSA cycle allowed for a rapid assessment for changes and/or adjustments as needed, post-intervention.

Results: In total, a pre-intervention retrospective charts review was conducted, yielding 1,648 charts. After exclusions, a total of 32 patients' charts in 2020 and 45 charts in 2021 were used for this quality improvement (QI) project. These charts met SIRS/Sepsis criteria with and suspected

infection(s) that missed a sepsis diagnosis. Unfortunately, many charts lacked follow-up vital signs, and providers did not complete full work-up for a more accurate inclusion count.

Conclusions: QI project purpose was to increase early sepsis recognition at NCCH ED using nurse-driven CDST, and to consolidate descriptive information about local patient population diagnosed with sepsis, to give the NCCH better understanding of scope of the problem. A lot of rich data was obtained, and results were mixed, in large part due to constraints of COVID-19 pandemic, valuable insights were acquired and presented to NCCH management to be utilized in future nursing education and triage process in the ED.

INTRODUCTION

Sepsis is a medical emergency with a high mortality rate that will continue to grow if it is not recognized early (CDC, 2016). Sepsis is a challenging disease due to patients' innumerable variables in the emergency department (ED) upon presentation. Therefore, it is a public health priority to recognize and identify early sepsis strategies to prevent a catastrophic medical emergency (Centers for Disease Control and Prevention [CDC], 2016, 2019; Tidswell & Singer, 2018). Registered nurses (RNs) who perform triage in the emergency department (ED) are in a prime position to assist in early recognition of sepsis. This paper describes a quality improvement (QI) project that was undertaken at a small rural critical access hospital in southern Arizona to implement a nurse-driven clinical decision support to for early sepsis recognition.

Due to the medical emergency of life-threatening organ dysfunction, over the past 30 years, multiple professional medical organizations and groups have undertaken efforts to improve the recognition and treatment of sepsis. The Society of Critical Care Medicine (SCCM) partnered to develop the Surviving Sepsis Campaign (SSC), which is a set of guidelines and recommendations for clinical support to improve sepsis mortality and improve standards of care in the hospital setting (SCCM, 2008, 2017, 2021). In 1991, the American College of Chest Physicians (ACCP) and the SCCM organized a sepsis consensus conference. The intended purpose was to develop a conceptual and practical framework for infections causing a systemic inflammatory response. Later, in 1992, the "Systemic Inflammatory Response Syndrome" (SIRS) was introduced. In 2004 Sepsis-1 was published, then revised in 2008 with Sepsis-2. The SSC had evolved and expanded to provide the best clinical practice for international guidelines for early sepsis recognition (ESR) and early goal-directed therapy (EGDT). Then, the SSC task

force updated the clinical definitions in 2016, Sepsis-3, due to the increasing knowledge and understanding of sepsis pathobiology, omitting the SIRS criteria, and adding Sequential Organ Failure Assessment (SOFA) for best clinical practice guidelines and recommendations for ESR and EGDT (SCCM, 2017, 2021).

Despite the voluminous evidence, guidelines, and recommendations to support ESR and EGDT in the ED, they remain underutilized for early sepsis management (Burney et al., 2012; Sungkar et al., 2018). Evidence-based guidelines (EBG) merely provide guidance to support best clinical practice for ESR and EGDT. These guidelines are only recommendations and do not replace the providers' decision-making when a patient presents to the ED with signs and symptoms that may indicate sepsis (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). There are no diagnostic tests to confirm the diagnosis of sepsis. It requires clinical judgment and teamwork, informed by evidence-based guidelines.

Background Knowledge and Significance

Sepsis is a clinical syndrome caused by an infection that becomes a dysregulated host response resulting in organ dysfunction (SCCM, 2017). The CDC data indicates that approximately 1.7 million adults in America develop sepsis each year. Nearly 270,000 die from it, which is approximately 1 in 3 patients. Health care expenditures related to sepsis totaled $23.7 billion in 2013 (CDC, 2019). Sepsis can be divided into three categories: sepsis, severe sepsis, and septic shock. These clinical signs that define “sepsis” consist of two or more of the following: heart rate (HR) > 90, respiratory rate (RR) > 20, a temperature (T) > 38 or < 36 degrees Celsius, high white blood cells (WBC) > 1,200/mm or low WBC < 4,000/mm, and an increased immature WBC > 10% along with a suspicious or identifiable infection that led to the

onset of SIRS (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). “Severe sepsis” is sepsis with one or more complications of organ dysfunction (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). However, persistent low blood pressure in severe sepsis, despite adequate fluid resuscitation, with systolic blood pressure (SBP) < 90 mmHg, mean arterial pressure (MAP) < 60, or decrease in SBP > 40 mmHg from baseline becomes septic shock (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). Furthermore, the Sepsis-1 and Sepsis-2 guidelines define sepsis as a clinical syndrome that required both an infection and at least two SIRS criteria, however, SSC realizing that these criteria are not perfect and would need updating because there was no definitive consensus then or currently (Rhodes et al., 2017; SCCM, 2008, 2017, 2021).

As of 2016, the SSC consists of 55 international experts from 25 different organizations who published the most current Sepsis-3 publication of the international recommendations and best practice for sepsis (Rhodes et al., 2017; SCCM, 2008, 2017). They refined the guidelines for the new definition for sepsis and septic shock. Sepsis is a “life-threatening organ dysfunction caused by a dysregulated host response to infection.” Septic shock is a “subset of sepsis with circulatory and cellular/metabolic dysfunction associated with a higher risk of mortality” (Rhodes et al., 2017, p. 305; SCCM, 2008, 2017). Furthermore, they omitted the SIRS criteria and added new clinical guidelines known as the Sequential Organ Failure Assessment (SOFA). These guidelines define organ dysfunctions for acute changes in septic patients. A score $\geq$ 2 points with an infection diagnose sepsis (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). The purpose of the SOFA score is to identify septic patients and to calculate a 28-day prediction of their mortality risks (Rhodes et al., 2017; SCCM, 2008, 2017, 2021).

The SCC guidelines and recommendations for best practice are ESR and EGDT; if not recognized or treated, a measurable upturn in mortality results for each delayed hour in recognizing and administering the appropriate treatment (Rhodes et al., 2017; SCCM, 2008, 2017, 2021; Tidswell & Singer, 2018). The SCC strongly recommends that hospitals perform QI projects to ensure best practices by screening acutely ill and high-risk patients for sepsis (Rhodes et al., 2017). The rationale is multifactorial, as mentioned above. However, most importantly, the QI projects are meant to improve patient outcomes. Implementing a nurse-driven clinical decision support tool (CDST) in the ED at Northern Cochise Community Hospital (NCCH) was intended to increase awareness for ESR for this QI project.

Local Problem

The local problem of focus resides in NCCH ED located in Willcox, Arizona (AZ). According to the 2021 census, Cochise and Graham Counties has a combined total population of 165,100 that have access to NCCH for healthcare, including the burden of patients with multiple co-morbidities (US Census Bureau, 2021). These patients with multiple co-morbidities are at higher risk of developing sepsis. The ED is the leading portal of entry to the hospital for this population. Having ED staff capable of early sepsis recognition has a potential to save lives.

Unfortunately, the rural community hospital, which serves a large population, struggles with multiple issues common to rural critical access hospitals. It has a high staff turnover in all departments, especially among managers, nurses and providers (C. Aroz, personal communication, April 12, 2020). Nurses are understaffed, and the providers that serve this hospital work and live in other cities and states, making it difficult for providers to invest in making NCCH a better and long-term place to work. There is a lack of standardization of patient

approach, lack of consistency, intermittently poor teamwork, and lapses in communication, which leaves the managers in damage control the majority of their time, addressing problems (C. Aroz, personal communication, April 12, 2020). Due to the difficulties of staff turnover with new managers, nurses and providers, there are always new changes. The long-term staff has become complacent, and change becomes difficult for them to embrace, and there is an inconsistency that makes it difficult for the new staff to learn one consistent formalized standard of care (C. Aroz, personal communication, April 12, 2020).

More specifically, the ED has never had one designated triage nurse and did not have a triage room until recently (C. Aroz, personal communication, April 12, 2020). The triage room was eliminated after only a few months. Most ED nurses did not learn and experience what triage means. Their triage would flow into their nursing assessment without knowing or understanding how to use the Emergency Severity Index (ESI) triage algorithm system that provides clinically relevant stratification for prioritizing patients, and Level 3 is mostly used without truly understanding (C. Aroz, personal communication, April 12, 2020). Also, the lab and radiology departments do not always recognize the urgency necessary for follow-up results. Sometimes, the wait may take up to four hours (C. Aroz, personal communication, April 12, 2020). The managers' most significant challenges are lack of consistent follow through on the multiple processes or quality improvement changes that have been introduced over the years for better patient outcomes (C. Aroz, personal communication, April 12, 2020).

From January 2019 to April 2020, hospital administrators commissioned a retrospective chart review as a needs assessment, to identify problems that need addressing to implement a quality improvement intervention (P. Noland, personal communication, April 15, 2020). The

lack of early recognition of sepsis had been identified as a problem in 2019. In November 2019, a "sepsis shock clock" nurse-driven CDST had been implemented, which staff had a difficult time understanding (P. Noland, personal communication, April 15, 2020; C. Aroz, personal communication, April 12, 2020). However, due to the lack of SIRS criteria recognition, most nurses would wait for ED providers to diagnose a patient with sepsis, then filled out the sepsis shock clock CDST after the fact (C. Aroz, personal communication, April 12, 2020). Frequently, charts lacked follow-up vital signs that would have been significant indicators in recognizing SIRS criteria as patients deteriorated during the ED hospital admission. Furthermore, providers recognized and treated early septic patients, but treatment lacked consistent follow-through, some bundle times were not met, also charts lacked the proper billing code for a sepsis diagnosis, thus missing an opportunity for capturing revenue (C. Aroz, personal communication, April 12, 2020; P. Noland, personal communication, April 15, 2020). Therefore, NCCH management supported this subsequent QI project to improve early sepsis recognition.

Intended Improvement

Project Purpose

This quality improvement (QI) project aims to increase early recognition of patients with sepsis or septic shock by implementing a nurse-driven clinical decision support tool in the NCCH ED.

Project Question

Will a nurse-driven sepsis CDST (Appendix D) among the ED nurses increase the number of early recognitions by 50% of the adult patients at the NCCH emergency department?

Project Objectives

- Educate ED nurses about the SSC 2016 guidelines for early sepsis recognition.
- Implement a nurse driven CDST.
- Capture and improve early recognition of septic patients in the ED.

A secondary purpose of this project was to consolidate descriptive information about the local patient population with missed diagnoses with sepsis, to give NCCH a better understanding of the scope of the problem. This information will serve as an illustration of sepsis that can be used in future nursing education and QI projects at NCCH. The project also provided an opportunity to examine nursing practices with regard to triage in the ED, to identify other potential areas for improvement.

Theoretical Framework

The theoretical framework that guided this Doctor of Nursing Practice (DNP) QI project is the adult learning theory (ALT), also known as Knowles' model of andragogy. Andragogy's meaning is "the art and science of helping adults learn" (Chan, 2010, p. 27). This framework was perfect for guiding this undertaking because it holds foundational principles that interconnect how adults acquire knowledge for effective learning. The ALT values the adult learning process, uses a problem-based and collaborative approach to learning, which matches and supports the same concepts in the project model for change, with problem-solving collaboratively (Chan, 2010).

Malcolm Knowles developed and introduced the ALT based on five andragogy principles. The andragogy had been around since before 1833, which entailed a long history of evolution through the years. In 1926, this concept became popular by Eduard C. Lindeman. Then

Malcolm Knowles extended the work on andragogy to develop a theory of adult learning (Pratt, 1993; Chan, 2010). However, his perspective articulates that the most effective adult learning recognizes adults' learning needs, applies their experience, and acknowledges their self-directed intrinsic motivated nature (Pratt, 1993; Chan, 2010). Therefore, ALT is appropriate for the adult nurses' learning in the ED. The five ALT principles were employed in this QI project.

Five Andragogy Principles

1. *Self-concept*: Adult learning requires self-awareness, and the ED nurses who are self-directed in caring for their patients use their autonomous and independent thinking, based on their current knowledge. Whether an advanced or novice nurse, this concept never changes only grows.
2. *Role of Experience*: This is the most valuable and robust resource for ED nurses to continue learning daily in the ED with each patient. They learn and grow by adding new knowledge to their repertoire of skills and behaviors needed in the ED to improve patient-centered care.
3. *Readiness to Learn*: ED nurses are educated professional adults ready to learn new challenging disease processes, treatments, and guidelines. Readiness to learn is a critical concept for ED nurses. Their patients' lives depend on ED nurses staying current in their knowledge.
4. *Learning Orientation*: This refers to visual, auditory, and experiential learning. Learning orientation is a critical principle for most adults. An example of experiential learning is running a code blue for cardiac arrest. It is problem-centered, task-oriented, and life-

focused. When experiencing it instead of merely simulating a code, the learning is immediately applied, which then becomes added experience for their repertoire.

5. *Motivation to Learn*: This comes from within. Internal self-motivation drives the ED nurses to learn and feel the joy and fulfillment of helping other people and being useful to society. This contrasts with an external motivation of job security, higher income, or opportunities to advance.

After 25-years, Pratt (1993) took a different perspective and debated that andragogy rested upon two adult learning principles, based on the psychological and sociological perspective, which means adult learning includes the adult learner's agency and their social structures as significant antecedents. Problems exist in both environments, but it is the experience adults acquire that is most important (Pratt, 1993).

Furthermore, Pratt reports that knowledge transformation is an individual interpretation and integration of the adult learner because learning is more subjective than objective through experiences (1993). For example, ways to avoid medication errors are taught from day one in nursing pharmacology classes, plus additional continuing education yearly reminders. However, it is only when the error becomes the nurses' problem, that the nurse will genuinely learn from their experience. Therefore, it is imperative to collaborate and share experiences so nurses and providers can relate. These perspectives integrate with Knowles's five principles of andragogy.

A critical component of being effective with change is understanding adult learners by collaborating and sharing knowledge. Therefore, a multidisciplinary team approach of active participants with the experience and knowledge can empower nurses by building upon their education and experience for a change and better patient outcomes.

Concepts

Recognizing early sepsis is difficult and complicated due to multiple aspects of the disease process between the host and infecting microorganisms that triggered SIRS criteria for decades (Salomao et al., 2019). For example, sepsis once was the concept from the SIRS triggered by an infection (Sepsis-1 & Sepsis 2) to a potentially fatal organic dysfunction caused by a dysregulated host response to an infection with a high mortality (Sepsis-3) (Rhodes et al., 2017; SCCM, 2017, 2021; Salomao et al., 2019). The evidence transpired through robust databases into decades of research, but in different clinical settings, economic, and epidemiological contexts (Salomao et al., 2019) Therefore, this presents challenges along with the differentiation between sepsis, severe sepsis, and septic shock from Sepsis-1 to Sepsis-3 with the pathophysiology focused concept for the new criteria. It is recommended to use Sepsis-3 to recognize and diagnose sepsis and septic shock by using the Sequential Organ Failure Assessment (SOFA) score (Sepsis-3) to predict mortality rates, this was mostly studied in the ICU setting, as defined in Sepsis-3 below.

Defining Sepsis-1, Sepsis-2, and Sepsis-3

Systemic Inflammatory Response Syndrome (SIRS) (Sepsis-1 & 2)

Is an umbrella term to define patients with clinical symptoms of increase heart rate (HR) > 90 beats/min, respiratory rate (RR) > 20 breaths/min, temperature (T) < 36 or > 38, and white blood cell count (WBC) < 4,000 or >12,000, or > 10% bands (Rhodes et al., 2017; SCCM, 2008, 2017).

Sepsis (Sepsis-1 & 2)

Is two or more of SIRS criteria secondary to a suspected or clinically diagnosed infectious source, then later a positive culture adds to the validity. However, it is not required to diagnose (Rhodes et al., 2017; SCCM, 2008, 2017).

Severe Sepsis (Sepsis-1 & 2)

Is a syndrome of sepsis with end-organ dysfunction such as, but not limited to, elevated lactate > 2, hypotension, altered mental status, coagulopathy, decreased urine output, and oxygen saturation (Rhodes et al., 2017; SCCM, 2008, 2017).

Septic Shock (Sepsis-1 & 2)

Indicates severe sepsis with refractory hypotension of a systolic blood pressure (SBP) < 90 and/or a diastolic blood pressure (DBP) < 50, despite adequate intravenous (IV) fluid bolus, and IV fluid resuscitation of 30 ml/kg or a lactate $\geq$ 4, requiring vasopressors (Rhodes et al., 2017; SCCM, 2008, 2017).

Sepsis (Sepsis-3)

Is a "life-threatening organ dysfunction caused by a dysregulated host response to infection" (Rhodes et al., 2017, p. 306; SCCM, 2017, 2021).

Septic Shock (Sepsis-3)

Is a "subset of sepsis with circulatory and cellular/metabolic dysfunction associated with a higher risk of mortality" (Rhodes et al., 2017, p. 306; SCCM, 2017, 2021).

Sequential Organ Failure Assessment (SOFA) Score (Sepsis-3)

Confirms sepsis and mortality rates. The full SOFA score will not be discussed in this project, along with ICU monitoring and terms.

Quick Sequential Organ Failure Assessment (qSOFA) Score (Sepsis-3)

Is a mortality predictor that scores for a quicker assessment such as altered mental status, RR $\geq$ 22, and SBP $\leq$ 100, each worth one point and a score $\geq$ 2 suggests a high risk of a poor outcome and is associated with a 3 to 14 fold increase in inpatient mortality (SCCM, 2017, 2021; Salomao et al., 2019). Sepsis-3 recommends a quick calculation of the full SOFA score $\geq$ 2 with an infection to confirm a sepsis diagnosis and recommend not using the SIRS criteria (SCCM, 2017, 2021; Salomao et al., 2019). Additionally, the need to assess for any organ dysfunction along with serum biomarker tests for sepsis as defined next.

Serum Biomarkers

Serum biomarkers for sepsis are widely studied. The most used includes serum bicarbonate (HCO3), anion gap (AG) $\geq$ 12, procalcitonin (PCT), C-reactive protein (CRP), lactic acid (LA), and Sed-Rate. However, these are sensitive but not specific to sepsis. A systemic inflammatory reaction by the immune system to an injury will elevate these markers. These biomarkers help support sepsis diagnosis and may allow early intervention to reduce the high risk of mortality.

Sepsis Bundle

Is the recommended and appropriate best practice management for suspected or diagnosis of septic patients in the ED within one-three hour: oxygen Sp02 > 94%, IV fluid resuscitation, serial lactic acid, blood cultures, broad-spectrum IV antibiotics, and measure urine output hourly (Rhodes et al., 2017; Keeley, Hine, & Nsutebu, 2017; SCCM, 2017, 2021).

The technology and research are available in the United States (US) for best practice for early sepsis recognition and EGDT by understanding these concepts. As is evident, sepsis has

multiple defining factors, and there are numerous sensitive biomarkers that are not specific to early sepsis recognition. However, these concepts provide a useful framework for nursing education. They also provide the foundation to develop and perform a nurse driven CDST to identify signs and symptoms for early sepsis recognition at NCCH.

Literature Synthesis

Evidence Search

Several relevant studies were identified by searching PubMed, Google Scholar, and Cumulative Index to Nursing and Allied Literature (CINAHL). The search yielded thousands of articles, which were skimmed by the titles that best met the inclusion criteria. The following key words were used: *systemic inflammatory response syndrome (SIRS), sepsis, severe sepsis, septic shock, emergency department, emergency room, early goal-directed therapy (EGDT), clinical decision-support tool (CDST), sepsis screening tools, early sepsis symptoms, sepsis biomarkers, surviving sepsis campaign,* and *qSOFA*.

The article inclusion criteria included: published in the English language, within the last fifteen years, peer-reviewed, adult population > 16 years-old in the ED setting, early sepsis, severe sepsis, septic shock, sepsis screening tools, roles of nurses in the ED, sepsis screening in triage, implementing an ED guideline, protocol or CDST, and qSOFA for early sepsis recognition. Ten articles were selected that applied to the general concept to the quality improvement project at NCCH (Figure 3). Out of the 10 articles, six were chosen before the SSC 2016 publication, and four after, to compare effectiveness of using SIRS vs qSOFA criteria for early sepsis recognition.

Comprehensive Appraisal of Evidence

It is evident through this comprehensive appraisal that SSC and researched articles agree that sepsis is a worldwide leading cause of mortality. This is especially true in the elderly and patients at high-risk, but ESR can decrease the mortality rate (Jones et al., 2007; SCCM, 2008, 2017, 2021; Francis et al., 2010; Burney et al., 2012; Holder et al., 2016; Sungkar et al., 2018). It is also agreed upon for best practice that education for healthcare staff and using EBG is paramount in reducing sepsis mortality rates (Jones et al., 2007; SCCM, 2008, 2017, 2021; Francis et al., 2010; Burney et al., 2012; Holder et al., 2016; Hung et al., 2018; Sungkar et al., 2018).

The SSC and researched evidence support a strong recommendation for best practice of ESR and EGDT for sepsis and septic shock to reduce mortality (Jones et al., 2007; SCCM, 2008, 2017, 2021; Francis et al., 2010; Burney et al., 2012; Holder et al., 2016; Hung et al., 2018; Sungkar et al., 2018). For this project, the aim remains focused on the SSC Sepsis-3 recommendations for best practice screening for ESR by educating the ED staff and implementing a CDST for acutely ill and high-risk patients presenting with suspected infection in the ED setting (Rhodes et al., 2017; SCCM, 2008, 2017, 2021). Furthermore, Sepsis-3 recommends using the quick SOFA (qSOFA) scoring for best practice in ESR. However, four studies report that qSOFA is not sensitive to ESR. It is sensitive to use in the Intensive Care Unit (ICU) setting to predict patients' mortality and still prefer SIRS criteria for ESR in the ED setting (SCCM, 2008, 2017, 2021; Hung et al., 2018; Anand et al., 2019; Tusgul et al., 2017). Plus, several studies believe and argue, despite the removal of SIRS criteria and redefining sepsis

definition SIRS is a more a sensitive indicator for ESR in the ED setting (SCCM, 2008, 2017, 2021; Hung et al., 2018; Anand et al., 2019; Tusgul et al., 2017).

Research also supports the value of including nurses in early sepsis identification. In the ED, Nurses may not realize they play a critical role in ESR. Their role is critical, because they are the first clinical staff who encounter patients waiting to be triaged. They can recognize, identify, and initiate sepsis treatment to impact mortality positively (Gatewood et al., 2015). Research indicates that nurses can significantly improve mortality by using an inexpensive screening tool during triage to recognize and initiate sepsis protocols on their initial contact in the ED (Tromp et al., 2010). This initial contact will improve the quality of care for an all-around ESR and EGDT improvement (Tromp et al., 2010; Mitzkewich, 2019). Overall, research shows a lack of knowledge, lack of consensus on sepsis criteria, lack of departmental guidelines, and underutilized tools for ESR, EDGT, and bundle times for treating early sepsis (Burney et al., 2012; Hung et al., 2018).

Strengths of Evidence

According to the SSC (Sepsis-3), it is best practice for hospitals to have a performance improvement program to screen for sepsis in the acutely ill and high-risk patients (SSC, 2016; SCCM, 2008, 2017, 2021). A meta-analysis (Level-1) of 50 observational studies showed significant compliance with the SSC guidelines and reported a decrease in mortality (SCC, 2017; SCCM, 2008, 2017, 2021). Therefore, observational studies begin as low-quality evidence; however, the quality can be upgraded due to, but not limited to, a larger study with a larger magnitude of the effect, showing higher quality. Plus, “best practice” is considered an upgrade

for strong recommendations, as noted in the SSC Sepsis-3 guidelines (SCC, 2017; SCCM, 2008, 2017, 2021).

Therefore, several larger observational studies discussed in this literature research and appraisal are considered strong evidence due to their size, less bias, and significant results (Tromp et al., 2010; Burney et al., 2012; Tusgul et al., 2017; Hung et al., 2018). One observational study regarding nurses' role in recognizing early sepsis, and treating sepsis patients in the ED, per SSC guidelines, was conducted in a large teaching hospital. It provided external validity that led to a grade B recommendation and was endorsed by 11 professional organizations (Jones et al., 2007). For this QI project, the goal is to have successful results, despite the small sample size, with a nurse-driven CDST in the ED, for early sepsis recognition that will lead to faster care for early septic patients to meet those bundle times recommended by the SSC guidelines. However, actually measuring bundle times could be a future study at NCCH ED.

Weaknesses of Evidence

As mentioned above, observational studies begin at lower quality levels but can be upgraded to be stronger. With that in mind, a few studies chosen for this literature search were single hospitals with fewer chart reviews. Unfortunately, some reported missing and inconsistent charts, missing lab values, conducted voluntary surveys, personal bias expressions, one evaluator, and one sole reviewer, which contributes to weaker evidence. More robust evidence may have some of the same issues as mentioned. However, their sample size is more extensive in numbers, giving them more power, less bias, inconsistency, and a larger magnitude of effects or other factors. Despite these weaknesses, a study can still have good positive results but is more

specific to their environment than a generalized population. However, the general theme and results remain the same, whether with increased strength or weakness of the evidence.

Gaps and Limitations

The most significant gap noted in four studies is that SIRS criteria are more sensitive than qSOFA for early sepsis recognition. Neither is specific in the ED setting. However, qSOFA is more sensitive in the ICU setting to assess organ dysfunction and predicting mortality with or without infection (Hung et al., 2018; Tusgul et al., 2017; Anand et al., 2019; Mitzkewich, 2019). Several studies reported that the role of qSOFA has been controversial in sepsis screening and management. Plus, SSC lacked consensus with the new changed definition (Anand et al., 2019; SCC, 2017; SCCM, 2008, 2017, 2021).

Furthermore, before labs are drawn for critical patients the qSOFA tool may help by prompting ED nurses and providers to identify and consider sepsis to treat appropriately (Anand et al., 2019; Tusgul et al., 2017). A couple of studies have recommended that a more sensitive and specific tool is needed for risk stratifications, plus one sensitive for prehospital and triage before labs are drawn (Anand et al., 2019; Tusgul et al., 2017). In four studies that compared SIRS vs. qSOFA, the SIRS criteria were a more sensitive indicator for ESR with suspected or known infection. Furthermore, qSOFA is a tool best used in the ICU setting for the risk of mortality, with or without an infection (Tusgul et al., 2017; Anand et al., 2019).

Anecdotal evidence from hospitalist providers suggests that the lack of consensus with CMS, Medicaid, and private payors makes it challenging to know which guidelines and recommendations to follow. At the time of this QI project CMS was using Sepsis-1 for a Sepsis diagnosis, then in 2021 it was changed to Sepsis-2, which the definition has not changed like in

Sepsis-3 (Center for Medicare & Medicaid Services [CMS], 2021). The private payors use qSOFA/SOFA, which leads to a peer-to-peer discussion with the payor for admission approval with evidence of sepsis without septic shock. This gap is significantly due to the lack of consensus for the proper diagnosis of sepsis.

METHODS

Project Design

Quality improvements (QI) are complicated and challenging, especially in a complex healthcare system. There are many QI methods that may meet the needs of patients, but the team needs to perform well to meet those needs, and selecting the best method is critical for the appropriate change for the facility.

FOCUS-Plan-Do-Check-Act (PDCA)

The method that will guide this DNP project is the FOCUS-Plan-Do-Check-Act (PDCA) four-cycle model to problem-solve for early sepsis recognition. The first step of the model is FOCUS, an acronym that is part of the *plan* step in the PDCA model, similar to the process already in use at NCCH, to organize a systematic problem solving (SPS) structure for obtaining useful information in preparation for a team to recognize, understand, and communicate problems that need solving (Taylor et al., 2014; AHRQ, n.d.). The FOCUS process helped the NCCH sepsis team to identify the root causes by analyzing the facts presented through an EHR retrospective chart review, and to provide a well-defined baseline for measuring progress outcomes.

A visual depiction of the FOCUS process for the NCCH ED SPS structure is identified in Figure 1. However, to better understand the FOCUS SPS structure, further information is provided below to understanding the acronyms (Taylor, 2014):

- ⇒ **F –** Found a problem that needs resolving that relates to the organization for change to meet a specific targeted goal.
- ⇒ **O –** Organize a committed team (key stakeholders & nurse champions) that is committed to the cause, work diligently for continuous integration, regularly report as scheduled, redirect staff if needed, and be available to nurses and providers. The commitment of the team will model, inspire, challenge and encourage others to sustain the change.
- ⇒ **C –** Clarify and understand the current organization's background, workflow, nurses' skill levels, working environment, and the barriers. Clarifying enhances communication to help define detailed specifics for change and resolution to problems.
- ⇒ **U –** Understanding that the cause of a problem may be multifactorial. Some causes may relate to other causes, creating a chain of events, so a root cause analysis is essential to correct the problem.
- ⇒ **S –** Select a QI initiative to meet the organizations targeted goal, using countermeasures to make the necessary and sustained changes. The selected QI is a nurse-driven sepsis CDST at NCCH emergency department for early recognition, to test whether performance can improve with nurse and provider education about early recognition of sepsis, and by providing a CDST.

Once the planning has been agreed upon, the next step is to implement (Do) nursing education and introduce the sepsis CDST to be tested through the four-step model of change. This process can identify real-world problems for testing change, similar to the Plan-Do-Study-Act (PDSA) cycle. The Plan-Do-Check-Act (PDCA) (Figure 2) cycle allows for implementing small-scale changes with the idea for a rapid assessment, making adjustments over and over as needed. By the fourth step (Act), when implementation proves successful, the change can be adopted (Taylor et al., 2014). This cycling process provides a valuable and straightforward project planning tool. Furthermore, as research continues to evolve, it allows for continuous innovation and improvements to evolve in healthcare settings.

Model for Implementation

The FOCUS-PDCA (Figures 1 & 2) model is essential in guiding this QI project at NCCH because if ED nurses better understood and recognized early sepsis, they could serve this population better. Such knowledge will increase early sepsis recognition, sepsis compliance, improve early bundle treatment, decrease sepsis mortality, and improve patients' length of stay for an overall better outcome. However, for this project, the focus is on early recognition in the ED.

Figure 1

The Model for Improvement: FOCUS

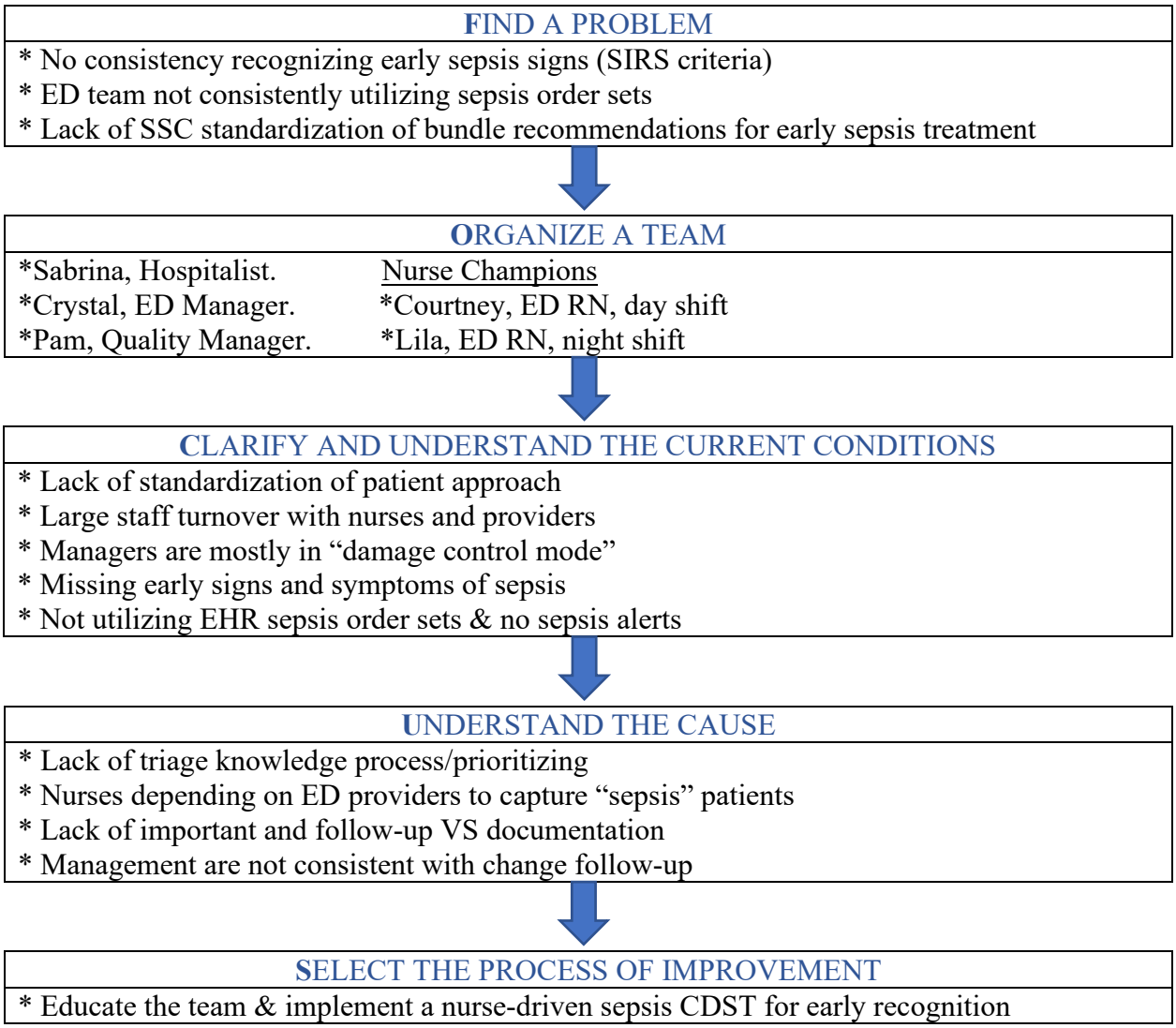
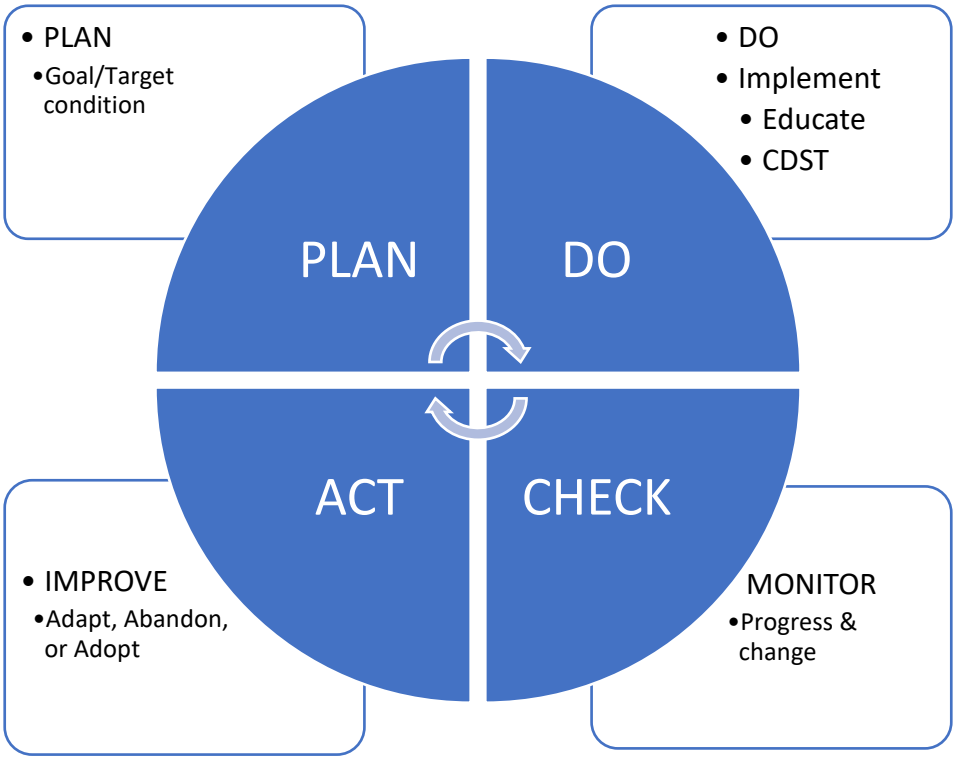


Figure 2

Plan-Do-Check-Act (PDCA) Cycle



Population, Setting, and Stakeholders

The population of interest is the ED staff at NCCH ED, specifically the emergency nurses. However, the providers will be included in the ESR educational presentation to understand the nurses' role in utilizing the CDST in the ED. The staff is responsible for managing patients care, including ESR and management. NCCH's annual average visits over the last two years of 2018 and 2019 were 5,297 patients (P. Noland, personal communication, May 2, 2020). Initially, the staff included eight ED full-time nurses, eight ED part-time nurses, and eleven ED providers employed at the time of the project. Throughout the implementation of this

QI project, nursing staff changed, and travelers were added to the staff. The ED manager changed three times, and a new interim Chief Nursing Office (CNO) was appointed.

The stakeholders include the patients and the ED staff that implemented the QI project using the nurse-driven CDST on initial patient contact with suspected or known infection for ESR. Other stakeholders (Figure 3) are the members of the sepsis team, including the project coordinator (this author), the quality control (QC) manager, three ED nursing managers, and two ED nurse champions. Indirect stakeholders include ED physician director, two chief nursing officers and one interim (CNO), and two Chief Executive Officers (CEO), who supported this project. Throughout the project, the hospital's stakeholders and staff expressed their desire for excellent patient care and their commitment to evidence-based practice (EBP) changes for improvement.

Table 1

Team Stakeholders' Primary Responsibilities

Team Stakeholders	General Hospital Responsibilities for Optimal Patient-Centered Care and Outcomes
Project coordinator (this author) who is a Nurse Practitioner, Hospitalist	Responsible for making patient-centered clinical and medical decisions based on best practice for optimal patient outcomes. Recommend and/or initiate QI changes.
Quality control manager	Responsible for assessing how well the organization is performing, as a whole and in each department by monitoring the safety performance, functions, and compliances with regulations and best practice.
ED nursing manager	Responsible for decision-making about how well their work area is operating, mentoring staff, planning, goal setting, proposing areas for improvement, and monitoring staff performance.
Nurse Champions, ED staff nurses	Responsible for triage, assessing patients, managing care orders, communicating with providers, providing patient-centered clinical care, and making recommendations for patient safety (catching provider errors & offering suggestions) based on best nursing practice for optimal patient outcomes.

Planning the Intervention

Phase 1

The timeline for implementation of this project was eight weeks. The first phase started in January 2020. It consisted of a meeting with the QC manager to decide the best course of action for the hospital and ED staff that would benefit the most. It was a time for brainstorming a plan, which changed multiple times. After deciding to improve sepsis care in the ED, Phase 2 got initiated for a needs assessment.

Phase 2

In the second phase, a needs assessment was conducted by retrospective chart review that started at the end of March 2020, with the decision to improve sepsis care in the ED. The QC manager pulled charts from the electronic health recorders (EHR) using ICD-10 codes for sepsis and urosepsis diagnosis, but it only yielded 21 charts over 12 months. Then the chart search was expanded to patients for whom a lactic acid blood test and blood cultures were ordered, which yielded 415 more charts. At the end of July 2020, the process of the chart reviewing ended. The needs assessment identified multiple problems, and it appeared that a lack of early sepsis recognition in the ED, on initial patient contact with suspected or known infection was a problem that warranted an improvement.

Phase 3

The third phase began in August 2020, brainstorming the best approach for this project, garnering stakeholders' buy-in, and forming a sepsis team for this QI project. Once approved by the stakeholders, the sepsis coordinator and QC manager arranged a sepsis team formation. At

the time, the final team included this author, QC manager, the ED nursing manager, and two ED nursing staff champions, one for the day shift and the other for the night shift.

Phase 4

The fourth phase was the completion of the proposal, sepsis education materials, and CDST that were submitted to the College of Nursing (CON), then to the University of Arizona (UofA) Institutional Review Board (IRB). The IRB's role was to ensure that the appropriate steps and measures were in place to protect participants from any risks and safeguard their privacy (Polit & Beck, 2012). IRB granted their approval in 10/27/2020 (Appendix A).

Phase 5

In the final phase, the sepsis coordinator implemented the QI project using the conceptual and theoretical framework chosen for this QI project. The implementation was an educational presentation on early sepsis recognition and utilizing the sepsis CDST as recommended by the SSC guidelines and recommendations. The purpose was to improve patient-centered care by ESR to prevent septic shock and reduce sepsis mortality. See Appendix G for project timeline.

Participants and Recruitment

With this project being a quality improvement undertaking, the ED nursing staff were invited to participate in ESR by utilizing a CDST (Appendix D) on their initial patient contact during triage with a suspected infection. Recruitment consisted of an informational flyer (Appendix C) that was placed in the break rooms, ER and med-surg nurses' stations, and emailed to all nursing staff from the ED director.

The inclusion criteria to participate was the willingness of ED staff nurses performing triage on initial patient contact. Initially, the ED staff nurses who agreed to participate were

scheduled to attend an educational presentation on ESR (Appendix E) and using the CDST in the hospital conference room. Those ED nurses and providers who could not attend were to be given the sepsis presentation on paper to read at their earliest convenience or have it sent to them via email by the ED nursing director. The ED providers received the presentation in their emails by the ED medical director.

However, unfortunately due to the COVID-19 pandemic in 2020 and early 2021, all face-to-face meetings in an open classroom were cancelled. Therefore, the presentation was sent out by the ED nursing director to all nursing staff via email. Upon follow-up with the ED nursing staff, six nurses did not see the presentation, two nurses had seen it in their email but did not have time to listen to it, and five nurses reviewed it.

Consent and Ethical Considerations

A DNP QI project was being conducted, and the information was extracted from the patient's chart related to the SSC Sepsis-3 guidelines and recommendations. There was no direct contact with patients concerning their care. No interviews were conducted with patients or family members. The Health Insurance Portability and Accountability Act (HIPAA) compliance was followed per protocol with patients' abstracted information from the electronic health records (EHR). No patients' identifiers, other than their chart ID number and age, were collected. The information was placed in a binder that does not leave the hospital and was kept in the ED manager's locked office.

Respect for Persons

Respect for persons ensures the ED staff has the right to make their own choices and decision to participate or not without the feeling of peer pressure or coercion (Polit & Beck,

2012). Participation was voluntary and did not receive any repercussions from management if staff did not participate in this QI project. Furthermore, the participants were educated ED staff members who were instructed and understood the QI project's nature to make an informed autonomous decision.

Beneficence

Beneficence is the duty to minimize harm and maximize benefits (Polit & Beck, 2012, 2014). Despite this not being a generalizable research project, an ethical principle's obligation remains the same to do good, show kindness, and compassion (Fremgen, 2019). Additionally, the ED staff nurses have the right to avoid unnecessary risks of harm or discomfort, such as emotional distress, social bullying from their peers, or any financial obligation imposed on them (Polit & Beck, 2014).

Justice

Justice is the right for all the ED nursing participants to be treated with equality, no prejudice, the right to privacy, and fairness regardless of any issues that may arose during the QI project period and ensure that they were not discriminated against (Polit & Beck, 2012; Fremgen, 2019). For example, if they choose not to participate, this remained confidential and private, and decisions of those who opted-out of the QI project were treated in a nonprejudicial manner and maintained the respect of peers in the professional relationships regardless.

Data Collection and Analysis

The QC manager extracted the data collected for this QI project using a Strategic Quality Support System (SQSS). SQSS is a robust risk management tracking tool for quality and performance improvements for financial success, with the ability to automatically create real-

time data reporting, such as dates, times, demographics, diagnosis, and disposition for patients' ED charts from the EHR. A retrospective chart review served as the primary data collection method, both pre- and post-intervention, and was tracked on an Excel spreadsheet for descriptive statistical analysis. The data information was printed, placed in a binder and remained secure to protect patient information and was reviewed while on sight.

To extract the chart information of variables to measure, the sepsis coordinator created a standardized screening sepsis audit form (Appendix F) to provide uniformity of the variables for comparison. Then each patient's chart was screened for SIRS/Sepsis criteria with a suspected infection. Those patient charts that did not meet SIRS criteria with and without suspected infection were excluded.

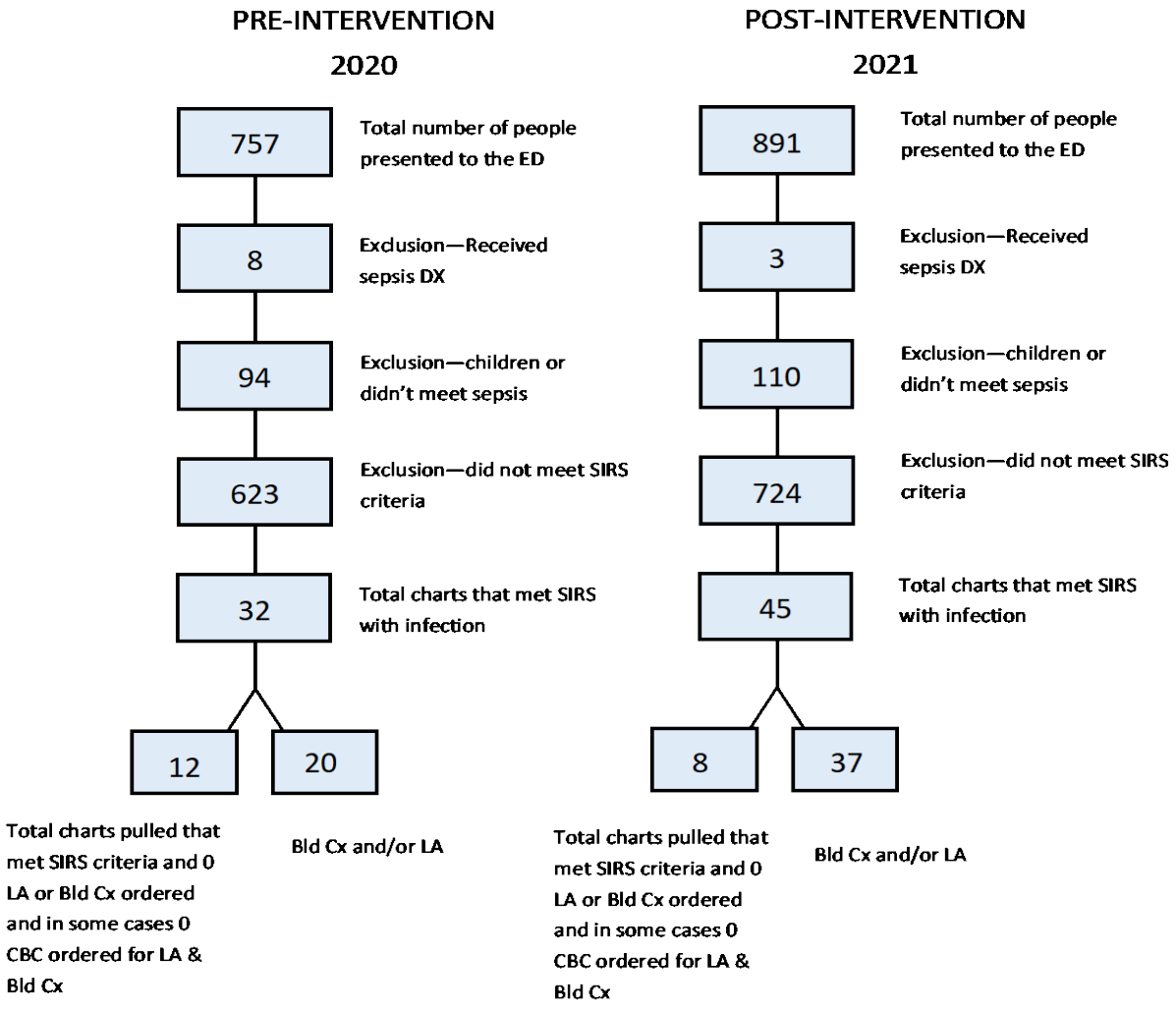
RESULTS

After receiving consensus on the before and after intervention chart reviews that meet SIRS/Sepsis criteria, the data was entered and tracked on an Excel spreadsheet by the variables measured from the sepsis audit form. In total, 1,648 patient charts were received and reviewed of the combined pre- and post-intervention (Figure 3). Charts were initially extracted by sepsis diagnosis, lactic acid, and ordered blood cultures. After excluding patients who arrived already having a sepsis diagnosis, children, and patients not meeting SIRS/Sepsis criteria, a total of 20 patient charts in 2020 and 37 in 2021 met SIRS/Sepsis criteria with or with a suspected infection (a total of 57 charts). After further investigation, all charts showing a suspected source of infection related to the pulmonary, urinary tract, skin/soft tissue, fever (unknown origin), or intra-abdominal infection were reviewed for SIRS/Sepsis criteria. This yielded a total of 20 more charts (12 for 2020 and 8 for 2021) without lactic acid and blood cultures ordered.

Unfortunately, many more patient charts may have met SIRS/Sepsis criteria with or a suspected infection. However, follow-up vital signs were lacking, and multiple patient charts lacked a full workup, such as a complete blood count (CBC), lactic acid (LA) and blood cultures obtained, and those charts were excluded.

Figure 3

Flow Diagram for Review of Patient Charts



The patient charts reviewed were broken down to consist of two months of pre- (March & April 2020) and post-intervention (March 15th thru May 15th, 2021). The ED director verified the charts audit results for consensus to avoid bias. All screening variables listed on the sepsis audit form are provided in Table 2, plus additional documentation was extracted, such as patient disposition, presumed infections, ED times of admissions to ordering lactic acid, blood cultures, intravenous fluid (IVF), and antibiotics (Tables 5-10) that will be discussed below in data analysis. The purpose of the additional information extracted was to provide NCCH management as much information on this project for an assessment and a comparison baseline performance.

Table 2

Patient Demographics, Clinical Characteristics, and Physiologic Measurements

Variables	n=32 (2020)	%	n=45 (2021)	%
GENDER				
Male	19	59%	18	40%
Female	13	41%	26	58%
AGE				
20-32	4	13%	1	2%
31-40	3	9%	2	4%
41-50	4	13%	6	13%
51-60	6	19%	6	13%
61-70	9	28%	16	36%
71-80	9	28%	8	18%
81+	1	3%	5	11%
SIRS Criteria Met				
Temp	13	41%	23	51%
HR	29	91%	40	89%
RR	27	84%	32	71%
WBC > 12, < 4	16	50%	24	53%
WBC bands > 10	2	7%	0	0%
Lactic Acid ordered	5	16%	17	38%
PRESUMED INFECTION				
Pulmonary	9	28%	23	51%
Intra-abdominal	2	6%	7	16%
Urinary	11	34%	7	16%
Skin/soft tissue	5	16%	2	4%
Unknown	5	16%	6	13%

Table 2 – *Continued*

Variables	n=32 (2020)	%	n=45 (2021)	%
qSOFA Score				
0	8	25%	14	31%
1	16	50%	24	53%
≥2	8	25%	7	16%
DISPOSITION				
Home	11	34%	12	27%
Admitted	12	38%	14	31%
Transfer	9	28%	19	42%

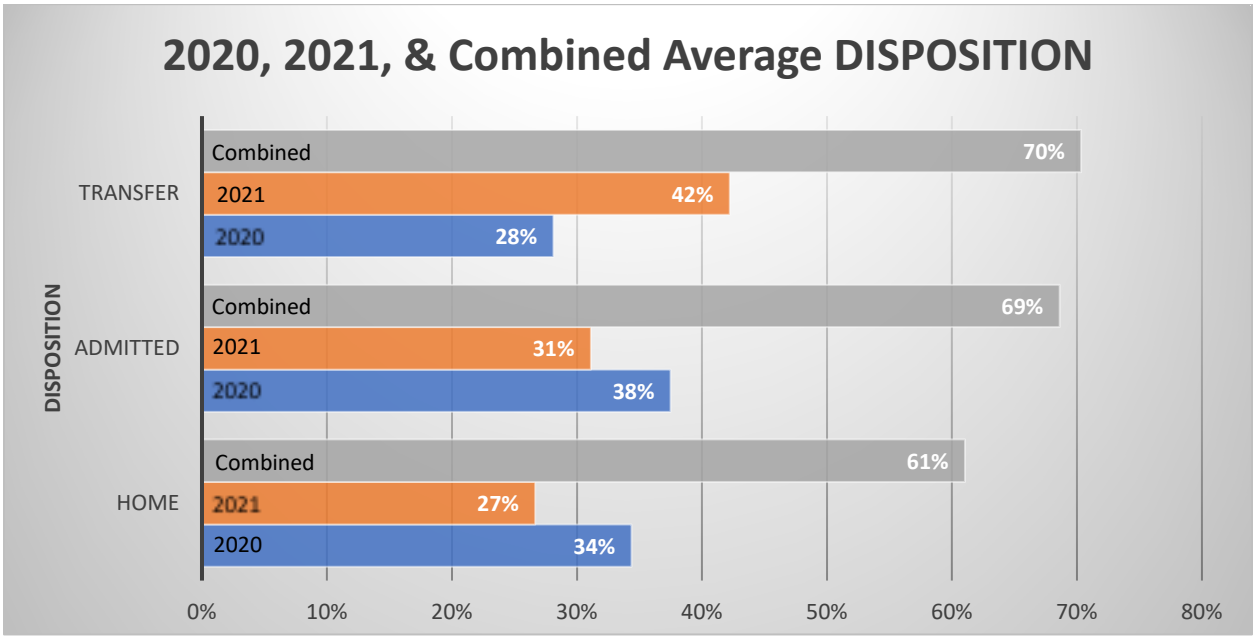
Data Analysis

The data analysis was conducted using descriptive statistics through retrospective chart review and was reviewed for accuracy to avoid bias and assure veracity. The results are presented with tables, charts, and graphs to compare the QI project's pre- and post-implementation findings. This statistical analysis will represent the project outcome data into meaningful information for interpretation for further knowledge and improvements.

Figure 4 is a representation of pre- and post-intervention of patient that met SIRS/Sepsis criteria on disposition. The combined data indicate that 70% were transferred to a higher level of care, 69% were admitted to the hospital, and 61% were discharged home with follow-up care and oral antibiotics.

Figure 4

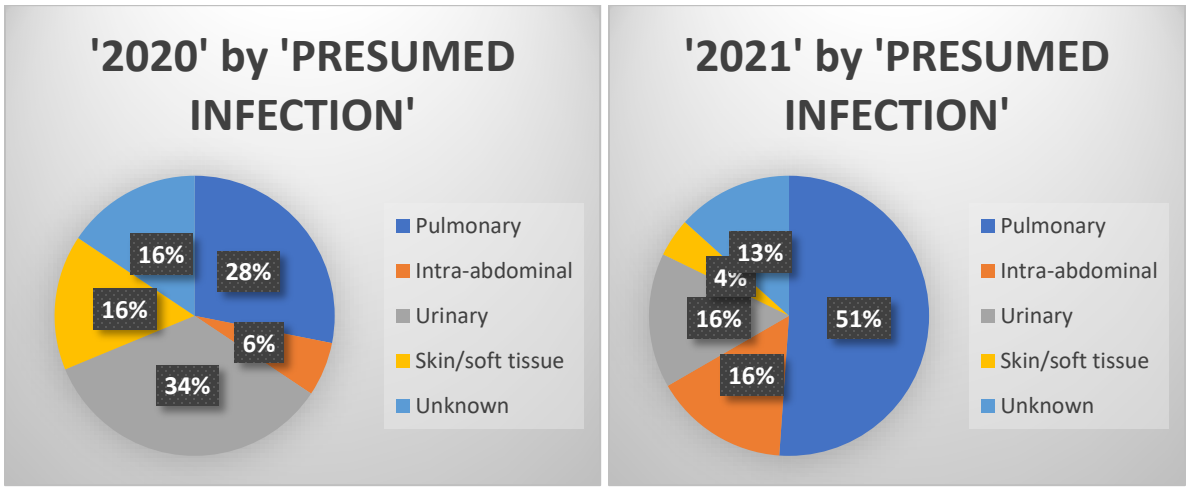
2020, 2021, and Combined Average Disposition



The most common infectious etiology for SIRS/Sepsis with presumed infection for 2020 (Figure 5) was Urosepsis (34%), pulmonary/pneumonia (28%), skin/soft tissue/cellulitis and unknown (16%), and intra-abdominal (6%). In 2021 (Figure 5), pulmonary/pneumonia took the lead (51%) secondary to viral vs bacterial or both relating to COVID-19, then intra-abdominal and urosepsis (16%), unknown etiology (13%), and skin/soft tissue/cellulitis (4%).

Figure 5

2020 and 2021 Presumed Infection

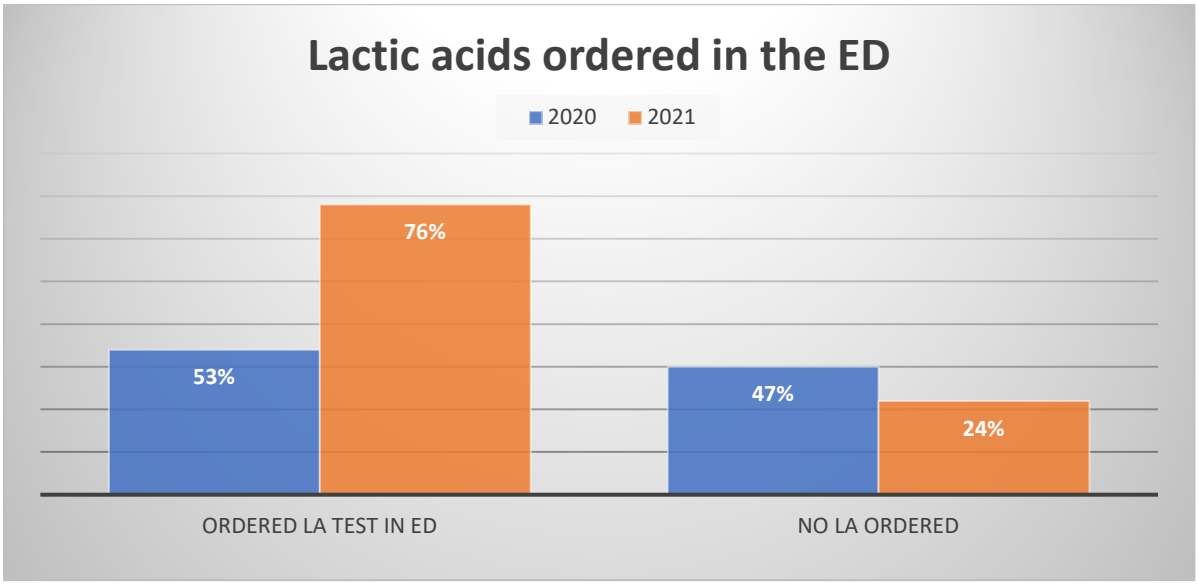


The SCC recommends a sepsis bundle guideline to ensure EGDT, which requires obtaining lactate levels and blood cultures, delivering the appropriate IV fluids, and administering empirical antibiotics (SCCM, 2017). Sepsis should be treated as an emergency because of its effectiveness in reducing mortality (SCCM, 2017). However, the sepsis bundle guidelines recommend that these interventions be done and given within three hours of presentation in the ED (SCCM, 2017).

Despite the low-quality evidence and weak recommendations, SSC suggests measuring lactic acid levels because it is associated with mortality in patients with suspected infections or sepsis (Rhodes et al., 2017; SCCM, 2021). Elevated lactate is common in patients with severe sepsis or septic shock, which correlates with illness severity and prognosis (SCCM, 2017). The rationale is to identify tissue hypoxia or an adaptive response to metabolic processes of severe infection and response to therapies such as IV fluids and antibiotics (SCCM, 2017, 2021). Figure 6 represents post-intervention (2021) had a 23% improvement from the 2020 pre-intervention.

Figure 6

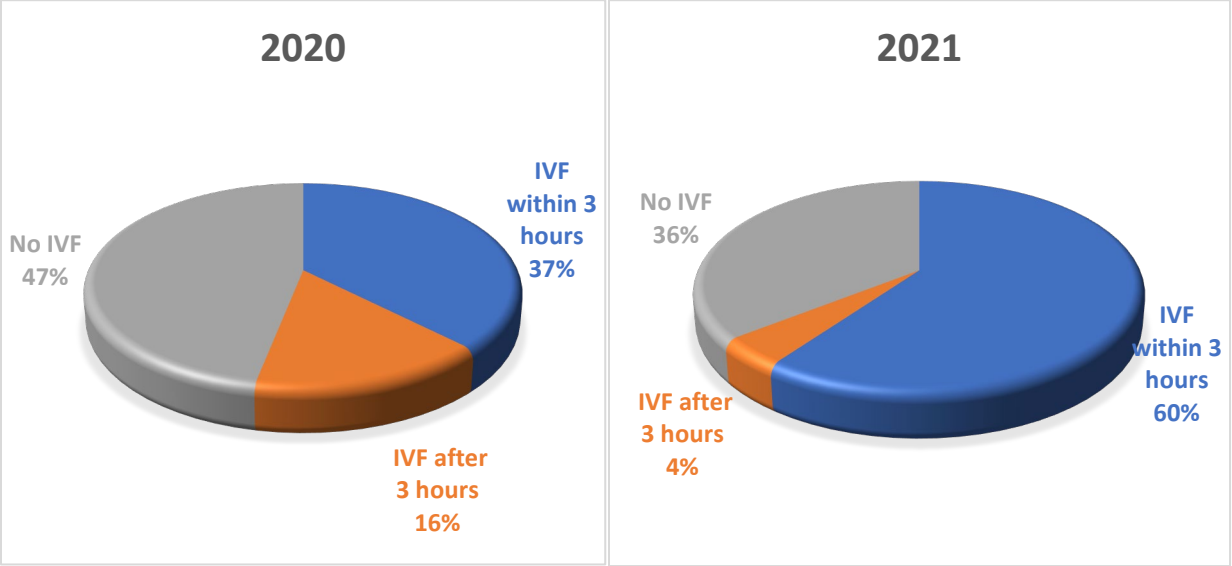
Lactic Acids Ordered in the ED



The SSC and SCCM recommend that IV fluid resuscitation begin immediately (Rhodes et al., SCCM, 2017). The delay in receiving IV fluid resuscitation delays the resolution of tissue profusion. Also, it increases the length of stay without regard to comorbidities such as end-stage renal disease (ESRD) and heart failure (HF) (Kuttab, 2019). The SCC 2016 guidelines recommended using a minimum of 30mL/kg (ideal body weight) of crystalloid IV fluid for initial resuscitation. This guideline recommendation was based on observational evidence without prospective intervention studies that compared other volume levels to initiate resuscitation within three hours of suspected sepsis or sepsis onset (Rhodes et al., 2017; SCCM, 2017). A retrospective analysis was conducted with patients who presented to the ED who showed a failure to receive the recommended IV fluids within three hours and an increase in mortality (Kuttab, 2019). In Figure 7, the comparison of IV fluids ordered in 2020 pre-intervention and 2021 post-intervention shows an increase of 23% post-intervention.

Figure 7

2020 and 2021 Patients Receiving IV Fluids in the ED



Ideally, administering the antibiotics within one hour of recognizing the infection and/or suspected sepsis is the goal SSC would like to achieve, but this is not the standard of care (SCCM, 2017, 2021; Rhodes et al., 2017). During the chart reviews, it was difficult to know at what point the ED provider recognized an infection and/or suspected early sepsis to know if the antibiotics were administered within one hour, so that information was not collected. Therefore, Figure 8 shows that the antibiotics (abx) patients received in the ED correlate with the SSC guidelines, the time from 'door to antibiotics' within the first three hours. The rationale for administering antibiotics within one hour is the goal, but three hours is the standard of care because the delay is associated with less optimal outcomes in patients with sepsis (SCCM, 2017, 2021; Rhodes et al., 2017). In 2020, pre-intervention shows 59% of the charts reviewed met the three-hour sepsis bundle, 16% were after the three-hour bundle, and 25% met SIRS/Sepsis criteria with a documented, or suspected infection did not receive antibiotics. In 2021, post-

intervention, 33% met the three-hour sepsis bundle time, 31% did not meet the three-hour bundle time, and 36% did not receive any antibiotics. Overall, 2020 showed more compliance than 2021 by administering antibiotics within the first three hours.

Obtaining blood (Bld) cultures (cx) is a best practice statement to routinely obtain prior to administering antibiotics (abx) (SCCM, 2017). Figure 9 compares 2020 pre-intervention and 2021 post-intervention blood cultures obtained before and after receiving antibiotics for a documented or suspected infection and those who received antibiotics without obtaining blood cultures. Again, the 2020 pre-intervention complied better than the 2021 post-intervention.

Figure 8

Antibiotics Received in the ED

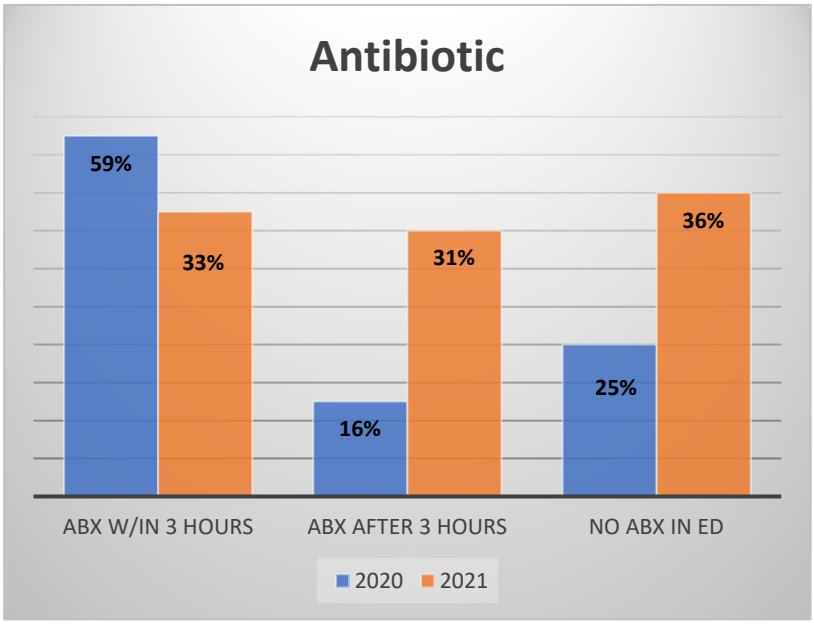
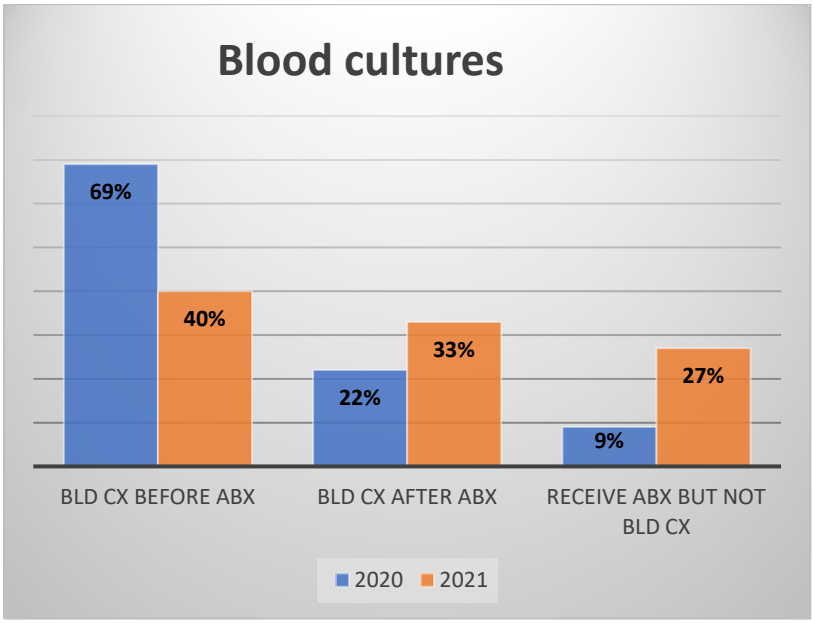


Figure 9

Blood Cultures Prior to Starting Antibiotics



Despite the failure of the overall objective of utilizing the nurse-driven CDST for early sepsis recognition, the additional time and effort on this project were well spent to obtain more information regarding the results and outcome of early sepsis recognition at NCCH ED. As a reminder, SSC 2016 aims to initiate antibiotic therapy within one hour of recognizing early sepsis or suspecting an infection, which is possible and can be done. The current data collected shows (Table 3) that the 'door to antibiotic' barely makes the three hour mark. I feel this QI project provides a baseline and an opportunity to improve the times by a nurse-driven CDST during triage to initiate the sepsis order set or the basic labs such as a CBC, CMP, LA, and UA, if needed, during triage with the guidelines given. In Table 3, improvement is seen, however, more improvement can be made by improving 'door to antibiotic' times.

Table 3

t-Test Analysis of Group Differences in Mean Time to Sepsis-Bundle Measures Pre- and Post-Intervention

Variables	Pre- Mean Time	Post-Mean Time	Time Differences
Time to Abx	2:45	2:50	5 min. slower
Time to Bld Cx	1:12	0:32	40 min. faster
Time to initial lactate	1:15	0:38	37 min. faster
Time to IVF	1:58	1:06	52 min. faster

Outcomes

The objective for the QI project was explicitly looking for ED nurses to recognize early signs of SIRS/Sepsis criteria by utilizing the sepsis CDST during initial contact with the patient at triage then to initiate the EHR sepsis protocol. Unfortunately, due to the unforeseen circumstance of the COVID-19 pandemic in 2020 and 2021, this QI project did not go as intended from the very beginning. Through the chart reviews, no sepsis protocol was utilized in 2020 from the dates selected, and the protocol was utilized only once in 2021. There was only one triage nurses and/or ED provider who recognized SIRS/Sepsis criteria and initiated the sepsis order set in the EHR. However, from a different perspective, the overall project successfully collected additional valuable information that was discussed in the data analysis for a baseline assessment for future QI projects for better and safer patient outcomes, as suggested above.

In addition, the educational presentation that had been scheduled in person had to be cancelled due to COVID-19, and all face-to-face gathering was prohibited. The educational presentation was intended for the sepsis team to give the nursing staff an understanding of the project objectives and to identify any confusion and/or clarification for optimal use of the nurse driven CDST. In addition, the in-person session would have served to increase stakeholder buy-

in to the QI project. Instead, the presentation was sent to all ED and med-surg nursing staff via email by the ED nursing director. As a result, the effectiveness of the educational intervention cannot be ascertained. The only conclusion that can be drawn is that emailing the presentation and making the viewing voluntary, especially during such an unprecedented crisis, was detrimental to the success of the project.

A needs assessment was not conducted among the nurses to identify any current gaps in knowledge and practice of ESR and EGDT, along with the contextual factors to identify strengths and weaknesses, which may have made for a more successful project (Silver et al., 2017). However, conducting this QI project elicited valuable information that will be used to identify those gaps in knowledge and practice to achieve the desired results.

DISCUSSION

Summary

The purpose of the QI project was to achieve a 50% increase of ESR of patients with potential sepsis or septic shock by implementing a nurse-driven CDST in the NCCH ED and initiate the sepsis order set during triage. The result was that the sepsis order set was initiated only once, and it was done by the ED provider after being notified by one of the ED nurses who recognized SIRS during triage. This one instance would account for a 50% increase in ESR, indicating successful accomplishment of this project's goal. However, true success would have been an ongoing awareness and utilization of the sepsis order set with more nursing and providers engagement in ESR, especially with having the patient's best interest in mind for a more positive outcome.

Implications

Practice

Healthcare is evolving daily, and change is inevitable in clinical practice. This DNP QI project can influence nursing practice in numerous ways by improving critical thinking skills, anticipating potential adverse events, being less task-oriented, monitoring and recording vital signs consistently, and using practical problem-solving when the monitor is not congruent with the patient's presentation. NCCH has a low retention rate for nursing staff and an increased rate of travelers that rotate throughout the hospital. Staff change has been problematic due to the high turnover and lack of consistency in clinical practice. Therefore, it may require frequent education, posting reminders, and future alerts in the EHR. There is potential that this QI project might result in consistent and effective change with the evidence-based protocols, guidelines, and a nursing sepsis order set in place.

Education

Healthcare workers require lifelong learning. One of the objectives of this project was to educate the nurses about the new sepsis guidelines and recommendations from the SSC. However, since COVID-19 altered social interactions with classroom gatherings, online communication platforms became the standard in education and healthcare. There is potential for an online group platform at NCCH for hospital education. With such a platform, it would then be possible for everyone to attend mandatory staff meetings with recorded options for those who could not attend and to make it more convenient with social isolation restrictions. As a result of this project, it has been proposed that new hires review the sepsis PowerPoint and take a quiz for accountability of the education provided to continue this QI initiative.

Research

Research is a continuously evolving process that brings new evidence to light, such as the publication of the SSC that provided the evidence and guidelines for this QI project for change into clinical practice through education. This QI project is based on evidence focused on improving the care of patients with early sepsis and/or diagnosing patients with sepsis. However, the improvement of patient outcomes was undetermined and beyond this project's scope. Furthermore, it is proven through evidence-based research that this project has the potential for significant findings for improved patient outcomes. There are several options for further research, such as improving bundle times, documentation, comorbidities predictors, and benefits from a protocol-based project of early goal-directed therapy (EGDT).

Policy

Healthcare policies and protocols provide a reference for nurses and providers to manage care for the best patient outcomes. These policies are researched evidence-based information that provides and aids in the decisions and actions of administering care. The nurse-driven CDST for this project was based on the SSC recommendations and guidelines for hospitals to develop a policy for ESR. The administration wants the nurse-driven CDST to aid in a new sepsis policy. It was proposed that the nurse-driven CDST be required for all nurses to fill out during triage and placed into the ED paper chart to track and record accountability.

Limitations

There were many significant limitations to this QI project. However, the unfortunate COVID-19 pandemic prevented a face-to-face meeting to clarify and answer questions that may have arrived during the presentation. A second limitation due to the pandemic was multiple new

changes and stressors going on simultaneously at NCCH and implementing a QI project was not a priority for the management or the staff. The third limitation, the nurse-driven CDST, was an anonymous and a volunteer QI project among the nurses, and there was no tracking or accountability required. There was a lack of follow-up and support because of a management turnover (CNO, ID nurse, & the ED director) without any replacements, which left the QC manager wearing multiple hats. In addition, the disease process of COVID-19 pneumonia was new. It was unclear if SIRS and sepsis criteria pertained to this population because it is a "virus" that many nurses and providers were undecided to treat (Dr. Fedko, personal communication, 2021). The timing of the project was unfortunate. Even a well-designed QI project can be ineffective if done at the wrong time (Silver et al., 2017). The last limitation was the lack of quality ED charting, the lack of a complete work-up, and the lack of follow-up documentation of vital signs.

After completing the project, the sepsis coordinator debriefed informally with some of the nurses. The nurses reported that the CDST process was not fully conceptualized or understood, in part due to other information that completed for their attention during the pandemic. The staff interest was understandably questionable among the nurses during this time period. In addition, the nurses reported that it was confusing for them to enter the sepsis protocol orders into the emergency department information system (EDIS) during triage, and they did not feel comfortable doing so. A lack of a formal structure, time, and process to implement a nurse-driven CDST or any change consistently remains challenging.

DNP Essentials Addressed

DNP Essential I: Scientific Underpinnings for Practice

Adult learning theory (ALT), also known as Knowles' model of andrology, was utilized as the foundational framework to incorporate the five foundational principles that interconnect how adults acquire knowledge by using a problem-based and collaborative approach to learning. This is "the art and science of helping adults learn," and it integrates relevant practice theories into nursing practice innovation. This is done by recognizing self-awareness, experience, readiness to learn, learning orientation, and how motivated they are internally vs. externally to integrate science with knowledge to inform advanced nursing practice.

DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking.

This project required applied leadership by fostering relationships to discuss collaboratively with key stakeholders to assess, evaluate, and develop a plan to meet the needs of the NCCH patient population, staff, and organization.

DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice

This project required an extensive literature review to critically analyze data for evidence-based practice to develop a nurse-driven CDST with criteria to recognize early sepsis. Furthermore, the FOCUS Plan-Do-Check-Act (PDCA) cycle was used for the systematic evaluation method to implement a nurse-driven CDST guideline to improve nursing practice, patient outcomes, and practice environment in the ED for early sepsis recognition.

DNP Essential IV: Information Systems/Technology and Patient Care Technology for Improvement and Transformation of Health Care

This project will continue to move forward with the plan to incorporate nurse-driven CDST into the EHR during triage. The CDST will allow the triage nurse to use the sepsis protocol consistently, which will eventually be integrated into their charting and to alert providers that the patient has early signs of sepsis. Technology will continue to evolve with more information and data that will support clinical practice and influence nursing and providers' decisions to improve patient care and healthcare systems' safety and quality.

DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes.

Creating change in a healthcare system is a complex and time-consuming process that requires planning, meetings, and collaboration with multiple disciplines for a team approach for this QI project. This project requires interprofessional collaboration with effective communication to improve patient outcomes. After weeks of careful evaluation, there were several possibilities for a QI project. Later, it was evident that early sepsis recognition was a great QI project to undertake to improve care for this patient population at NCCH.

Conclusions

The QI project aimed to increase early sepsis recognition at NCCH ED using a nurse-driven CDST. Although the results were mixed, in large part due to the constraints of the COVID-19 pandemic, valuable insights were acquired and presented to NCCH management to be utilized in future nursing education and the triage process in the ED.

Plan for Sustainability

Sustainability is the ability to maintain a QI project amid limitations and changes in a complex healthcare system (Silver et al., 2016). It provides the opportunity to identify and address problems that may threaten the longevity of a QI project or change (Silver et al., 2016). Therefore, sustainability should be considered early before implementing a new project. Unfortunately, this was a step that was not accounted for prior to implementing the nurse-driven CDST for early sepsis recognition at NCCH. At NCCH, there was prior knowledge of staff and organizational turnover. However, the COVID-19 pandemic could not have been anticipated, nor could the significant changes in staffing and management at the time of implementation. Change is unpredictable and inevitable, which makes stainability a challenge for any healthcare organization to implement a QI project. Sustainability strategies, such as a planning worksheet, and guidelines to identify issues, will be an added component of the project's model as the initiative continues to move forward.

Recommendations

The first recommendation is to have an in-person educational in-service meeting with all the ED staff at NCCH. Collaborating with the staff for this QI project becomes the new way of their workflow rather than adding something new to their already busy routine.

Secondly, the NCCH ED staff needs a simple monitoring system with positive contextual factors and transparent, progressive communication. This could be accomplished through strategies such as a process control board, performance board, or a quick daily huddle (Silver et al., 2016).

Lastly, collaborate for recommendations of a standardized sepsis order set. A set specific for nurses during triage, with provider approval, allows nurses the comfort to place orders in the EHR for IV, CBC, CMP, UA, Blood cultures, LA, cardiac monitor, oxygen, and CXR to initiate EGDT for early sepsis recognition.

Plan for Future Dissemination

Preliminary findings of this project, particularly with regard to nursing processes, have already informally been discussed with nursing staff at the time of this writing, in an effort to correct some immediate concerns as described earlier in this paper. The information obtained as it pertains to the main purpose of this QI project, along with the findings related to the secondary purpose, will be formally presented at the subsequent quality of care/patient safety committee meeting in the months ahead. These findings must be presented and disseminated with updated data to all NCCH ED staff and key stakeholders to keep this project at the forefront and not forgotten. This information should impact the current practice in the ED to improve the quality of care and patient outcomes.

APPENDIX A:

SITE APPROVAL / THE UNIVERSITY OF ARIZONA INSTITUTIONAL REVIEW BOARD AUTHORIZATION LETTER

NCCH NORTHERN COCHISE COMMUNITY HOSPITAL

Sulphur Springs Medical Center ◊ Sunsites Medical Clinic

Date 10/27/2020

University of Arizona Institutional Review Board
c/o Office of Human Subjects
1618 E Helen St
Tucson, AZ 85721

Please note that Ms. Sabrina Lucero-Jackson, UA Doctor of Nursing Practice (DNP) student, has permission of NCCH to conduct a Quality Improvement (QI) project at our facility for her project, "A Nurse-Driven Sepsis Clinical Decision Support Tool at Northern Cochise Community Hospital (NCCH) Emergency Department for Early Sepsis Recognition."

Ms. Lucero-Jackson will conduct a sepsis presentation and introduce a clinical decision support tool (CDST) to the NCCH emergency health care nurses and providers. There will be no patient contact. She will provide the ED providers through email the sepsis presentation, sent by FedkoEP. Also, provide a description of the project, what they will be asked to do (ED nurses to attend a sepsis presentation), and should not be longer than 30 minutes. Ms. Lucero-Jackson's activities will be completed by *(April 2021)*.

Ms. Lucero-Jackson has agreed to provide to my office a copy of the University of Arizona Determination before she recruits participants. She will also present aggregate results to the staff at their monthly or quarterly staff meeting.

If there are any questions, please contact my office at (520) 766-6564.

Signed,

Mo Sheldon, FACHE
Chief Executive Officer

This institution is an equal opportunity provider and employer
901 West Rex Allen Drive, Willcox, Arizona 85643
Phone (520) 384-3541 • Fax (520) 384-6365
Quality Health Care Close to Home

THE UNIVERSITY OF ARIZONA
Research, Discovery & Innovation

Human Subjects Protection Program

1618 E. Helen St.
P.O.Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
http://rgw.arizona.edu/compliance/home

Date:	March 01, 2021
Principal Investigator:	Sabrina Marie Lucero-Jackson
Protocol Number:	2102534385
Protocol Title:	IMPLEMENTING A NURSE-DRIVEN CLINICAL DECISION SUPPORT TOOL FOR EARLY SEPSIS RECOGNITION
Determination:	Human Subjects Review not Required

Documents Reviewed Concurrently:

Data Collection Tools: *SEPSIS Clinical Decision Support tool-1.docx*
Data Collection Tools: *Sepsis Screening Chart Review Tool-1.docx*
HSPP Forms/Correspondence: *Advisor Confirmation Email.pdf*
HSPP Forms/Correspondence: *S. Lucero-Jackson determination.pdf*
Informed Consent/PHI Forms: *NCCH Disclosure Form QI.doc*
Other Approvals and Authorizations: *NCCH site approval.pdf*
Participant Material: *Sepsis ppt NCCH.pptx*
Recruitment Material: *Recruitment flyer text.docx*
Recruitment Material: *SLJ Email recruitment.docx*

Regulatory Determinations/Comments:

- Not Research as defined by 45 CFR 46.102(l): As presented, the activities described above do not meet the definition of research cited in the regulations issued by U.S. Department of Health and Human Services which state that "Research means a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge. Activities that meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program that is considered research for other purposes. For example, some demonstration and service programs may include research activities. For purposes of this part, the following activities are deemed not to be research."

The project listed above does not require oversight by the University of Arizona.

If the nature of the project changes, submit a new determination form to the Human Subjects Protection Program (HSPP) for reassessment. Changes include addition of research with children, specimen collection, participant observation, prospective collection of data when the study was previously retrospective in nature, and broadening the scope or nature of the study activity. Please contact the HSPP to consult on whether the proposed changes need further review.

The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).

APPENDIX B:

CONSENT DOCUMENT (DISCLOSURE AND CONSENT FORM)

DISCLOSURE

Sepsis Quality Improvement Project

Principle Sepsis Coordinator: Sabrina M. Lucero, MSN, AGACNP, RN

This quality improvement (QI) project is to implement a sepsis presentation and clinical decision support tool in the ED for early sepsis recognition.

An Institutional Review Board (IRB) responsible for human subject research at The University of Arizona reviewed this study and found it to be acceptable, according to applicable state and federal regulations and university policies designed to protect the rights and welfare of participants. Please contact the Human Rights Protection Program at 520-626-6721 or online at http://rgw.arizona.edu/compliance/human-subjects-protection-program for any questions about your rights as a participant in this implementation.

If you have any questions or concerns regarding this educational sepsis presentation or CDCT, please do not hesitate to contact Sabrina Lucero-Jackson, Doctor of Nursing Practice (DNP) candidate at 520-730-6411. Thank you for your time and participation in this quality improvement project.

Sabrina M. Lucero-Jackson, MSN, AGACNP, RN, DNP Candidate
University of Arizona, College of Nursing

APPENDIX C:

RECRUITMENT MATERIAL (RECRUITMENT FLYER)

WHAT NURSES NEED TO KNOW!!!

Together wE Achieve More

Quality Improvement Presentation

Date: TBA Time: 12:00 Place: Classroom

Presenter: Sabrina Lucero-Jackson, NP

APPENDIX D:

EVALUATION INSTRUMENTS (EMERGENCY DEPARTMENT NURSE-DRIVEN CLINICAL DECISION SUPPORT TOOL)

North Cochise Community Hospital

SEPSIS Clinical Decision Support Tool for Early Recognition

DATE / TIME **NOTES**

1. Patient's known or suspected infection: _____

(If there is NO suspected infection or SIRS criteria ≤ 2, stop documentation on this form)

2 Check all that apply, *SIRS criteria* *(2 or More Selected, + infection, Proceed to Question 3)*

- ❑ Temperature greater than 38.3°C (100.9 F) or Less than 36°C (96.8°F)
- ❑ Heart Rate greater than 90 bpm
- ❑ Respiratory Rate greater than 20

- ❑ **INITIATE SEPSIS ORDERSET (CBC, CMP, LA, UA, Procalcitonin, Blood Cx, & CXR)**
- ❑ WBC count > 12,000 or < 4000 or >10% bands
- ❑ Lactate > 2 mmol/L
- ❑ Start time: _____

3 *qSOFA Sepsis criteria* (Sepsis-3 guidelines) *(1 or more Selected, Proceed to Bundle)*

- ❑ Respiratory Rate: ≥ 22 (1 pt.)
- ❑ Altered Mental Status (new or worsening from baseline) (1 pt.)
- ❑ Systolic BP < 100 (1 pt.)
- ❑ Score < 2 – Sepsis is not suspected = DC home or consider Med-Surg admission
- ❑ Score ≥ 2 – Severe sepsis/Septic shock = Med-Surg or ICU admission

Bundle
COMPLETED WITHIN 3 HOURS *Check box(s) if applicable*

- ❑ Blood Cultures x's 2, before starting antibiotics
- ❑ LA level_____
- ❑ Broad Spectrum antibiotic ordered: _____
- ❑ Administer 30 ml/kg crystalloid for hypotension (SBP <90 or MAP<65) or lactate ≥4mmol/L
- ❑ Vasopressor initiated: Levophed or other_____
- ❑ Initiated transfer to higher level of care from ED (if applies)

STOP HERE

***6 HOURS* Bundle, IF ADMITTED to NCCH (Not for project purposes, maybe for future use)**

- ❑ Repeat Lactic Acid if initial lactate elevated > 2: _____
  - ❑ SBP <90 or MAP < 65 mm Hg after fluid resuscitation
  - ❑ Vasopressor : Levophed or other_____
  - ❑ For persistent hypotension after initial fluid administration (SBP <90, or decrease by >40 mm HG, or MAP <65) or if initial lactate was ≥4 mmol/L*
  - ❑ Add Sepsis or Septic Shock Diagnosis in EMR, if not already done
  - ❑ Initiated transfer to higher level of care if not improving.

APPENDIX E:

PARTICIPANT MATERIAL (SEPSIS PRESENTATION)

Early Sepsis Recognition

Implementing a Nurse-Driven Clinical Decision Support Tool for Early Sepsis Recognition

Quality Improvement Project

1

Objective

- Understanding sepsis recommendations and guidelines (Surviving Sepsis Campaign)
- CMS guidelines
- Nurse-Driven Sepsis Clinical Decision Support Tool (CDST)
- Nurses' role in early sepsis recognition
- EDIS sepsis order set & notify provider
- Early-Goal Directed Therapy (EGDT)

* Think *

2

Key Points

- Improving patient care & outcomes
- CMS follow Sepsis-1 guidelines
- Some insurance follows Sepsis-3 guidelines
- In efforts to improve our process and save lives, we are implementing a couple of changes for early sepsis recognition
  - 1. A nurse-driven Sepsis CDST will be implemented to help recognize early sepsis.
  - 2. To initiating sepsis order set in EDIS & notify provider

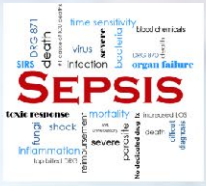
3

What is Surviving Sepsis Campaign (SSC)?

- International Guidelines for Management of Sepsis and Septic Shock
- Patient care that research has shown to result in better outcomes for patients (Evidence-base practice)
- Sep-1 (2004), Sep-2 (2008/2012), and Sep-3 (2016)
- **Sep-1** and **Sep-2**
  - Sepsis Definition: "Two SIRS criteria plus suspected infection" (ACEP, ,2021).
- **Sep-3**
  - Sepsis Definition: "A life-threatening organ dysfunction caused by a dysregulated host response to infection" (SSC, 2017).

4

What is Surviving Sepsis Campaign (SSC)?



- **Sep-3** cont.
- Septic Shock Definition: "A subset of sepsis with circulatory and cellular/metabolic dysfunction associated with a higher risk of mortality" (SSC, 2017)

5

Quick Review of Sepsis-1

- SIRS = Patient meeting 2 or more of the following criteria:
  - HR greater than 90 bpm
  - Respiratory rate greater than 20 bpm
  - Temperature greater than 38 °C or less than 36 °C or 100.4 F > **temp** < 96.8 F
  - PaCO2 less than 32
  - Serum WBC less than 4,000 or greater than 12,000 mm³
- Sepsis = SIRS + documented or suspected infection
- Severe Sepsis = Sepsis + SBP < 90
  - *AND/OR a Lactic ≥4.0 mmol/L*
  - *AND/OR evidence of one organ dysfunction (ie. Altered mental status, AKI, respiratory distress)*
- Septic Shock = Septic shock is severe sepsis with persistent hypotension (SBP < 90 mm Hg or 40 mm Hg below baseline) **despite** adequate fluid resuscitation resulting in circulatory collapse (30 ml/kg).

6

What is a core measure?

Improved patient outcomes

7

Sepsis CMS Core Measure (Sep-1) Highlights

SIRS+ Infection

SIRS Criteria	Organ Dysfunction Variables (SOFA)
Temp >101	SBP < 90
Temp < 96.8	MAP < 70
HR > 90	SBP decrease > 40 from known baseline
RR > 20	Cr > 2.0
WBC > 12,000	UOP < 0.5 ml/kg/hr for > 2 hours
WBC < 4000	Bilirubin > 2.0
> 10% Bandemia	Platelets < 100,000
SEPSIS	INR > 1.5 or PTT > 60 secs
	Altered Mental Status
	Lactate > 2

SOFA Calculation

8

CMS Sepsis-1 Guideline

Box 2
CMS SEP-1 required actions for included patients (numerator statements)

CMS Sep-1 Severe Sepsis Requirements

Must meet all of within 3 hours of presentation:
- Initial lactate level measurement
- Broad-spectrum or other antibiotics administered
- Blood cultures drawn BEFORE antibiotics

And within 6 hours of presentation of severe sepsis:
- Repeat lactate level measurement (if initial elevated)

CMS Sep-1 Septic Shock Requirements

All must receive within 3 hours if septic shock present:
- Resuscitation with 30 mL/kg crystalloid fluids

If hypotension persists after fluid administration must receive within 6 hours of presentation:
- Vasopressors

If hypotension persists after fluids or initial lactate ≥4 mmol/L must receive within 6 hours of presentation:
- Repeat volume status and tissue perfusion assessment via:
  - A focused examination including vital signs, cardiopulmonary examination, capillary refill, peripheral pulse evaluation, and skin examination
  - OR
- Any two of the following four:
  - Central venous pressure measurement
  - Central venous oxygen measurement
  - Bedside cardiovascular ultrasound
  - Passive leg raise or fluid challenge

9

qSOFA (Sepsis-3)
quick Sequential Organ Failure Assessment

- qSOFA = AMS, RR>22, & SBP ≤ 90
- qSOFA = tool used to identify early sepsis outside of the ICU (proposed recommendations)
- Using qSOFA & SOFA is controversial for may reasons
- 271,500 pts - qSOFA positive requiring ICU admission, had an increased higher mortality rate
- With 1:3 pts positive on admission with suspected infection, but 1:6 pts had sepsis
- qSOFA/SOFA - has a low sensitivity for suspected infection & sepsis.
- However, SOFA is highly specific as a mortality predictor in the critically ill, ICU patients

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SOFA (Sepsis-3)
Sequential Organ Failure Assessment

- Positive qSOFA (RR, AMS, SBP), prompt a SOFA calculation to determines mortality rate, length of stay, & discharge in ICU settings.
- SOFA (sepsis-related) - Initially designed to "sequentially" assess severity of organ dysfunction
- SOFA scoring, is best used in ICU settings, of critically ill pts with "sepsis" (or suspected)
- SOFA score DOES NOT diagnose sepsis
- It identifies organ dysfunction d/t infection, helps to determines a patient-centered care plan and/or outcomes.

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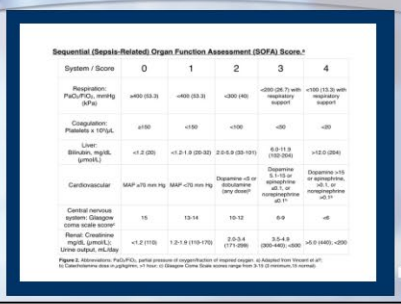
SOFA (Sepsis-3)
Sequential Organ Failure Assessment

- SOFA calculation are best, 24 hrs after ICU admit, and every 48 hrs thereafter.
- Measurements of organ dysfunction: Resp., Cardio, Hepatic, Coagulation, Neuro, and Renal systems.
- Correlation of Total Score & Hospital Mortality

SOFA Score	Mortality
0 to 6	< 10%
7 to 9	15 – 20%
10 to 12	40 – 50 %
13 to 14	50 – 60%
15	> 80%
16 to 24	> 90%

12

SOFA (Sepsis-3)
Sequential Organ Failure Assessment



Sequential (Sepsis-Related) Organ Function Assessment (SOFA) Score.*

System / Score	0	1	2	3	4
Respiration: PaO_2/FiO_2, mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation: Platelets x 10³/µL	≥150	<150	<100	<50	<20
Liver: Bilirubin, mg/dL (µmol/L)	<1.2 (20)	<1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥70 mm Hg	MAP <70 mm Hg	Dopamine <5 or dobutamine (any dose)†	Dopamine 5.1-15 or epinephrine ≤0.1, or norepinephrine ≤0.1†	Dopamine >15 or epinephrine, >0.1, or norepinephrine >0.1†
Central nervous system: Glasgow coma scale score‡	15	13-14	10-12	6-9	<6
Renal: Creatinine mg/dL (µmol/L); Urine output, mL/day	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440); <500	>5.0 (440); <200

Figure 2. Abbreviations: PaO_2/FiO_2, partial pressure of oxygen/fraction of inspired oxygen. a) Adapted from Vincent et al[1]. b) Catecholamine dose in µg/kg/min, ≥1 hour. c) Glasgow Coma Scale scores range from 3-15 (3 minimum, 15 normal).

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Research Summary

- Research has proven that early sepsis recognition, prompts early goal directed therapy (EGDT), & reduces sepsis mortality.
- The AAEM recommend the use of SIRS criteria vs. qSOFA as a tool for pts in the ED for early sepsis recognition (AAEM, 2019)
- SOFA is sensitive for increased prognosis of mortality, but not specific for infection & sepsis
- SIRS criteria, is more sensitive for early sepsis, but not specific for infection
- Several studies - report a consensus that a more sensitive & specific tool for sepsis screening & risk stratification are needed.

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Why is Early Sepsis Recognition Important?

- #1 Target: The **PATIENT**
  - ***It isn't about the numbers...it is about the right care every time!***
  - ***Reduce mortality and morbidity***
  - ***Reduce Disability***
  - ***Reduce length of stay***
  - ***Reduce readmissions***

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Nurses Role in Early Sepsis Recognition

- Sepsis CDST - to help identify patients with early sepsis
- Initiate sepsis protocol in EDIS
- Inform ED provider of early sepsis identification and orders placed

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SEPSIS CDST

North Cochise Community Hospital

SEPSIS Clinical Decision Support tool (CDST)

1. *Patient's known or suspected Infection ONLY*
   - → If there is NO known or suspected infection or at least 2 SIRS, no intervention is required until criteria are met any time while in the ED. It is critical to monitor frequently & document VS frequently.
2. *Check all that apply- 2 or more wanted, initiate time and order set, (SIRS may be less for different situations, i.e., immunocompromised or patients on beta blockers)*
   - → Temperature greater than 38.3°C (100.4 F) or Less than 36°C (96.8°F)
   - → Heart Rate greater than 90 bpm
   - → Respiratory Rate greater than 20
   - → Start time: _____ Time of recognition & Document in nurse notes _____
   - → *Initiate Sepsis order set with CXR or/and UA, depending on pts symptoms.*
   - → NOTIFY PROVIDER: Give a quick report & sepsis order set was initiated during triage.
   - → WBC count > 12,000 or < 4,000 or >10% bands
3. *Quick Sequential Organ Failure Assessment (qSOFA) (A score > 2 indicates organ dysfunction, a prediction for increased mortality), anticipate admission or ICU transfer to higher level of care.*
   - → Cardiovascular: SBP < 90 or MAP < 65 or SBP decrease of more than 40pts from baseline
   - → Respiratory: RR > 22
   - → CNS: altered mental status (unrelated to primary baseline)
   - → Recommendations are to calculate SOFA for high-risk mortality

Bundle

TO BE COMPLETED WITHIN 1-3 HOURS:
- → Initial Lactate Level (STEP 2) Document findings & intervention.
- → Blood Cultures: Peripherally x's 2 obtained
- → Broad Spectrum antibiotic
- → 30 ml/kg crystalloid for hypotension (SBP <90, or decrease by >40, or MAP <65) or lactate ≥ 4mmol/L (caution in HF & CKF pts)
- ⇒ Anticipate admission to NCCH or transfer to higher level of care.

TO BE COMPLETED WITHIN 6 HOURS, in ED or Admitted to NCCH – Report to M/S nurses
- → Repeat Lactic Acid if initially > 2, and not done in the ED
- → Initial fluid administration (SBP <90, or decrease by >40 mm HG, or MAP <65) or if initial lactate was ≥ 4 mmol/L*
- → Anticipate a vasopressor for SBP <90 or MAP < 65 mm Hg after fluid resuscitation
- → If worsening condition, immediately notify Hospitalist and document.

Constantly re-assess volume status and tissue perfusion

17

EDIS Sepsis Order Set

18

EDIS Sepsis Order Set cont.

19

Key Concepts

- Sepsis is the primary cause of death from infection
- Dysregulated host response
- Organ dysfunction may be occult
- Phenotypes may be modified by comorbidities / interventions **(or lack thereof) THINK Early SEPSIS**
- Infections may cause local dysfunction without a dysregulated response

20

Key Concepts

- *Early Identification is the* **KEY**
- **Use Nurse-Driven Sepsis CDST**
  - Suspected infection vs Noninfecting etiology
  - SIRS is not always related to an infection
- **During triage**
  - If SIRS criteria are met,
    - initiate sepsis order set, then notify ED provider
- **After triage during ER admission**
  - If patient meets the required criteria for Sepsis or Septic Shock, inform the ED provider so that the appropriate orders can be implemented.
  - ***Advocate for your patient*** if the appropriate orders are not placed (i.e. blood cultures x 2, appropriate fluid resuscitation, repeat lactic, etc.) to promote EGDT.

21

NCCH is the BESTEST !!

22

Use the CDST & Sepsis order set! Beat sepsis! *The End!*

Just Kidding, Molly is watching you!!!!

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APPENDIX F:

CHART AUDIT FORMS (SEPSIS SCREENING CHART AUDIT FORM)

<table>
<tr><th></th><th colspan="3">Sepsis Screening Chart Audit Form</th><th>YES</th><th>NO</th></tr>
<tr><td>1</td><td>DOS:

Missed #:

Page #:

Auditor:</td><td colspan="2">Met SIRS Criteria ≥ 2 on Triage

❑ T > 100.9 or < 96.8
❑ HR ≥ 90
❑ RR ≥ 20, PaCO2 ≤ 32
❑ WBC ≥ 12,000 or ≤ 4,000 or bands ≥ 10%</td><td></td><td></td></tr>
<tr><td>2</td><td>Sepsis

SIRS, due to known or suspected infection, new or worsening infection?

❑ Not ordered
❑ Lactic Acid < 2
❑ Lactic Acid > 2
❑ Lactic Acid > 4</td><td colspan="2">❑ Pneumonia/Empyema
❑ UTI / Pyelonephritis
❑ Skin/soft tissue/Cellulitis
❑ Wound infection
❑ Abdominal infection
❑ Bone/joint infection
❑ Catheter or device infection
❑ Chills or rigors
❑ Meningitis
❑ Endocarditis
❑ Etiology unknown</td><td></td><td></td></tr>
<tr><td>3</td><td>qSOFA (Sepsis-3 guidelines)
❑ RR ≥ 22
❑ Systolic BP < 100
❑ AMS (from baseline)

❑ Score 0
❑ Score 1
❑ Score ≥ 2</td><td colspan="2">ED Disposition

❑ DC home
❑ Admitted NCCH OBS
❑ Admitted NCCH Acute
❑ Transferred higher-level care</td><td></td><td></td></tr>
<tr><td>4</td><td>❑ Male
❑ Female

❑ Missing f/u Temp after triage
❑ Met SIRS after triage < 2 hrs in the ED</td><td>AGE
❑ 20-40
❑ 41-50
❑ 51-60
❑ 61-70
❑ 71-80
❑ 81-90
❑ 91-100</td><td>Diagnosis
❑ Missed Dx
❑ SIRS
❑ Sepsis
❑ Sever Sepsis
❑ Sepsis syndrome w/o shock
❑ Septic shock</td><td></td><td></td></tr>
</table>

APPENDIX G:

PROJECT TIMELINE

Phase 1	**Phase 2**	**Phase 3**	**Phase 4**	**Phase 5**
Brainstorming	*Need assessment*	*Buy-In & Team*	*IRB Approval*	*Implement QI*
1/5/20 – 3/24/20	3/24/20 – 6/20/20	6/20/20 – 7/31/20	3/24/20 – 10/31/20	03/15/21 – 05/15/21
- brainstorming ideas with QC manager for the most cost effective & beneficial QIP for the hospital - final decision was on implementing an improvement on sepsis care in the ED.	- retrospect chart review conducted, to identify the need to improve sepsis patient care in the ED - Multiple problems identified - Root cause: lack of early sepsis recognition secondary to lack of triage priority knowledge, & patient approach	- Discussed findings with CNO (interim CEO at the time), ED provider & nursing manager. received support - Official meeting with the new CEO regarding QIP will take place on 10/29/20 for signature of site approval.	- Complete proposal & sepsis PowerPoint presentation - Make corrections & Obtain CON approval - Obtain UofA IRB approval to implement QIP	- Recruit ED nurses and providers - Schedule date to present QIP to willing participants - Implement sepsis presentation & introduce the sepsis CDST -Schedule biweekly meets with the team on the Check/Act cycle for process improvements. - GO Live 03/15/21 - END QIP 05/15/21

APPENDIX H:

LITERATURE REVIEW GRID

Author/Article	Qual: Concepts or phenomena Quan: Key Variables Hypothesis Research Question	Study Design	Sample (N) Setting	Method for Data Collection/Analysis (Instruments/Tools)	Key Findings
Francis, M., Rich, T., Williamson, T., & Peterson, D. (2010). Effect of an emergency department sepsis protocol on time to antibiotics in severe sepsis. *Journal of Emergency Medicine, 12*(4), 303-310.	1) The aim is to rapidly identify septic patients, early recognition, institute aggressive resuscitation and reduce time to antibiotics in severe septic patients by implementing a sepsis protocol in the ED.	*A retrospective chart review who met criteria – 18 years or older and severe sepsis in the ED. *Study limitations - potential for bias - unrecorded confounders - identified by ICD codes - some severe sepsis dx of patients could have been missed - limited quality ED charting - inconsistent documented times - questionable definition of severe sepsis	**Sample:** *Adult patients' charts diagnosed with sepsis, septicemia, urosepsis, septic shock and toxic shock, were reviewed. *However, patients' charts meeting criteria for severe sepsis, was the final study sample. **Setting**: *3 urban EDs teaching hospitals in Calgary Alta, London	**Data Collection:** *Data abstractors (medical residents & research nurses) reviewed all charts to capture SIRS criteria, sepsis and severe sepsis criteria. *Standardized data abstraction forms used to ensure uniformity. **Data Analysis:** *Statistical analysis used – Kaplan-Meier survival analysis & log-rank test (nonparametric data). *Data compared before and after implementation of protocol. *Intercooled STATA version 9.2 (SPSS Inc.) used for all statistical analyses. *95% confidence intervals for outcome measures. Based on method by Bonett & Price.	*Paper-based sepsis protocol *Initial empiric antibiotic selection guidelines *n-912 charts reviewed *n-213 met SIRS & severe sepsis criteria *Most common infection - 29% community acquired pneumonia (CAP) - 21% unknown etiology upon DC from the ED. - 17% intra-abdominal sepsis - 16% urosepsis *Most common SIRS criteria - 80% HR > 90 beats/min. - 64% RR > 20 breaths/min. - 50% WBC > 12K. *Most common severe sepsis criteria - 69% hypotension, SBP < 90 mmHg - 42% hypoxia, oxygen saturation < 90% on room air (RA) - 23% renal insufficiency, creatinine > 60 umol/L from baseline. *After implementation of an ED sepsis protocol - statistically significant (log-rank test p value < 0.001)

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					- mean time before protocol, met criteria to antibiotics was 163 min. (95% CI 124 to 210 min). - mean time after protocol, 79 min. (95% CI 64 to 94 min).
Holder, A. L., Gupta, N., Lulaj, E., Furgiuele, M., Hidalgo, I., Jones, M. P., Tiphany, J., Gennis, P. & Birnbaum, A. (2016). Predictors of early progression to severe sepsis or shock among emergency department patients with nonsevere sepsis. *International Journal of Emergency Medicine, 9*(10), 1-11. doi: 10.1186/s12245-016-0106-7	Quantitative study *The key goal/aim – focus on accessible information (protocol/another tool) in the ED for providers to utilize and to increase triage levels by identifying sepsis as being a higher risk and treat more aggressively. *Hypothesis: - Hypoalbuminemia is correlated with sepsis progression, to be the main mediators for increased capillary leak in acute inflammatory states like sepsis. *Key variables for regression remodeling: - Demographic predictors - Clinical predictors - Laboratory predictors - Comorbidities - Organ dysfunction - Tissue hypoperfusion - Shock	*A retrospective cohort study *Chart review – followed strict protocol with blinded data collection of predictors and outcomes. *Study limitations - Some data was missing - Repeated lab tests were not available in some patients to indicate disease progression; labs not ordered. - Potential misclassification bias.	**Sample:** *Population: - 18 years and older - had sepsis that met ≥ 2 SIRS criteria with suspicion of infection (based on consensus definition) - initial lactate level <4 within 6 hours of ED presentation - patients with signs of early sepsis. **Setting:** *Urban academic ED in the Bronx, NY, at Jacobi Medical Center.	**Data Collection:** *QuadraMed health information system that automatically combined triage vital signs with the white blood cell count, then prompted providers that a lactate testing was recommended. *Standardized data collection instrument utilized by 5 residents, 1 attending ED provider, and 1 physician volunteer that evaluated the patient charts. **Data Analysis:** *Statistical analysis conducted with STATA 10.1 (StataCorp LP, College Station, TX), below. *Sepsis progression – univariate analyses, also included in a logistic regression model. *Continuous variables became categorical variable – both Pearson's chi-squared or Fisher's	*Independent predictors related with disease progression in sepsis pts. 1. Hypoalbuminemia < 3.5 g/dL – creates loss of endothelial barrier function 2. Low diastolic BP < 52 mmHg – creates low capillary perfusion pressure 3. Both 1 & 2 above, due to extensive cytokine-derived damage to endothelial tissues that are major contributors to organ failure in sepsis. *Early recognition & treatment shows clinically and statistically significant mortality benefit from protocol based of EGDT. *Increase triage level as a higher risk for septic shock. *Future studies suggest - Validate their findings with a low percentage of missing data - Derive and validate a prediction tool for ED identification for increased risk of disease progression.

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				exact tests, as appropriate. *Wald statistics *Hosmer and Lemeshow goodness-of-fit test *Delta chi-squared *Delta deviance influence statistics.	
Burney, M., Underwood, J., McEvoy, S., Nelson, G., Dzierba, A., Kauari, V. & Chong, D. (2012). Early Detection and treatment of severe sepsis in the emergency department: Identifying barriers to implementations of a protocol-based approach. *Journal of Emergency Nursing, 38*(6), p. 512-517.	*Quantitative questionnaire on a protocol for sepsis, current practice, & difficulties in managing sepsis patients. *Qualitative questionnaire of perceived barriers and baseline knowledge and self-reporting competence in recognizing SIRS and sepsis. *Designed to Assess - Baseline knowledge & reporting confidence in recognizing SIRS & sepsis - Current practice treatment - Perceived barriers - Elicit suggestions to improve sepsis treatment in the ED.	*Cross-sectional design, online anonymous & confidential survey. *Study Limitations - Voluntary survey may result in selection bias - Reflected to conditions at one facility - Survey was not a validated survey tool.	**Sample:** *Full-time nurses and ED providers at Presbyterian Hospital **Setting:** *New York-Presbyterian Hospital-Columbia University Medical Center, NY, NY.	**Data Collection:** *Online survey questionnaires - 14 items – nurses - 13 items – providers - 8 general questions of closed & open ended **Data Analysis:** *PASW/SPSS version 18.0, and Descriptive statistics reported using Pearson X^2 tests of independence with $P < .05$ set for statistical significance.	*89% of nurses and 86% of providers, reported a written protocol would improve managing sepsis patients in the ED. *85% of nurses reported "not at all" or "somewhat" familiar with SIRS criteria. *Barriers to early identification & treatment: - #2 barrier – to implement a protocol-based early sepsis resuscitation - knowledge gap – RN lack of recognition in triage - delayed diagnosis of sepsis by providers - nurse-related delays completing orders by providers - lack of agreement on a protocol. *Other barriers: - #1 barrier - access to central venous pressure/central venous oxygen saturation (CVP/Scv02)

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					- lack of ED space - lack of nursing staff - general overcrowding - several critically ill patients at once with a heavy patient task load. *Staff recommendations - Triage protocol - Point-of-care LA testing - In-service on sepsis protocol & physiology - Sepsis rapid response team - Earlier critical care consults
Hung, K., Lam, R., Lo, R., Tenney, J. W., Yang, M., Tal, M. & Graham, C. A. (2018) Cross-sectional study on emergency department management of sepsis. *Hong Kong Medical Journal, 24*(6), 571-578.	*Nine domains (Key variables), regarding sepsis: 1. Dept. guidelines 2. Screening criteria 3. Provider resources 4. Care & microbiology 5. Available antibiotics & guidelines 6. ICU & other departmental support 7. Affecting factors of level of care provided 8. Priority of audits & research 9. Training and quality assurance *Questions developed by the study team with the recommendation structure by UK Sepsis Trust	*Cross-sectional study *Study Limitations: - No all Hong Kong ED participated - Current ED process of care assessed - Some expressed personal bias - Materials & views didn't reflect real current practice. *Future Studies: - Evaluate current clinical practice - Patient outcome with sepsis - Impact of adopting new sepsis definitions & international guidelines	**Sample:** *16 public EDs participated (provider & nurses) out of 18 EDs invited to participate in Hong Kong. **Setting:** *Hong Kong	**Data Collection:** *Structured telephone interviews *Interview guide included nine domains regarding sepsis by using a 5-point Likert scale: **Data Analysis:** *Audio recorded telephone interviews were obtained. *Standardized data collection sheet with the information entered into an Excel spreadsheet. *Descriptive statistics used for continuous variables & categorical variables.	*It was perceived by the interviewees that sepsis was the leading cause of mortality in-hospital. *Less than half of the EDs had sepsis guidelines. *Needs: the ***top #1 barriers***; ***lack of knowledge and experience***, needs for higher standard of care for sepsis patients, and sustained improvements in research, resources & training to improve care with septic patients. *Seven EDs used sepsis screening criteria, however, four departments used qSOFA guidelines based off Sepsis-3 recommendations.

Author/Article	Qual: Concepts or phenomena Quan: Key Variables Hypothesis Research Question	Study Design	Sample (N) Setting	Method for Data Collection/Analysis (Instruments/Tools)	Key Findings
					*Three out of the seven EDs used modified qSOFA criteria, due to definition changes of 'severe sepsis', which may increase positive cases requiring management in resuscitation and further strain in the ED. *Between 2014-2017 guidelines were implemented in the seven EDs. *qSOFA score commonly used in ICUs *However, ED providers mostly relied on SIRS criteria and clinical presentation.
Anand, V., Zhang, Z., Kadri, S. S., & Klompas, M., Rhee, C. (2019) Epidemiology of quick sequential organ failure assessment criteria in undifferentiated patients and association with suspected infection and sepsis. *American College of Chest Physicians 156*(2), 289-297. doi.org/10.1016	*Key Variables were qSOFA criteria within 1 day of admission with or without infection, and using the diagnosis code strategies with sepsis *Seeking to inform the role of qSOFA in sepsis identification & risk stratification with and without suspected infection.	*Retrospect chart review from 1/2012 to 9/2015 *Future study: - A need for new screening tools for sepsis that are both sensitive and specific.	**Sample:** *Admitted adult, ≥ 20 years or older, with or without ≥ 2 qSOFA criteria *To maximize data quality, they excluded most charts missing GCS and lack of consistently recorded vital signs. **Setting:** *Academic and community hospitals throughout the United States that participate using the Cerner Health Facts data set.	**Data Collection:** *Cerner Health Facts data set *Elixhauser method for better predictive validity for mortality *Assessed model discrimination with area under the receiver operating characteristic (AUROC) curves for deaths with qSOFA was added to the baseline risk model, also hospitals included as random effects **Data Analysis:**	*Out of 1 million hospitalized, n=271,500 (27%) were qSOFA positive on admission, - n=77,252 (28.5%) required ICU - White was the dominate race (78.1%), - median age 65 (51-78 interquartile range [IQR]) * n=732,847 were qSOFA negative on admission, - n=47,299 (6.5%) required ICU - White (73.5%) - median age 58 (40-72 IQR)

Author/Article	Qual: Concepts or phenomena Quan: Key Variables Hypothesis Research Question	Study Design	Sample (N) Setting	Method for Data Collection/Analysis (Instruments/Tools)	Key Findings
			*Final cohort for analysis: n=1,004,347, inpatient encounters from 85 hospitals *Before exclusions N=1,481,120, inpatient from 119 hospitals	*All analyses – SAS (institute) version 9.3 *All significance used two-sided *P* values at ≤ .05	*Median AHRQ Elixhauser score with 5 (0-14), without 0 (-1 to 8) *Sensitivity & Positive Predictive Value (PPV) of qSOFA for suspected infection & sepsis on admission & DC - **qSOFA sensitivity** for suspected – 41.3%, infection dx on DC – 36.3%, sepsis on admission – 62.8%, and sepsis dx on DC – 62.7% - **qSOFA PPV** for suspected on admit – 31%, infection dx of DC – 40.4%, sepsis on admit – 17.4%, and sepsis dx on DC – 13.3% *qSOFA score are common in condition other than infection/sepsis and have low PPV, but good for risk of mortality.
Tusgul, S., Carron, P.N., Yersin, B., Calandra, T., & Fami, F. (2017). Low sensitivity of qSOFA, SIRS criteria and sepsis definition to identify infected patients at risk of complication in the prehospital setting and at the emergency department triage. *25*(108), p 1-7. doi:	*The aim: compare the identification sensitivity of the qSOFA score with clinical SIRS criteria and Sepsis definition, within the prehospital setting and the initial ED triaged patients. Variables - age ≥ 18 - infected patients - most severe cases	*Retrospect study *Limitations - monocentric retrospective design - specific prehospital study - qSOFA, SIRS, Sepsis definition with confirmed or suspected infection - Sole reviewer determined the clinical categories and final	**Sample:** All adult patients transferred from emergency medical services (EMS) to the University hospital from Jan. 1, 2012 to Dec. 31, 2012 *Urban & suburban population (730,000) in western Switzerland.	**Data Collection:** *Data extracted from both prehospital and hospital electronic medical records that met criteria. **Data analysis**: *Dimple descriptive statistics, calculations done by XLSTAT, statistical software	*qSOFA and sepsis definitions were suboptimal and did not recognize most seriously infected patients early. *SIRS criteria performed well for both prehospital and at triage in the ED. *Despite SSC removing the SIRS criteria and redefining sepsis definition, they consider SIRS a good

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10.1186/s13049-017-0449-y.	- at risk of complications, in-hospital, mortality at 48 hours, ICU admission & stay ≥ 3 days.	diagnosis & performance measured	*n=11,411 total transported *n=7,617 included *n=890 Infection suspected/diagnosed in ED. *n=454 infection group *n=432 sepsis group *EXCLUSIONS - <18 years, n=278 - Cardio-resp. arrest, n=80 - trauma, n=2,692 - seizures, n=355 - pregnancy, =78 - prisoners, n=184 - no available charts, n=127 **Setting:** *Lausanne University Hospital (CHUV) ED, the state of Vaud, western Switzerland	compatible with Microsoft Excel. *Chart reviews done by one evaluator.	indicator for infection recognition (SSC, 2016) *qSOFA sensitivity results: - ICU admission, 31.2% - ICU stay ≥ 3 days, 30.5% - at 48-hour mortality, 60% *SIRS criteria sensitivity results: - ICU admission, 58.8% - ICU stay ≥ 3 days, 57.6% - at 48-hour mortality, 80% *Sepsis definition sensitivity results: - ICU admission, 42.5% - ICU stay ≥ 3 days, 42.4% - at 48-hour mortality, 60%
Jones, A. E., Focht, A., Horton, J. M., & Kline, J. A. (2007). Prospective external validation of the clinical effectiveness of an ED-based early goal-directed therapy protocol for severe sepsis and septic shock. *American College of Chest Physicians, 132*(2), p. 425-432. doi: 10.1378/chest.07-0234.	*To determine the clinical effectiveness of implementing early goal-directed therapy (EGDT) as a routine protocol in the emergency department (ED). *Study results was compared to that of River et al. (to establish efficacy).	*Prospective interventional study *Designed to test the *Clinical effectiveness* of EGDT, not the efficacy. *Prospective before and after study of the clinical effectiveness of EGDT protocol in the ED. *Before phase – providers were not aware of the EGDT implementation plan. Also, had not previously used a protocol.	**Sample:** *Preintervention patients, n=79 *Postintervention patients, n=77 Total enrolled, n-157 **Setting:** *Patients enrolled in the Carolina Medical Center ED. *An urban, 800-bed, teaching hospital, with > 100,000 yearly patient visits.	**Data Collection:** *Pt. data was entered in real time in an EHR. **Data Analysis:** *Continuous data (mean ± SD): unpaired *t* test or Mann Whitney *U* test. *Categorical data (95% CI & significance): X2 or Fisher exact test. *Time-to-primary comparison analysis: Kaplan-Meier survival	*EGDT implementation in the ED was associated with a 9% absolute (33% relative) mortality reduction. *This ED EGDT study data provided external validation of the "*clinical effectiveness"* treating sepsis and septic shock. *Results lead to a grade B recommendation for the routine use of EGDT in the ED, as part of the SSC

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		*A nurse and provider with experience in protocols, were available by pager, 24/7, for quality assurance to answer questions regarding protocol execution.		estimates and log-rank test. *All statistical tests, $p < 0.05$ was considered significant.	guidelines, and indorsed by 11 professional societies. *This study was aimed to mimic as much as possible to River et al., through protocol-driven resuscitation strategy aimed at hemodynamic optimization in the ED and the varies endpoints. This study "*measured the effect of the intervention of the EGDT protocol*" *Efficacy of EGDT was established by Rivers et al.
Gatewood, M. O., Wemple, M., Greco, S., Kritek, P. A., & Durvasula, R. (2015). A quality improvement project to improve early sepsis care in the emergency department. *British Medical Journal, 24*, 787-795. doi: 10.1136/bmjqs-2014-003552.	*Sought to develop a protocol focusing on early identification of patients with uncomplicated sepsis, severe sepsis, and septic shock. *The nurse-driven protocol focused on earliest screening, on first encounter, in the ED.	*A before and after retrospective cohort study. *Limitations - use of ICD-9 codes, imperfect tool, may have missed some sepsis cases. - Subjective interpretation chart review - Alert fatigue/clinician overrides, may increase specificity.	**Sample:** *Total cases admitted to the ED, n=1032 *Cases included in the study, n=624 *Cases excluded, n=408, however, n=124 (30%) not identified in the ED. **Setting:** *The University of Washington Medical Center ED. Seattle, Washington.	**Data Collection:** *Retrospective analysis performed using ICD-9 for sepsis, severe sepsis and septic shock. *To perform a validate accuracy of the coded data, a manual chart audit was conducted. *EM Health Data Management System was created to capture all sepsis-designated ICD-9 codes, on those that presented to the ED. **Data Analysis:** *Data is analyzed through a repository Structured Query Language Server database (Amalga).	*Overall bundle compliance increased 154%. Baseline 28% to 71% in the last quart of their study ($p<0.001$). *Early screening protocol intervention by using a nurse-driven screening tool, computer alerts, and specific sepsis order set, can lead to faster care to patients with sepsis in the ED, which could serve as a model for other facilities. *Rivers *et al.,* the original randomized controlled trial was used as a reference that reported improved outcomes. *Protocol-Based Care for Early Sepsis Shock (ProCESS) and Australian

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				*The 3M reports are crossed-referenced with the Amalga database to obtain the relevant information needed for the study. *Manual chart review done to validate accuracy. *Used Pearson's X2 analyses for compliance and mortality data.	Resuscitation of Sepsis Evaluation (ARISE) are current trials that failed to show a clinical benefit from EGDT. *This study demonstrated EGDT leads to faster delivery of care in the ED with sepsis. *A novel approach in 2015, results showed effectiveness, and worthy to consider implementing in other facilities.
Mitzkewich, M. (2019) Sepsis screening in triage to decrease door-to-antibiotic time. *Journal of Emergency Nursing, 45*(3), 254-256.	*Identify and treat patients more quickly with sepsis to meet the recommendation of the Surviving Sepsis campaign guidelines.	*Pre and Post-intervention.	**Sample:** *Total initial charts reviewed, pre-intervention, n=120 *Total post-intervention, n=20 charts reviewed. **Setting:** *Small community ED in San Diego, California. No name mentioned.	**Data Collection:** *Manual chart abstraction (pre-intervention) and reviewed, of 10 charts per month for 12 months. *Post-interventions, manual chart abstraction, and reviewed 10 charts for 2 months, with an immediate impact. **Data Analysis:** *Results were analyzed using a control chart for the change that depicted the course over 14 months.	*Reported time improvement from baseline, from 105.3 minutes to 71.9 minutes. Showing a 33.4-minute improvement. *The study reports a simple change of a screening protocol into triage for throughput improved times with minimal obstacles. And, without decreasing triage time. *Screening tool based off Sepsis-1 and Sepsis-2 definitions and not Sepsis-3, which excluded SIRS criteria. *Pts who walked-in and met SIRS criteria were made a priority and did not have to wait in the waiting

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					room, which extend their treatment time.
Tromp, M., Hulscher, M., Bleeker-Rovers, C. P., Peters, L., Van Den Berg, D., Borm, G. F., Kullbert, B. J., Van Achterbert, T., & Pickkers, P. (2010) The role of nurses in the recognition and treatment of patients with sepsis in the ED: a prospective before-and-after intervention study.	*To determine the effects of implementing a nurse-driven, care bundle based, sepsis protocol in the ED after training and performance feedback.	*A prospective before-and-after (of two interventions study, with three dense periods of measurements. 1. Pre-use of new care bundle sepsis protocol 2. Post-use of protocol 3. After training & performance feedback.	**Sample:** *Adult patients ≥ 18 years old, with an ED visit for suspected infection, that had 2 or more of SIRS criteria *Actual study included n=825, patients in the ED that presented with sepsis. *However, total patients admitted to the ED during the study time and patients with sepsis, n=24,412 * Period 1, n=6,730 * Period 2, n=12,429 * Period 3, n=5252 **Setting:** *University hospital in the Netherlands of 35 registered nurses are employed.	**Data Collection:** *Retrospectively checking for diagnoses on ED admission with sepsis. *Baseline performance - collected from clinical patient databases, medical & nursing records. *Before & after intervention, & missing data was collected prospectively from the screening and performance lists. **Data Analysis:** *Descriptive statistics for the 6 elements of the bundle. *Generalized linear model with a logarithmic link and Bernoulli distribution function to analyze the differences in compliance *Estimated the interclass correlation coefficient, mixed model analysis to adjust for many nurses that treated several patients.	*No significant differences of characteristics in patients with sepsis. *ICU/Med/Surg patient admissions showed 89%, with pneumonia & urogenital infections as the most commonly suspected infections. *82% final diagnosis was a bacterial infection with 33% lungs and 21% urine. *Improving quality of care can be done by a simple protocol that is inexpensive. *Without the protocol in triage patients with sepsis were initially missed in triage, but attending providers identified and treated them. *Using the screening tool alone resulted in better compliance with completion of the six elements on the protocol to mark off. *The main focus was on nursed & their role in recognizing & treat patients with sepsis.

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