Sepsis Bundle Compliance and the Utilization of Sepsis Checklist in the Emergency Department: A Program Evaluation

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Abstract

Sepsis is the leading cause of death worldwide. The best practice treatment for sepsis is the SEP-1 bundle. Unfortunately, less than 50% of hospitals complete the SEP-1bundle despite many tools and resources available. This program evaluation evaluated if the addition of a nurse driven sepsis protocol utilizing a paper SEP-1 bundle documentation tool would (1) increase SEP-1 compliance, (2) reduce sepsis mortality and hospital length of stay (LOS), (3) increase nursing satisfaction (4) increase provider satisfaction, and (5) be cost effective. The setting was a 55 bed Metro Detroit Emergency Department (ED). Participants were septic patients that visited the ED, ED nurses, and ED providers. Retrospective chart analysis was conducted three months before and after implementation of the protocol to assess for SEP-1 compliance, patient mortality, LOS, and cost. Lastly, a Likert survey was given to nurses and providers to assess satisfaction with the program. Results of the program evaluation found a 388% increase in SEP-1 bundle compliance, 73% decrease in mortality, and 22% increase in hospital length of stay. The Likert survey results found nursing satisfaction rating to be 77% and provider satisfaction 66%. This program evaluation found the protocol significantly increases SEP-1 compliance and reduced sepsis mortality. Length of stay increased. The leading cause of incomplete SEP-1 compliance was a failure of the providers to order the SEP-1 bundle.

Keywords: Sepsis, SEP-1 bundle, nurse driven protocol, documentation tool, emergency department, mortality, length of stay, cost of care, nurse satisfaction, provider satisfaction, program evaluation

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Sepsis is the leading cause of death worldwide with a mortality ratio of 1:5 (Rudd et al., 2020). In the United States (U.S.), sepsis is the leading cause of death in the hospital with 50% of total deaths being related to sepsis and 66% of those death being directly caused by sepsis (Rhee et al., 2019). Sepsis is also the costliest in-hospital condition to treat. The cost of inpatient sepsis treatment is between $39,336 and $68,671 per case with the greater delay in care equaling the greater cost of care (Paoli et al., 2018). In 2019, the United States spent $57.47 billion in the treatment of sepsis pre-COVID (Frank et al., 2021). It was found that 12.5% of those deaths related to or caused by sepsis, could have been prevented with better hospital care (Rhee et al., 2019). The Surviving Sepsis Campaign created a treatment plan for sepsis that has been adopted by the Centers for Medicare and Medicaid Services (CMS) (Townsend et al., 2022). This plan is now the established standard of care for the treatment of sepsis. The SEP-1 sepsis bundle is the expected standard of sepsis care. All hospitals that participate in CMS are required to publicly report their compliance to the SEP-1 bundle.

The use of real-time checklists has demonstrated improved outcomes including obtaining timely lactate levels, blood cultures, and early intervention compliance in patients with suspected sepsis. The use of these real-time checklists has led to a reduction in sepsis mortality, time to sepsis screen and length of stay by 2.5 days. These statistics are useful in supporting increased compliance for the SEP-1 sepsis bundle to further improve patient outcomes and reduce costs in the septic population (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; Threatt, 2020).

On 9/1/2022 a sepsis documentation tool (titled Nursing Severe Sepsis / Septic Shock Documentation Tool) was implemented in a community hospital's Emergency Department (ED)

located in Warren, Michigan. The purpose of the documentation tool was to function as a hand off guide so that sepsis care could be transferred seamlessly from nurse to nurse, augment sepsis charting, and provide a check list for completion of the SEP-1 bundle. The Nursing Severe Sepsis / Septic Shock Documentation Tool was created by the Ascension Michigan Sepsis committee and approved for use at all Ascension metro Detroit locations. Ascension hospital in Warren, Michigan has a 55 bed ED that serves between 180 to 220 patients per day. A large part of its volume is from nearby chronic care, acute care, and rehab centers in the area. Approximately three to eight sepsis alerts, including one to two severe sepsis or septic shock patients, are evaluated in the ED each day. Prior to the current sepsis documentation tool, another sepsis checklist was available but grossly underutilized and was ineffective at meeting sepsis improvement goals. Utilization was at or near 0% over a recent two-year period (2019-2021). Furthermore, the hospital has had 16 more sepsis related mortalities in 2022 compared to 2021 (Evans, 2022).

Background & Significance

Approximately 1.7 million sepsis cases were diagnosed in U.S. emergency rooms in 2020 and approximately 270,000 deaths resulted from those cases (Rhee et al., 2017). Early treatment of sepsis in the ED is extremely important as this provides the first opportunity for sepsis recognition and treatment (Wang et al., 2017). In most institutions, nursing staff are often the first medical contact patients have in the hospital. Nurses should recognize sepsis early, take swift action in expediting treatment, and be familiar with the treatment process and all its complexities/necessities in order to improve outcomes.

The standard of sepsis treatment revolves around the SEP-1 sepsis bundle also known as the Sepsis Bundle established by the Centers for Medicare and Medicare Services (Townsend et al., 2022). The bundle was first introduced during the Surviving Sepsis Campaign in 2002

(Surviving Sepsis Campaign, 2021). Compliance with this bundle has shown a significant reduction in sepsis mortality, cost of care, and length of hospital stay (Liu et al., 2017, Moore et al., 2019, Townsend et al., 2022). Furthermore, a recent study showed that compliance with the SEP-1 sepsis bundle has the greatest effect on improving patient outcomes when related to community acquired sepsis, a common etiology for many community ED's (Baghdadi et al., 2020). Unfortunately, SEP-1 compliance averages around 50% among hospitals in the United States (Barbash et al., 2019). Earlier identification of sepsis and utilization of the SEP-1 sepsis bundle could prevent 92,000 deaths per year, decrease the number of hospitalized days by 1.25 million annually, and decrease hospital expenditures by more than $1.5 billion (Centers for Disease Control and Prevention [CDC], 2018) making increasing SEP-1 compliance an urgent quality improvement issue to solve.

Complying with the SEP-1 sepsis bundle is a multidisciplinary effort between providers, nurses, paramedics, pharmacy, laboratory services, and unlicensed personnel in the ED. To comply with the SEP-1 sepsis bundle, blood cultures, initial lactic acid, a 30ml/kg crystalloid fluid bolus, a broad-spectrum intravenous antibiotic, and reevaluation of fluid volume status (e.g., blood pressure and heart rate) must be performed/given within three hours of identification of two Systemic Inflammatory Response Syndrome signs (SIRS). SIRS signs and symptoms include fever >38.0°C or hypothermia <36.0°C, tachycardia >90 beats/minute, tachypnea>20 breaths/minute or partial pressure of CO2 <32mmHg, leukocytosis >12 or leucopoenia <4 or >10% immature forms (Chakraborty & Burns, 2021) and a potential or suspected source of infection (QualityNet Home [CMS.gov], 2022). This time of identification is also known as "time zero" which starts the clock for completing the above interventions (CMS.gov, 2022). Furthermore, a repeat lactic acid and administration of vasopressors must be drawn/administered within six hours of "time zero" (QualityNet Home [CMS.gov], 2022). In many instances, the

identification of sepsis and completion of sepsis treatment tasks is a nursing responsibility. Thus, these issues directly affect nursing and the nursing practice.

Sepsis bundle compliance in this Warren Michigan hospital has been inconsistent though the past few years. Previous interventions included the implementation of another "homemade" sepsis bundle checklist. Most recent audit data uncovered that in April of 2022, severe sepsis/ septic shock bundle compliance was 39%. Continuing, physicians' compliance in ordering the sepsis bundle power plan was 40.98%. Furthermore, the observed versus expected mortality rate of sepsis was found to be 1.223 which is 27.3% higher than the national benchmark (Evans, 2022).

The previous sepsis screening tool, which was not a part of the patient's permanent record, had an estimated cost of $2000 to $5000 annually (Evans, 2022). This cost included printing costs and filing time. One study found that the use of a sepsis screening tool reduced the cost of septic care by 51% as a result of preventing further complications related to sepsis delay of care (Toews et al., 2022). Another study found that utilizing a sepsis check list lowered the mean cost of sepsis care by $4794 per patient (Moore et al., 2019). Finally, several studies found that the completion of a SEP-1 lowered sepsis mortality significantly (Barbash et al., 2019; Milano et al., 2018; Rhee et al., 2018). One study finding it lowered mortality as much at 53% (Manaktala & Claypool, 2016). For reasons mentioned above, it was deemed necessary to implement this program and conduct a project evaluation on the utilization and outcomes of the sepsis documentation tool.

While there is a large body of strong evidence supporting the use of the SEP-1 bundle, the literature is not unanimous that the SEP-1 bundle protocol is the best way to treat all septic patients. One study found that lower nursing ratios are more crucial than bundle compliance in reducing sepsis mortality (Dierkes et al., 2022). Meaning, outcomes may see greater

improvement through reduced nursing ratios than implementing a sepsis checklist for SEP-1 compliance. Another study believes that more evidence is needed to support a national sepsis care mandate and that the SEP-1 bundle further leads to antimicrobial resistance (Wang et al., 2020). Further, one study even criticizes the 30ml/kg crystalloid fluid bolus stating that this number was derived from expert opinion and not meta-analysis, thus, posing a greater risk to patients as in fluid overload or hemodilution (Marik et al., 2020). Finally, a retrospective cohort study found that there was no change in mortality comparing those that received the SEP-1 bundle and those that did not (Rhee et al., 2021). However, it is not in the scope of this program evaluation to address the concerns or legitimacy of the SEP-1 bundle. The SEP-1 bundle is a CMS reported core measure and is supported by a large body of evidence to improve outcomes when compared to previous treatment standards.

Problem Statement

Sepsis is a complex pathology with high in-hospital mortality that requires a well-orchestrated multidisciplinary team to operate seamlessly in its early recognition, diagnosis, and treatment. Despite the high mortality of sepsis, CMS's strong push to SEP-1 compliance, and the literature supporting the SEP-1's effectiveness, bundle compliance remains low. A growing number of studies have shown the value in implementing a SEP-1 bundle checklist to increase compliance. Unfortunately, compliance in completing the SEP-1 bundle or utilizing tools such as sepsis checklist are less than 50% at this community hospital. Furthermore, low compliance leads to increased mortality, hospital length of stay, and cost of care.

Clinical Question

1) Will a nurse driven protocol utilizing a paper SEP-1 bundle documentation tool increase SEP-1 compliance in Ascension Macomb's Warren's Campus Emergency Department when compared to pre-existing measures?

2) Will a nurse driven protocol utilizing a paper SEP-1 bundle documentation tool reduce sepsis mortality and hospital length of stay at Ascension Macomb's Warren's Campus Emergency Department when compared to pre-existing measures?
3) Will a nurse driven protocol utilizing a paper SEP-1 bundle documentation tool increase nursing confidence in septic care at Ascension Macomb's Warren's Campus Emergency Department when compared to pre-existing measures?
4) Will a nurse driven protocol utilizing a paper SEP-1 bundle documentation tool increase provider confidence in septic care at Ascension Macomb's Warren's Campus Emergency Department when compared to pre-existing measures?
5) Will a nurse driven protocol utilizing a paper SEP-1 bundle documentation/check off tool reduce the cost of sepsis care Ascension Macomb's Warren's Campus Emergency Department when compared to pre-existing measures?

Literature Review

Scope of Review

Databases for this comprehensive literature review included Cumulated Index in Nursing and Allied Health Literature Complete (CINAHL), PubMed, and SAGE. Search terms included Sepsis Checklist, Sepsis Bundle Compliance, Emergency Department, SEP1 Bundle Compliance, Sepsis Bundle Compliance Tool, and Increasing Sepsis Bundle Compliance.

Year range for studies included articles that were published in the past five years (2017-2022). Inclusion criteria included studies that addressed SEP-1 sepsis bundle compliance using a checklist. Studies in the review included qualitative research to define the phenomenon, quantitative research to address the phenomenon, and mixed methods. Exclusion criteria included studies that did not include use of a sepsis (SEP-1) bundle checklist at least partially in their intervention, and studies occurring greater than five years from the time of literature review.

Analysis of the Literature

Themes

After reviewing the literature, specific recurring themes were identified. All studies aimed to improve their SEP-1 sepsis bundle compliance as well as the time in which they were performed (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; Threatt, 2020). Interventions were similar through the literature, however, implemented differently to best suit the intentions of the author/facility. Common interventional themes shared between all studies were utilization of a sepsis checklist, delivering sepsis education to staff, and forming multidisciplinary sepsis teams (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; Threatt, 2020). Results shared between all studies include early identification of sepsis, timely antibiotic administration, and increased SEP-1 bundle compliance (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; Threatt, 2020).

Major themes that were not uniform throughout the literature include the use of a nursing driven sepsis checklist (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Threatt, 2020) and physician driven sepsis checklist. Sonis et al., (2020) was the only study which implemented a physician driven sepsis checklist. Deploying a multidisciplinary sepsis team was another unanimous intervention, however, how that team functioned varied differently between each study. Delawder & Hulton (2020) created a team that was activated when a “code sepsis” was identified. This team functioned much as a rapid response team or code blue team would. On the other hand, Gripp et al., (2021), Maciolek & Dawson (2021), Moore et al., (2019), Sonis et al., (2020), and Threatt (2020) all utilized staff already in the department that were trained in sepsis identification, use of the developed tool, and the SEP-1 sepsis bundle. An important detail though, despite the slight variations, all studies had

statistical significance in improving specific steps (i.e., timely fluid administration, antibiotics, initial/repeat lactic acid draw, blood culture draw, and or vasopressor administration) and overall SEP-1 sepsis bundle compliance. Other studies even showed a decrease in length of stay (Gripp et al., 2021; Moore et al., 2019) and reduction in sepsis related mortality (Delawder & Hulton, 2020; Gripp et al., 2021; Threatt, 2020).

Implications for Practice

Each article in the literature review has significant implications for practice. Each one adds to the science of nursing and creates better patient outcomes all while creating revenue, leaning the process, and creating standardization. Specifically, Delawder & Hulton (2020), Gripp et al., (2021), Maciolek & Dawson (2021), Moore et al., (2019), Sonis et al., (2020), Threatt (2020) all had an increase in at least one of the interventions in the SEP-1 sepsis bundle. For instance, Gripp et al., (2021), Maciolek & Dawson (2021), Moore et al., (2019), Sonis et al., (2020), and Threatt (2020) all had a statistically significant decrease in time to receive antibiotics. If an institution was struggling with antibiotic time in their bundle, they could implement a sepsis checklist, sepsis education, and form a multidisciplinary team as done in the related studies. Implementing these strategies, as evidenced by the literature, should reduce antibiotic time and increase SEP-1 sepsis bundle compliance. This is important considering timely antibiotics have been shown to be the most important intervention in reducing sepsis mortality (Maciolek & Dawson, 2021).

Delawder & Hulton (2020), Maciolek & Dawson (2021), Moore et al., (2019), and Sonis et al., (2020) all identified a decrease in time to fluid bolus. This is a significant intervention for different key reasons. First, fluid bolus is the primary intervention for hypotension related to sepsis. Secondly, it is the precursor before vasopressors are started. Although important for short term perfusion, vasopressors come with a risk of permanent tissue and or organ damage

(Worapratya & Wuthisuthimethawee, 2019). Regardless, these interventions are part of the SEP-1 bundle which together have shown to reduce mortality, cost of care, and length of stay (Townsend et al., 2022).

Another part of the bundle, initial and repeat lactic acids, also had significant improvement in rate and time of completion in Delawder & Hulton (2020), Gripp et al., (2021), and Moore et al., (2019). Completing timely lactic acid draws are key for monitoring the vascular volume and tissue perfusion status. Post fluid bolus, if the lactic acid is still high or the blood pressure is under a mean arterial pressure of 65 mmHg then vasopressors might be required for extra support (Townsend et al., 2022). Implementing the sepsis hand off tool should help increase lactic acid draw compliance (Delawder & Hulton 2020; Gripp et al., 2021; Moore et al., 2019).

Appropriate and timely blood culture draw compliance also revealed significant improvements using a sepsis bundle checklist (Gripp et al., 2021; Moore et al., 2019). If antibiotics are given before blood cultures are drawn, the sample of blood culture will have less growth. This will cause a false negative result for bacteremia which places the patient at higher risk for receiving the wrong or ineffective antibiotics (Woo & Robinson, 2015).

Furthermore, length of stay was reduced in Gripp et al., (2021) and Moore et al., (2019). Length of stay is important for different reasons. First, the length of stay is directly related to increased risk for hospital acquired infections. Second, increased length of stay places undue financial burden on the hospital and patient. Third, increased length of stay puts throughput burden on the hospital causing an increased delay in patient admission from other hospital entrance ways e.g., ED, operating room, or direct admits (Toh et al., 2017). Partially associated with length of stay, a reduction in sepsis related financial cost decreased in Moore et al., (2019). Thus, supporting the sepsis checklist, sepsis education, and multidisciplinary team interventions.

Education was an intervention that remained consistent throughout all the studies. Education was given to all staff that were on the multidisciplinary sepsis team and or worked with patients that were at risk for or had severe sepsis/septic shock. The only variation was Gripp et al., (2021) who created a mandatory post education test that all providers and staff had to pass at 100%. The use of sepsis screening tools and care bundles was also correlated to increased nurse knowledge and confidence in managing septic patients (Chua et al., 2022).

Finally, and potentially most important, reducing mortality was seen in Delawder & Hulton (2020), Gripp et al., (2021), and Threatt (2020). Considering that the surviving sepsis campaign had a focus on reducing sepsis morbidity and mortality, the decrease in these factors is important. It shows that the SEP-1 bundle interventions are effective in treating severe sepsis/septic shock and that the interventions in Delawder & Hulton (2020), Gripp et al., (2021), and Threatt (2020) are effective in increasing SEP-1 sepsis bundle compliance.

Organizational Assessment

Strengths

After completing a two-week strength, weakness, opportunity, and threat (SWOT) assessment of Ascension Macomb-Warren's ED, many factors were appreciated that would lead to success of their increasing SEP-1 sepsis bundle program. The timeline of two weeks was recommended by the department's director to complete a comprehensive assessment and status of the current SEP-1 sepsis bundle compliance program. One of the most notable aspects of this ED is the strong work of the nurses. The physicians, nurses, and techs work well together with observed effective collaboration. The physician partners trust the nurses creating an environment of nurse autonomy. The nurses utilize an advanced practice care guide protocol which allows them to order their own basic lab work and imaging dependent on the patients chief compliant and the wait time in the ED.

One unique opportunity of this ED is its culture to adapt to change. After several interviews with senior staff members, most indicated willingness to implement evidence-based change. Furthermore, this hospital is a teaching hospital with a strong and eager resident physician team. This team is willing to try evidence-based practices that lead to better patient outcomes and quality improvements. Another strength of this ED is its strong and supportive leaders who are often on the floor assisting staff. There are also three shared governance committees (quality, supplies, morale) that have had several successful projects each the past year. Furthermore, the ED has hired a fulltime Clinical Nurse Specialist (CNS) that oversees patient quality outcomes, bedside staff support, and unit process troubleshooting. The next assessed strength is that ED has held onto many staff members that have five plus years at this institution. These experienced members now play a crucial role in training new nurses and maintaining a positive work culture. Lastly, The ED employs four Assistant Clinical Leaders (ACLs) who spend four hours a week on their assigned quality outcome projects (sepsis, trauma, myocardial infarction, and acute cerebral vascular accidents).

Weaknesses

Several weaknesses were appreciated during the two-week SWOT sepsis analysis. The largest weakness was the poor sepsis SEP-1 compliance and subsequent mortality rate and LOS. The next weakness was that 30 to 40% of current staff are hired from outside travel agencies known as contract nurses. Furthermore, many nurses are new to the workforce and have been licensed for less than two years. This makes for a very unexperienced or novice team who are not yet experts in their practice. Identifying sepsis early is largely a nurse's responsibility (Kleinpell, 2017).

Another identified weakness was the lack of any process change to improve sepsis outcomes in the previous three years. Relatedly, there are no full-time ED patient outcome,

benchmarking, or quality control personnel hired in the ED. Furthermore, older processes such as completing a previous sepsis checklist are not being implemented. In the past six months there has been 0% compliance in completing the sepsis checklist. The checklist had been mandatory at one time but due to COVID-19 is no longer being tracked or practiced.

Opportunities

Several opportunities were noted during the SWOT assessment. The most pressing opportunity is the current and drastic attempt to hire more full-time staff nurses. A large portion of current hospital resources are being put into finding and hiring staff nurses. Currently, there are 14 vacant nurse positions split between day and night shift with multiple interviews happening weekly to fill those positions. However, active recruiting is occurring by means of job fairs, sign-on bonuses, and presentations at local nursing colleges. With more staffing comes decreased nurse-patient ratios as well as opportunity for staff to rest during shifts. Ultimately creating better and more effective nursing interventions in sepsis care.

Another opportunity is the newly graduated and hired Clinical Nurse Specialist (CNS). Still in training, the CNS will oversee quality outcomes within the department, which includes sepsis, trauma, cerebral vascular accidents, and myocardial infarctions. Other duties of the CNS are to give nursing and physician staff direct bedside support by being an expert consultant in these four areas. Hiring the CNS offers the opportunity for increased collaboration and support between administrators, bedside clinicians/nurses, patients, and an increased focus on SEP-1 bundle compliance.

Lastly, there is support by staff and leadership for change in the ED. Especially when it comes to reducing mental and or physical strain. Staff have vocalized the need for further sepsis education and process improvements. To take advantage of this opportunity, Ascension Macomb has implemented a house made sepsis documentation tool in efforts to increase SEP-1 bundle

compliance. Data on the effectiveness of the documentation tool will consist of SEP-1 bundle completeness, patient sepsis mortality, patient length of stay, staff satisfaction with the tool, and cost effectiveness. After conclusion of project, the CNS will evaluate the effectiveness of the checklist on meeting its goals and offer recommendations for continued quality improvement.

Threats

Several threats were appreciated during the SWOT assessment. One large threat was the overwhelming number of patients cared for in this hospital. On average this ED cares for 170 to 220 patients per day. The ED has a combined 55 beds between its acute and observation units. This means that each room needs to turn over four times per day giving the average stay in the ED six hours or less. Turing over the room four time a day can be difficult due to the high acuity in the department. Another factor that increases the length of stay is the reduced staff on the floor leading to one to two floors currently being closed. Due to floors being closed, boarding in the ED has been common, causing long wait times and large ratios for nurses. Ultimately, all factors listed create a backup in the patients being seen in the ED and the ED's waiting room. With long wait times, patients may leave and seek treatment at another facility. This not only places the patient at risk for increased health concerns, but also causes financial hardship for the hospital. Especially when other hospitals in the metro area have advertised programs in place for door to provider times of 30minutes or less.

The last threat to the facility is the lack of full-time quality personnel specific to the ED. Other health care facilities have quality teams that are specific to the ED since the ED is the first point of caregiver contact and time zero for many CMS initiatives. For example, a competing healthcare facility nearby has three CNSs in their ED, consistently monitoring quality and patient outcomes.

Program Evaluation Cost

The cost associated with this program evaluation is limited and minimal. Time associated with gathering data from retrospective chart evaluation is the bulk of the expected expenses, which should be performed during working hours as a part of the sepsis committee's existing procedure. Other expenses are associated with implementing recommendations drawn from the program evaluation. Currently there are funds for quality improvement that the ED is allotted. There is no set amount that is allowed to the ED as each intervention is assessed individually for its front-end cost as well as expected return on investment. However, improvements under $500 in a single transaction does not require director approval and transactions greater than $10000 require nursing vice-president approval. Finally, the cost of the questionnaire is minimal as it will take less than 5 minutes to answer, leading to insignificant time cost. Cost savings from timely completion of the bundle on a single patient saves on average $4794 from reduced length of stay, reduction in unnecessary test, and orders (Moore et al., 2019).

Theories and Conceptual Frameworks

The theoretical framework that will guide and inform the program evaluation is the Logic Model. A logic model displays linear relationships between situations/context, resources/inputs, activities, outputs, and outcomes (short, intermediate, and long term) given specific assumptions such as that the program is working as listed (Centers for Disease Control and Prevention, 2010). The logic model will guide the program evaluation by organizing all parts of the process and mapping how inputs lead to outputs, and ultimately long-term outcomes. A copy of the logic model is in figure 1.1. The logic model is described as follows:

Contextual Factors

Both external and internal factors have an influence on this problem. Internal factors include very low SEP-1 compliance compared to national benchmarks and averages. In April of 2022, severe sepsis/ septic shock SEP-1 bundle compliance was 39% at Ascension Macomb.

Continuing, physicians' compliance in ordering the sepsis bundle power plan was 40.98%. The observed versus expected mortality rate of sepsis was found to be 1.223 which is 27.3% higher than the national benchmark (Evans, 2022). Continuing, staff utilization of a prior sepsis tool was grossly underutilized and was ineffective at meeting sepsis improvement goals. Utilization was at or near 0% over a recent two-year period (2019-2021). The hospital has had 16 more sepsis related mortalities in 2022 compared to 2021 (Evans, 2022). Furthermore, the increased nurse-patient ratio from four to five to one has placed extra strain on nursing staff. Finally, reduced throughput of the hospital has caused boarding (holding) in the ED.

External factors include approximately six to eight sepsis patients, including one to two severe sepsis or septic shock patients, are treated in the ED each day. This high number of septic patients is related to the high number of nursing homes surrounding the hospital with no other facility to be treated at. Ascension's Macomb Hospital is the only hospital in Warren Michigan, the 3rd largest city in Michigan.

Literature states that the utilization of a sepsis documentation tool (checklist), sepsis recognition/treatment education, as well as a designated multidisciplinary sepsis team have shown to increase SEP-1 compliance, reduce length of stay, reduce mortality, and reduce the cost of inpatient sepsis care (Delawder & Hulton, 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; Threatt, 2020). It was the goal for Ascension Macomb to implement a revamped sepsis program. The new program would include sepsis education, nursing sepsis identification protocol, and SEP-1 bundle checklist/documentation tool.

Inputs

Human inputs for this program include emergency bedside staff (nurses, medical providers, pharmacist, emergency technicians, and paramedics) and non-bedside staff (emergency nurse manager, nursing director, medical director, nursing vice-president, and

members of the quality department). Teamwork between bedside and non-bedside staff is crucial for the effective delivery of sepsis care. The education input includes training bedside staff to recognize sepsis, the protocol once sepsis is recognized, and the components of the SEP-1 bundle. Other inputs to consider are the time in which it takes to implement the program and the time in which it takes for new behaviors to become standardized practices. The price of the tool is minimal, however, is still a factor. Cost for this proposal is related to the cost for paper, the cost of human time (minutes added each day for auditing, implementation, and staff support), and the cost of auditing. However, these tasks are already in daily practice and thus should not cause any significant additional financial burden. Lastly, there is the input of nurse driven sepsis protocols including triage interventions, advanced nursing protocols, documentation tool use, sepsis power plan ordering by providers.

Activities

Activities in the program include training bedside staff to recognize sepsis, the protocol once sepsis is recognized, and the components of the SEP-1 bundle. Education was completed by nursing leadership during staff huddles prior to shift in the form of general sepsis care facts as well as case studies to apply knowledge. Mandatory online sepsis knowledge tests were also issued during program opening month to evaluate knowledge gained. Other activities include the development and practice of nurse driven triage interventions i.e., calling a “code sepsis” and escalating the emergency severity index to priority one. Next was the utilization of advanced nursing protocols giving nursing the ability to place lab and imaging orders. Furthermore, sepsis "Power plans” or order-sets were created and distributed to providers thus reducing forgotten orders. Finally, the sepsis documentation tool was distributed to nursing staff for use when sepsis is suspected, and orders are placed.

Outputs

Multiple outputs were obtained through the inputs and activities. Nurses activating the sepsis protocol by activating a “code sepsis” was one output. Once sepsis was discovered or suspected, nurses used the advanced practice nursing protocols to consult ED providers. Then providers ordered the sepsis diagnostic order-set and treatments. Finally, bedside staff utilized the sepsis documentation tool that was provided by ED leadership to keep track of the tasks included in the three- and six- hour SEP-1 bundles. The tool was also used for comprehensive hand-off communication.

Outcomes

Short term outcomes include acknowledging the feelings and attitude of staff with the current process and encouraging as well as explaining why the program is required. Competency in sepsis identification, treatment, and the program is another short-term outcome. This competency includes how the tool should be used, when to start its use, when to end it, and where it should be placed once complete. Staff should feel confident to question the providers when sepsis is likely or diagnosed and the bundle criteria is not ordered. When questioning the provider, the documentation tool will be the resource point for staff to follow.

Intermediate outcomes involve increased sepsis treatment awareness as well as its signs and symptoms. Behavior changes related to the consistent use of the documentation tool are also expected of the staff. These behavior changes are utilizing the documentation tool for 90% of sepsis cases, the timely completion of the SEP-1 bundle when ordered, and provider support when bundle is not ordered. The abilities for nursing and provider staff to provide benchmark sepsis treatment should also be expected in the intermediate outcomes.

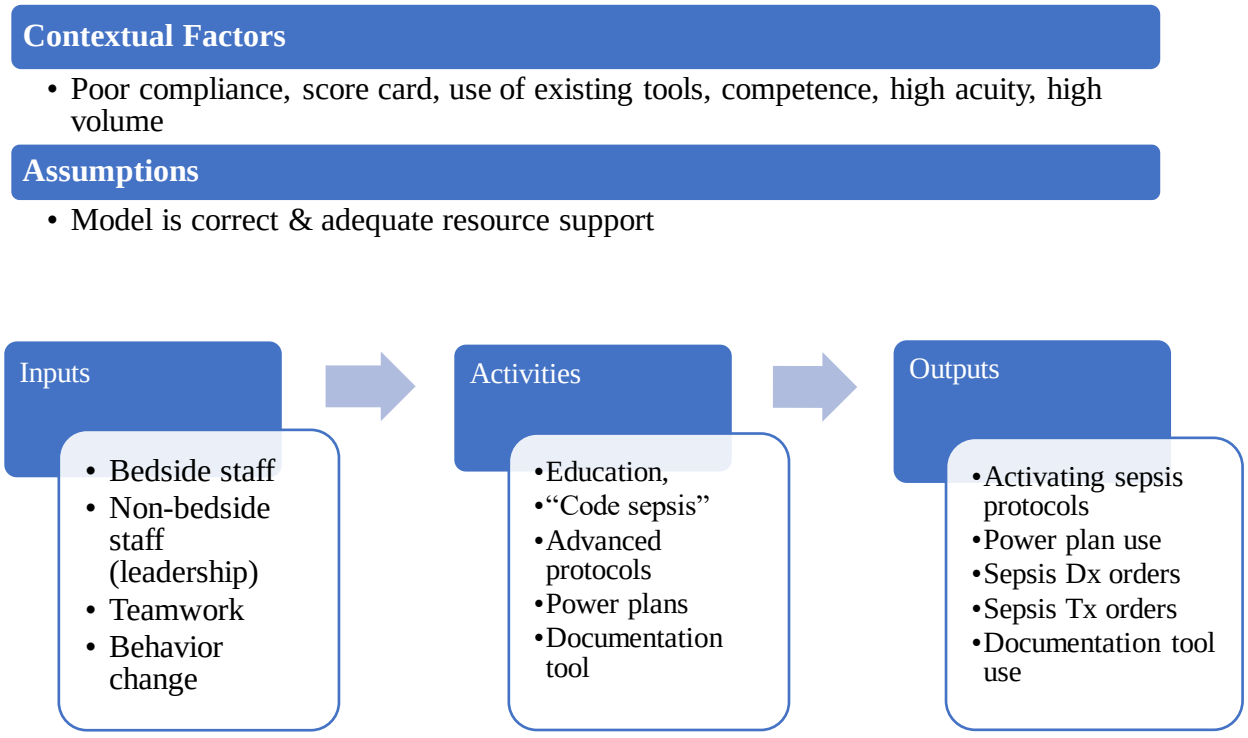
Long term outcomes include meeting the benchmark SEP-1 bundle completion rate, reducing the length of stay for septic patients (goal of 2.5 day on average), meeting benchmark mortality for sepsis patients as defined by CMS, increased nurse confidence in delivering sepsis

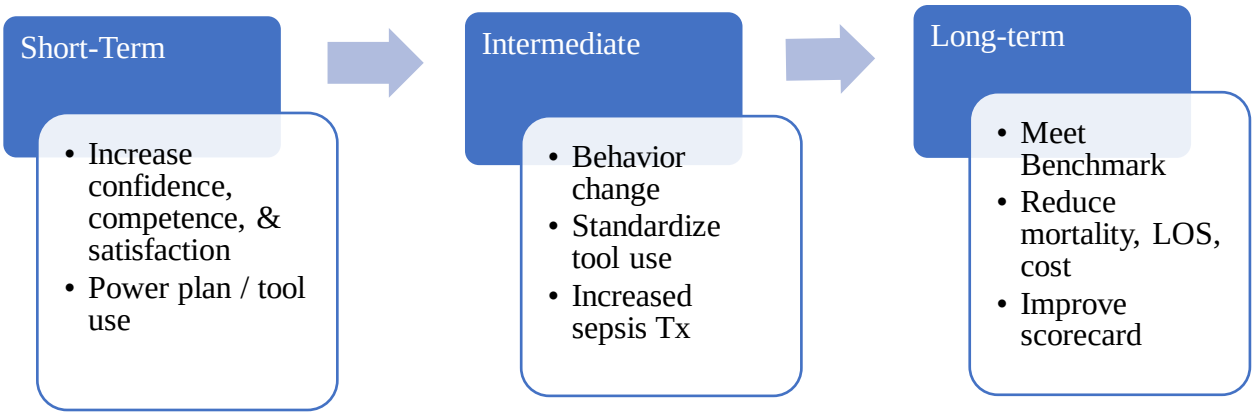
care, reduce cost of sepsis care, and improve hospitals sepsis score card given by the Centers for Medicare and Medicaid Services (CMS).

Assumptions

Assumptions in this logic model include this model's accuracy in reflecting the actual processes and relationships within the program. Furthermore, resources such as support from unit directors, managers, assistant managers, providers, and nursing staff are key for short- and long-term success. This support includes continued follow up for tool use, sepsis alert protocol, continued sepsis education, physician agreement to receive SEP-1 order request from nursing staff, and support from nursing and medical leadership for interdisciplinary collaboration.

Figure 1.1 – Logic Model





Purpose/Objective Statement

The purpose of this program evaluation was to evaluate the effectiveness of Ascension Macomb Hospitals Emergency Department's sepsis program with focus on its newly implemented documentation tool/sepsis checklist. The goals of the sepsis program's interventions were to increase SEP-1 sepsis bundle compliance, reduce sepsis mortality, reduce hospital length of stay, increase nursing confidence in sepsis care, increase provider/nurse confidence, as well as be cost effective. The objective of this program evaluation was to determine if the program is meeting its established goals. Furthermore, dependent on the program evaluations results, recommendations from the literature were given to adjust the program and or its process to best suit the needs of the ED, staff, and the patients as it pertains to SEP-1 sepsis bundle compliance.

Methods/Design

This DNP project was an evaluation of Ascension Macomb Hospital's Emergency Department's sepsis program with focus on its new sepsis documentation tool. The author evaluated the effectiveness of the current sepsis program and documentation tool in increasing SEP-1 bundle compliance, reducing sepsis mortality, reducing length of stay, cost of the program, as well as increasing satisfaction of the nursing and provider staff by using a post

analysis with mixed method design. Lastly, the interdisciplinary team gave recommendations for improvement of the sepsis program based on findings in the evaluation and matching it with current literature. These improvement recommendations were disseminated to Ascension Macomb's sepsis improvement committee for development and implementation. Primary stakeholders in this project were executive leadership, the sepsis multidisciplinary team, physicians, registered nurses, licensed practical nurses, paramedics, and or emergency technicians as well as the patients and or family that received sepsis treatment. Other stakeholders included hospital executive leadership, unit managers, directors, quality control persons, medical billers, educators, CMS, and assistant leaders.

The setting of this program evaluation was a 55 bed ED in Warren, Michigan that serves 180 to 220 patients per day. Participants in the post implementation evaluation were any physician or registered nurse that were included and or participated in the original quality improvement project as well as the patients who received sepsis care during that time frame. Support for this program evaluation was given by the chief medical officer, nursing vice president, emergency nursing director, emergency medical director, chair of the sepsis quality team, emergency unit manager, and emergency assistant clinical leaders.

The DNP project design was a mixed methods program evaluation. Key evaluation interventions included retrospective chart evaluation for patients that received sepsis care in the ED during the time frame of 6/1/2022-8/31/2022 (pre-implementation) and 9/1/2022-12/31/2022 (post-implementation). Comparative analysis of pre-post implementation data from retrospective chart review specifically looked at SEP-1 completion, mortality, LOS, cost of care, and utilization of the sepsis documentation tool. Furthermore, quantitative, and qualitative data was gathered on nurses and providers satisfaction with the program via questionnaires. Lastly,

review of the literature was completed with a focus on opportunities for improvement and suggestions for modification of the program.

To begin, a multidisciplinary team was created to implement and complete the program evaluation. This team consisted of an academic chair (PhD-RN), in field mentor (emergency medical director (DO)), chair of the sepsis quality team (DO), director of emergency nursing (MSN-RN), emergency department manager (MSN-RN), and emergency clinical nurse specialist (MSN-APRN). All members of this team (minus academic chair) are also a part of the hospital's sepsis committee. Once the team was assembled, applications for Institutional Review Board (IRB) were submitted.

The evaluation began by handing out questionnaires to the nursing staff. The nursing survey consisted of 13 questions, 11 questions on a five-point Likert scale and two open ended questions. A copy of the survey can be found in appendix B. The survey was handed out to each shift at huddle for two weeks. The questions determined the nurses understanding of the sepsis program, documentation tool, confidence level in the tool, satisfaction with the tool, and the program, as well as a chance to offer open-ended comments for growth for the program. Lastly the DNP student placed data into an excel sheet, created tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance.

The provider survey was also given to each provider over the same two-week period as the nurses. The provider survey was composed of 15 five-point Likert questions and one open ended question. The aim of the survey was to determine the providers understanding of the SEP-1 bundle, their satisfaction of the current sepsis program, and an opportunity to express their thoughts for growth of the program. A copy of the questionnaire is in appendix C. Again, the DNP student placed data into an excel sheet, created tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance.

After surveys were handed out and data analyzed, a retrospective chart evaluation was completed to determine what the correlation was between completing the sepsis documentation tool and fulfillment of the SEP-1 bundle, in hospital sepsis mortality, length of stay, and cost of care. Data was randomly pulled by Navient (a third-party company responsible for auditing SEP-1 compliance) on 10% of patients that had a diagnosis of sepsis, severe sepsis, or septic shock in the emergency department three months prior to intervention (June 1st, 2022 – August 31st, 2022) and three months post implementation (September 1st, 2022 – December 31st, 2022). Ten percent was chosen as this is the sampling requirement of hospitals to audit for CMS (Center for Medicaid & Medicare Services, 2022). Navient is contracted to be the liaison for CMS and Ascension. Furthermore, Navient was the chart abstractor for completeness of the SEP-1 bundle, mortality during that admission, and length of stay during admission. Data mining by the DNP student of each patient's chart post implementation determined if the documentation tool was utilized on that patient and if the SEP-1 bundle was complete. Comparisons were drawn between three groups, the pre-implementation group, post-implementation group with completed documentation tool, and post-implementation group without a completed documentation tool. Comparisons of the three groups determined if utilizing the tool reduced SEP-1 bundle fallouts. Furthermore, quality of completeness of the tool was also evaluated to see if partial tool completeness affected outcomes even partially. The results of the two post-implementation comparison groups were compared to SEP-1 bundle fallout data in the pre-implementation group. This determined if partial and or completeness of the documentation tool determined SEP-1 compliance, in hospital sepsis mortality, length of stay, and cost of care and to what degree. Lastly the DNP student placed data into an excel sheet, created tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance.

The timeline for this program evaluation included a beginning date of January 1st, 2023, and a concluding date July 30th, 2023. In the first month of the program evaluation, surveys of the staff were handed out, completed, collected, analyzed, and put into graphical format. Furthermore, during the first month, the sepsis quality team pulled 10% of all septic patient charts from June 1st, 2022, through August 31st, 2022, via Navient records. Furthermore, Ten percent of septic charts from September 1st through December 31st were also pulled by the sepsis quality team in order to evaluate post implementation data via Navient. The second month of the program evaluation consisted of auditing pulled charts for SEP-1 bundle completion, mortality, and length of stay. The third and fourth month of the evaluation consisted of pre-implementation and post-implementation data analysis. Furthermore, root cause analysis was performed by the multidisciplinary team to determine the reason for the incomplete SEP-1 bundle. In the fifth month of the evaluation, discussion was had between the multidisciplinary team around all SEP-1 fallouts as it related to the programs core measures. In the sixth month, a literature review was conducted by the multidisciplinary team to find recommendations for observed barriers or opportunities for improvement. Finally, in the seventh month, discussion and approval for literature recommended program improvements was had. Dissemination of the program evaluation to all stakeholders is expected to occur in September of 2023.

The cost of this evaluation was minimal as data storage, extraction, and analysis is already available and practiced by the quality department. Added work was on the DNP student to analyze specific data related to the documentation tool and the generated report. Lastly, qualitative, and quantitative data from the questionnaires were analyzed and reported by the DNP student. The questionnaire took staff about five minutes to answer, adding insignificant cost of its implementation.

Ethical Considerations

In this DNP program evaluation, there was no involvement of human or animal subjects. However, non-invasive data collection, which is already routinely used in practice, occurred. In this program evaluation ethical considerations were preserved, and limited risk was placed on human subjects. Application for IRB approval was submitted to Ascension's IRB on 2/28/23 and was approved 3/13/23. Next application for IRB was submitted to the University of Detroit Mercy's IRB on 3/14/23 and was approved 3/28/23. Risk to the patients included potential for personal healthcare information to be viewed during retrospective chart analysis. However, measures such as removing all patient identifiers were implemented to maintain patient privacy as data was extracted.

Evaluation Methods

For this DNP project evaluation, multiple methods were utilized to evaluate the current sepsis program at Ascension Macomb Hospital's Emergency Department. To determine if the sepsis program met its goals, the SEP-1 bundle compliance, in hospital sepsis mortality, and hospital length of stay data was analyzed from the randomly pulled retrospective chart review sample. Specifically, comparisons were drawn between the baseline pre-implementation data and completed documentation checklist in the post-implementation phase. Furthermore, the quality of completeness of the tool was also evaluated to see if tool completeness affected outcomes even partially. The results of the two post-implementation comparison groups were compared to SEP-1 bundle fallout data in the pre-implementation group. This determined if partial and or completeness of the documentation tool determines SEP-1 compliance and to what degree. Compliance was determined if all aspects of the SEP-1 bundle were satisfied in accordance with CMS's SEP-1 criteria. Partial or incomplete documentation tools were extracted by the DNP student and exported to separate groups to help determine if partial completion of the tool assisted in SEP-1 completion. Lastly the DNP student placed data into an excel sheet, created

tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance. Comparisons of the three groups determined if there were statistically significant differences between each group and if the program was effective at increasing SEP-1 compliance, in hospital sepsis mortality, and or hospital length of stay.

Nursing knowledge and satisfaction are key factors in behavior change and success of a program. The quantitative questions determined the nurses understanding of the sepsis program, documentation tool, satisfaction with the tool, and the program. Qualitative questions gave insight to growth for the program from the nurse's point of view and were displayed using descriptive statistical analysis. Lastly the DNP student placed data into an excel sheet, created tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance.

A provider survey was also given to each provider over the same two-week period as the nurses. The quantitative questions of the survey determined the providers comfortability with the SEP-1 program, working with the nurses and their role in the sepsis program, as well as their satisfaction of the current sepsis program. Qualitative questions gave opportunity to express their thoughts for growth of the program and was displayed using descriptive statical analysis. Lastly the DNP student placed data into an excel sheet, created tables to represent the data, and ran statistical analysis using SPSS software to determine statistical significance.

Finally, to determine if the cost of septic care decreased, two factors were analyzed, and assumptions made. Key factors were the statistically significant increase in SEP-1 bundle completion and length of stay. Meaning, if SEP-1 bundle compliance increased and length of stay decreased then it was assumed that the cost of care also decreased as supported by the literature review (Gripp et al., 2021; Moore et al., 2019). However, If the length of stay increased, despite the SEP-1 bundle being met, then it was determined that the cost of care also

increased. These factors were compared to pre-implementation data to measure growth. Actual sepsis cost versus reimbursement was unattainable when requested and is the reason for the assumptions above for calculating cost.

Furthermore, meaningful increase in nursing satisfaction as well as provider satisfaction could be considered for decreased cost as this reduces caregiver burden, burnout, and turnover (Oliveira et al., 2018). Utilizing the quadruple aim, staff satisfaction has a major impact on quality outcomes and the reduction of turnover (Bodenheimer & Sinsky, 2014). However, staff burnout, turnover, and related cost were out of the scope and not factored into this program evaluation.

Implications for practice

The implementation of this program evaluation strongly affects the sepsis practice of providers, nurses, and the healthcare system as well as the outcomes of septic patients. As demonstrated by the literature, utilization of a sepsis documentation/hand off tool, multidisciplinary sepsis team, and sepsis identification/treatment education leads to significant improvement in SEP-1 bundle completion, reduced mortality, length of stay, cost of care, and increased nursing/provider satisfaction/confidence. This program evaluation assessed the impact of the literature supported interventions. Finally, results of this program evaluation could have large implications for nursing and medical sepsis practice around the world. Results will either support or null the interventions leading to their expansion or retraction in practice and the outcomes of the patients.

Results

Thirty-one patient charts that had a diagnosis of severe sepsis or septic shock during the pre-implementation phase (6/1/2022 – 8/31/2022) were randomly selected and audited by a third-party company for completeness of the SEP-1 bundle, mortality during that admission, and

length of stay during admission. Thirty-one charts represent 10% of all septic patients during pre-implementation. Associated cost of care related to length of stay was inferred i.e., greater length of stay in the hospital is related and estimated to have greater cost of care. Actual cost of care nor reimbursement data was available for this program evaluation. During the post-implementation phase (9/1/2022 – 12/31/2022), 42 sepsis documentation tools were completed during the post-implementation phase and audited for completeness of the SEP-1 bundle, mortality during that admission, and length of stay during admission using the same criteria as those charts audited in pre-implementation. Of the 42-documentation tools, two (N=2) were partially complete.

Completed SEP-1 Bundles

In the pre-implementation phase, 31 patient charts (10% of population) (N=31) had a diagnosis of severe sepsis or septic shock and were audited by Navient. Of the 31 patients, eight had met all the requirements for the SEP-1 bundle. After auditing the 42 (N=42) charts that utilized the sepsis documentation tools from the post-implementation phase, 39 had successfully met all the requirements for the SEP-1 bundle and were filled out completely. This led to a 388% increase in completion of the SEP-1 bundle. The chi-square test found these findings were statistically significant (P=0.0036). Of the 42-documentation tools, two (N=2) were partially completed and were in the fallout group.

Mortality

In the pre-implementation phase, 31 patient charts (N=31) had a diagnosis of severe sepsis or septic shock. Of the 31 patients, eight had expired during that admission. After auditing the 42 charts (N=42) that utilized the sepsis documentation tools from the post-implementation phase, three had expired during that admission demonstrating a 73% decrease in mortality when the sepsis tool was implemented. The chi-square test determined that these findings were

clinically significant but statistically insignificant (P=0.06). Of the 42-documentation tools, two (N=2) were partially completed and neither patient expired during that admission. All three expirations were patients that had completed tools and SEP-1 bundles. Comorbidities or advanced directives were not analyzed or factored into mortality.

Length of Stay & Cost of Care

In the pre-implementation phase, 31 patient charts (N=31) had a diagnosis of severe sepsis or septic shock. Of the 31 patients, the average length of stay was 254 hours. After auditing the 42 charts (N=42) that utilized the sepsis documentation tools from the post-implementation phase the average length of stay was 310.7 hours. This percent change equates to a 22.32% increase in the length of stay. The student t-test found that these findings were statistically insignificant (P=0.386). With the increase in the hospital length of stay it is assumed there is an increase in cost of care, and we expect there would be an estimated 22% increase in cost of care. Of the 42-documentation tools, two (N=2) were partially completed and their average LOS was 90 hours.

Nurse Sepsis Care Process Satisfaction Survey

The nurse sepsis care process satisfaction survey was completed by 41 nurses (N=41) who were part of both the pre- and post-implementation periods. Each survey was answered anonymously and thus demographic data for each returned survey is unavailable. All questions were answered by each participating nurse. Responses to the nurse sepsis care process satisfaction survey are displayed in appendix E1 and appendix F1-3.

Objective results show positive views on the updated sepsis care process and documentation tool. Twenty-nine nurses (70%) found the new sepsis documentation tool to be “much easier” (N=7) or “easier” (N=22) to use than previous tools. Thirty nurses (73%) stated they either agreed (N=24) or strongly agreed (N=6) that the tool helped them complete the SEP-1

bundle in a timely matter. Thirty-two nurses (79%) either agreed (N=23) or strongly agreed (N=9) that the documentation tool assisted in tracking the timely completion of the SEP-1 bundle. Thirty-one nurses (75%) stated they either agreed (N=25) or strongly agreed (N=6) that the sepsis documentation tool increased their knowledge of current best practice for the treatment of sepsis. Thirty-four (83%) of nurses stated they either agreed (N=24) or strongly agreed (N=10) that using the tool increased their confidence that they were completing the bundle correctly. Thirty-three nurses (80%) stated they either agreed (N=24) or strongly agreed (N=9) that utilizing the documentation tool increased their confidence that they were consistently delivering best practice sepsis care.

Next the survey evaluated the staff's perception of the bundles effectiveness on reducing sepsis mortality, length of stay, and cost of care. Twenty-seven (66%) of nurses stated they either agreed (N=15) or strongly agreed (N=12) that completion of the SEP-1 bundle leads to a reduction in sepsis mortality. Whereas 34% (N=14) of nurses neither agreed nor disagreed. Next, 63% (N=26) of nurses stated they either agreed or strongly agreed that completion of the SEP-1 bundle leads to a reduction in sepsis related hospital length of stay. Whereas 34% (N=14) of nurses neither agreed nor disagreed and one nurse (N=1) stated they did not believe completion of the SEP-1 bundle leads to a reduction in sepsis related hospital length of stay. Finally, 59% (N=24) of nurses stated they either agreed or strongly agreed that completion of the SEP-1 bundle leads to a reduction in sepsis related hospital length of stay. Whereas 39% (N=16) of nurses neither agreed nor disagreed and one nurse stated they did not believe completion of the SEP-1 bundle leads to a reduction in sepsis related hospital length of stay.

Satisfaction with the tool and process also demonstrated positive results. Thirty-two nurses (N=32) (79%) were either satisfied or extremely satisfied with the overall sepsis care process. Whereas seven (N=7) nurses were neither satisfied nor dissatisfied and two (N=2) were

dissatisfied. Thirty-one nurses (N=31) (75%) were either satisfied or extremely satisfied with the sepsis documentation tool. Whereas nine nurses (N=9) were neither satisfied nor dissatisfied and one nurse (N=1) was dissatisfied.

Statements from the open-ended questions are as follows. Four nurses (N=4) commented on the need for better or more concise communication with the providers ordering the SEP-1 bundle. The next leading topic was related to the nurse-to-patient ratio. Three nurses stated that the nurse-to-patient ratio is too high which causes delays in completing the SEP-1 bundle. Other single occurrence suggestions include the formation of a "code sepsis" team, making the sepsis tool a part of the patient's chart (which it was during the implementation phase and still is), not believing the SEP-1 bundle decreased mortality/LOS/cost of care and finally, more education is needed for nursing staff so that the tool isn't needed. Another nurse stated that they believed that only the antibiotics were needed in the bundle and that the other elements are not necessary for improved patient outcomes.

Provider Sepsis Care Process Satisfaction Survey

The provider sepsis care process survey was completed by 16 (N=16) emergency providers including attending physician's, physician residence, and advanced practice providers. Each survey was answered anonymously and thus demographic data for each returned survey is unavailable. Each participating provider answered all questions. Responses to the provider sepsis care process satisfaction survey are displayed in appendix E2 and appendix F4-9.

Thirteen providers (81%) stated they were either familiar (N=4) or very familiar (N=9) with the SEP-1 sepsis bundle treatment plan. One (N=1) provider stated that they were somewhat familiar, one (N=1) stated they were not very familiar, and finally one (N=1) stated that they were not familiar with the SEP-1 sepsis bundle. Eight providers (50%) stated they were either familiar (N=4) or very familiar (N=4) with the nurse driven sepsis protocol. Three (N=3)

providers stated that they were somewhat familiar, two (N=2) stated they were not very familiar, and finally three (N=3) stated that they were not familiar with the nurse driven sepsis protocol. Ten providers (63%) stated they were either familiar (N=2) or very familiar (N=8) with the sepsis documentation tool. Five (N=5) providers stated that they were somewhat familiar, and one (N=1) stated that they were not familiar with the sepsis documentation tool.

Twelve providers (75%) stated they either agree (N=9) or strongly agree (N=3) that the completion of the SEP-1 bundle leads to a reduction of sepsis mortality. Two (N=2) providers stated they neither agree nor disagree and two (N=2) disagreed that completion of the SEP-1 bundle leads to a reduction of sepsis mortality. Nine providers (56%) stated they either agree (N=7) or strongly agree (N=2) that the completion of the SEP-1 bundle leads to a reduction in hospital length of stay. Six (N=6) providers stated they neither agree nor disagree and one (N=1) disagreed that completion of the SEP-1 bundle leads to a reduction in hospital length of stay. Ten providers (63%) stated they either agree (N=6) or strongly agree (N=4) that the completion of the SEP-1 bundle leads to a reduction in associated sepsis treatment cost. Five (N=5) providers stated they neither agree nor disagree and one (N=1) disagreed that completion of the SEP-1 bundle leads to a reduction in associated sepsis treatment cost.

Looking at potential resolution and the future of the sepsis program, twelve providers (75%) stated they either agree (N=5) or strongly agree (N=7) that a provider focused documentation tool would be helpful if easily retrieved and utilized. Three (N=3) providers stated they neither agree nor disagree and two (N=2) disagreed that a provider focused documentation tool would be helpful if easily retrieved and utilized. Six providers (38%) stated they either agree (N=3) or strongly agree (N=3) that a provider focused sepsis reference sheet would be helpful if easily retrieved and utilized. Six (N=6) providers stated they neither agree nor disagree and four (N=4) disagreed that a provider focused sepsis reference sheet would be

helpful if easily retrieved and utilized. Thirteen providers (81%) stated they either agree (N=7) or strongly agree (N=6) that a provider focused sepsis care algorithm would be helpful if easily retrieved and utilized. One (N=1) provider stated they neither agree nor disagree and two (N=2) disagreed that a provider focused sepsis care algorithm would be helpful if easily retrieved and utilized. Finally, seven providers (44%) stated they agree (N=6) or strongly agree (N=1) that the timely completion of the SEP-1 bundle has increased in the past three months. Nine (N=9) provider stated they neither agree nor disagreed that the timely completion of the SEP-1 Bundle has increased in the last three months.

Twelve providers (75%) stated they either are confident (N=11) or very confident (N=1) that completing the SEP-1 bundle is best practice for sepsis care. Two (N=2) provider stated they neither agree nor disagree and two (N=2) disagreed that completing the SEP-1 bundle is best practice for sepsis care. Eleven providers (69%) stated they are confident (N=11) that the nurse will complete the SEP-1 bundle as ordered. Four (N=4) providers stated they neither agree nor disagree and one (N=1) disagreed that the nurse will complete the SEP-1 bundle as ordered.

Eight providers (50%) stated they either are comfortable (N=5) or very comfortable (N=3) with placing a nurse recommended order for the SEP-1 bundle when sepsis is suspected. Seven (N=7) providers stated they were neither comfortable nor uncomfortable and one (N=1) provider was uncomfortable with placing a recommended order for the SEP-1 bundle when sepsis is suspected. Fifteen providers (94%) stated they order the sepsis power plan almost every time (N=10) or every time (N=5) when sepsis is suspected. One provider (N=1) provider stated they order the sepsis power plan about half the time when sepsis is suspected. Finally, sixteen providers (100%) stated they are either satisfied (N=7) or very satisfied (N=9) with the current sepsis process with the new nurse driven documentation tool.

Statements from the open-ended questions are as follows. Two providers (N=2) commented on the need for better or more concise communication on the current sepsis compliance rates. The next leading statement was related to the concerns about the nurse's ability to carry out orders due to department load (N=2) and the need for a better more efficient power plan to ease ordering/documenting (N=2). Finally, two (N=2) statements mentioned the need for more education or clarification about the SEP-1 sepsis bundle treatment plan.

Discussion

Completed SEP-1 Bundles

In the pre-implementation phase, SEP-1 bundle compliance was low with only 25.8% of cases meeting the mandatory bundle. When the bundle is not completed in its entirety, it leads to a SEP-1 bundle fallout and this data will be made public by CMS. Causes for the fallouts in this program evaluation ranged from incomplete bundle orders, sepsis diagnosis outside of SEP-1 window, and nursing orders not being completed on time.

Thirty-one patient charts were included in the pre-implementation audit. Of the 31 audits, eight had met all the requirements for the SEP-1 bundle. After auditing the 42 charts in the post-implementation phase, 39 had successfully met all the requirements for the SEP-1 bundle, a 388% increase. The chi-square test found this statistically significant (P=0.0036). Given this evidence, it is suggestive that in person sepsis treatment education, the nurse driven protocol, as well as utilization and completion of the documentation tool leads to greater completion of the SEP-1 bundle which was the major goal of this quality improvement program.

An analysis and recommendations of the post-implementation SEP-1 fallouts by the multidisciplinary team are as follows. One SEP-1 bundle fallout post-implementation was due to the provider not completely ordering the SEP-1 bundle. A solution to this type of fallout was the creation and utilization of a sepsis "power plan" or pre-filled order set (Fargo et al., 2018). A

pre-filled order set would allow the provider to order the SEP-1 bundle within a single power plan versus individually ordering each piece of the bundle. Furthermore, education needs to be given to the providers on how to use the “power plan”, why they should use the “power plan”, and present evidence on the SEP-1 bundles benefits. Another fallout was due to the diagnosis of sepsis outside of the SEP-1 window resulting in the SEP-1 bundle being ordered after the 3-hour mandate. A resolution for this type of fallout by the multidisciplinary team is the use of artificial intelligence software to identify the SIRS signs, organ dysfunction, and potential source leading to a diagnosis of sepsis minutes to hours prior to traditional methods (Henry et al., 2022). Computerized logic algorithms currently exist in the ED for alerting potential SIRS and organ dysfunction signs. However, this software is outdated causing as many as 15 false positive alarms per day and alarm fatigue. The last fallout was due to the nurse not completing the repeat lactic acid. Retrospective chart analysis and interview showed that the nurse was a travel nurse and was unaware of the protocol that the repeat lactic acid should have been drawn prior to the patient being transported to the floor. Nurses on the medical surgical floors do not draw their own labs and thus the labs are likely to not be drawn on time. The hospital sepsis committee has found this to be a reoccurring issue with new and travel staff. A potential solution for this problem is digitizing push notification alerts. The alerts would work by the computer recognizing that a part of the bundle has not been completed and the due time is near. A push notification will be fired alerting the nurse to complete the task as well as notifying the nurse how long until the task is due.

Mortality

In the pre-implementation phase, 31 patient charts had a diagnosis of severe sepsis or septic shock. Of the 31 patients, eight had expired during that admission. Post-implementation, 42 charts utilized the sepsis documentation tools and three had expired during that admission.

This led to a 72.48% decrease in mortality. The chi-square test found this statistically insignificant (P=0.06). Despite the low statistical significance, there was a decrease in mortality, which has clinical significance. Just one life saved has clinical significance. Coupled with the tool's low risk and evidence for reducing mortality, the tool should be utilized in practice. Sepsis mortality results may further improve by lowering the timeframe from three hours for antibiotic administration to one hour. Im et al., (2022) found lowering the timeframe from three hours for antibiotic administration to one hour is the largest factor in reducing sepsis mortality.

Length of Stay & Cost of Care

In the pre-implementation phase, 31 patient charts had a diagnosis of severe sepsis or septic shock. Of the 31 patients, the average length of stay was 254 hours. In the post-implementation phase, 42 charts utilized the sepsis documentation tool and had an average length of stay of 310.7 hours. This percent change equates to a 22.32% increase in the length of stay. The student t-test found this to be statistically insignificant (P=0.386). Furthermore, assuming that an increase in hospital length of stay equates to an increase in cost of care, it is estimated that there was a 22% increase in cost of care. With no statistical significance, it is suggestive that there is no difference between the sepsis documentation tool use and lowering the LOS or cost of care compared to baseline data.

After data analysis, several outliers in the post-implementation data were found. These outliers may be the cause for the increased LOS. In the pre-implementation phase, the longest three LOSs were 816 hours, 624 hours, and 528 hours. The median score was 216 hours. In the post-implementation phase the three leading LOSs were 1752 hours, 1416 hours, and 864 hours. Post-implementation LOS also had a median value of 216 hours. The data demonstrated that with the outliers removed, average LOS would have been 231 hours, 23 hours less than the pre-implementation data. Future studies with higher N values would likely show lower timeframes

from three hours for SEP-1 bundle completion to 1 hour which has been shown to have greater patient outcomes, decrease in LOCs, and decrease cost in care (Ko et al., 2021).

Nurse Sepsis Care Process Satisfaction Survey

Overall nursing responses were positive and supported the use of the new documentation tool. The survey answers revealed that the new tool was easier to use than previous tools (70%), helped nurses complete the SEP-1 bundle in a timely matter (73%), assisted in tracking the timely completion of the SEP-1 bundle (79%), increased nursing knowledge of current best practice for the treatment of sepsis (75%), increased nursing's confidence that they were completing the bundle correctly (83%), and increased the nurses confidence that they were consistently delivering best practice sepsis care (80%). Separate from the tool, survey data showed that there is less confidence amongst the nurses that the SEP-1 bundle reduces sepsis mortality (66%), hospital length of stay (63%), and or cost of care (59%). The lack of confidence could be a potential barrier preventing the timely completion of the SEP-1 bundle. Studies such as those conducted by Wang et al., (2020) found a lack of significant evidence for the SEP-1 bundle. Due to insignificant evidence, there is a lack of confidence that the SEP-1 bundle will improve patient outcomes and thus should not be a mandatory standard of care. The lack of confidence in the SEP-1 bundle and the added resource burden it requires may be a factor for the uncertainty that the SEP-1 bundle reduces mortality, LOS, and cost of care. Furthermore, the survey showed subjective majority support for the current sepsis program (78%) and documentation tool/checklist (76%). This shows that despite a lack in SEP-1 bundle confidence nurses are satisfied with the program and tool. This support is key for program success.

Despite some evidence that the SEP-1 bundle has little influence on positive sepsis outcomes, there is a greater magnitude of evidence supporting its use including but not limited to the CDC and majority of the references in this program evaluation. Given this large abundance

of evidence, the multidisciplinary team recommends an educational session comparing evidence in literature. The goal of the comparative evidence analysis is to reveal and persuade practitioners that the SEP-1 bundle, in fact, reduces mortality, LOS, and cost of care, leading to greater buy-in and utilization.

Related to the open-ended answers the leading suggestion for the sepsis program, by nurses, was to increase communication between the ordering providers and nurses. One example was that providers had ordered the bundle and the nurse was unaware of the patient's acuity or the fact the bundle was ordered. While the ED's current software does send alerts to the nurse when new orders are placed, the nurse must actively search out the tab and review the order. Searching for orders can cause delays in completing orders if the nurse is not at their workstation or if in another patient's chart. One recommendation to prevent order completion delay is for the provider to speak directly to the nurse, especially for time sensitive orders like the SEP-1 bundle. After investigating the ED's current electronic charting software, it was also found that there are options for the provider to send the nurse direct messages as well as the nurse to the provider. These messages can be seen by anyone logged into the ED's department which can lead to team members seeing the messages and begin completing the orders if that nurse is unavailable.

The next leading recommendation for the sepsis program, by nursing, was to decrease the nursing-patient ratio. While there have been multiple studies published with strong evidence for nursing ratio caps, this ED is facing a significant nursing shortage. During the timeframe of the study, there were between eight and fifteen open nursing positions. Short staffing places a strong burden on current staff, especially when the ED is also caring for an increased number of patients compared to recent history. To resolve the nursing shortage problem, the ED is currently partnering with local colleges and universities to launch a nursing internship and clinical program. The goal of the program is to bring nursing students into the ED, begin their training

while being a student, and hopefully retain the student to start as a graduate nurse or registered nurse post completion of the state boards. To address individual nurse suggestions, the implementation of a “sepsis code team” is a widely used practice and successful approach to delivering sepsis education. Numerous studies reported utilizing a sepsis response team and delivered SEP-1 education to the staff with increased patient outcomes (Delawder & Hulton 2020; Gripp et al., 2021; Maciolek & Dawson, 2021; Moore et al., 2019; Sonis et al., 2020; & Threatt, 2020). Finally, offering education with current statistics on SEP-1 outcomes would be beneficial, like those in Townsend et al., (2022).

Provider Sepsis Care Process Satisfaction Survey

Evaluation of the provider sepsis satisfaction survey revealed more mixed results than in the nursing survey and potentially some greater opportunities for improvement in the current sepsis program. For instance, 81% of providers are familiar with the SEP-1 bundle. This means that almost 20% of emergency providers are unfamiliar with the SEP-1 treatment bundle which can lead to the lack of or inappropriate orders to treat sepsis. Not only will this lead to a CMS fallout but also negatively influence patient outcomes. Continuing, 75% of providers felt that the SEP-1 bundle led to a decrease in mortality, 56% felt the bundle led to a reduction in hospital LOS, and 63% felt the bundle led to a reduction in sepsis related cost of treatment. These results were relatively similar to the nursing survey and could support that this uncertainty may be a factor in reducing confidence in the program and thus lack of participation. Furthermore, 31% of providers ordered the SEP-1 Bundle every time sepsis was suspected. If the provider fails to initiate the SEP-1 bundle orders when sepsis is suspected or identified (two SIRS & suspected or confirmed source of infection) and within the three- and six-hour time frames (not including the time it takes the nurse to fulfill the order), there is no chance that the patient will receive the best practice treatment and a SEP-1 fallout will occur. Whereas, if the orders are placed, the nurse is

obligated to follow the order, if appropriate, increasing the chance that the best practice treatment will reach the patient.

Looking at possible adjustments to the sepsis program, 75% of providers stated that a documentation tool would be useful. Examples given in survey comments stated that this tool could be in the form of a paper or digital sepsis diagnostic tool, order set, and or prefilled templet for charting purposes. Other adjunct tools that might be helpful are digital or paper reminders for tissue perfusion reassessments, lactic acid reassessment, and or vasopressor activation trigger. Finally, with only 33% of providers ordering the SEP-1 bundle every time, emphasis and accountability needs to be placed on the provider to order the SEP-1 bundle every time sepsis is suspected and or identified. The SEP-1 bundle not being ordered will lead to a fallout every time as well as have direct impact on mortality and possibly LOS and cost.

Sustainability Plan

Ascension Macomb Hospital has recently restructured their sepsis committee adding new members and executive participation. This multidisciplinary sepsis committee comprised of multiple specialties meets once per month. Tasks at this meeting include reviewing “SEP-1 fallouts”, finding trends in fallouts, developing interventions for recurring or trending fallouts, implementing developed interventions, and delivering real time sepsis coaching. Dissemination of this program's evaluation as well as the recommendations it draws will be given to the sepsis committee and other key stakeholders such as the emergency medical director, nursing director, emergency CNS, and executive leadership. The sepsis committee and stakeholders have verbalized the need for this comprehensive evaluation of their current sepsis program. The sepsis committee and stakeholders have also expressed taking ownership of reported results recommendations brought forth by the evaluation. Furthermore, the sepsis committee has the capacity to take the disseminated data as well as recommendations and create an action plan as

well as sustainability plan. Given the result of increased SEP-1 bundle compliance, reduction in hospital sepsis mortality, and positive staff program satisfaction, the sepsis quality team and hospital leadership have agreed to sustain and improve this program.

Conclusion

Utilization of the sepsis documentation tool had statistical and clinical significance in increasing SEP-1 compliance from 25.8% to 92.8% (P=0.0032). Although statistically insignificant, utilization of the sepsis documentation tool lowered severe sepsis and septic shock mortality from 25.8% to 7.2% (P=0.06). Continuing, utilization of the sepsis documentation tool had statistically insignificant effects on patients' length of stay as well as cost of care (P=0.386). Subsequently, there was a 22% increase in the length of stay and estimated cost of care. Finally, the partially completed checklists were correlated with SEP-1 fallouts. These incomplete tools were due to the provider not ordering the SEP-1 bundle in its entirety and the patient leaving the floor prior to the second lactic acid draw.

Post survey analysis showed that nursing staff had an average satisfaction rating of 76.6% and supported the use of the sepsis documentation tool/ checklist. The nurses stated that the tool was easier to use than previous tools (70%), help them complete the SEP-1 bundle in a timely matter (73%), assisted in tracking the timely completion of the SEP-1 bundle (79%), increased knowledge of current best practice for the treatment of sepsis (75%), increased confidence that they were completing the bundle correctly (83%), and increased confidence that they were consistently delivering best practice sepsis care (80%). There was less average confidence amongst the nurses that the SEP-1 bundle reduces sepsis mortality (66%), hospital length of stay (63%), and cost of care (59%). Finally, provider feedback revealed that 75% of providers felt that the SEP-1 bundle led to a decrease in mortality, 56% felt the bundle led to a reduction in hospital LOS, and 63% felt the bundle led to a reduction in sepsis related cost of treatment. Low

confidence in the SEP-1 program amongst providers might be a factor in its low utilization/ordering. However, 75% of providers stated that a documentation tool, diagnostic tool, order set, digital reminders, or SEP-1 template would be beneficial, paper or digital and should be the focus on future studies.

Literature supported program modifications from this program evaluation multidisciplinary team includes; (1) create, educate, and implement a pre-filled order-set to allow the provider to order the SEP-1 bundle within a single power plan versus individually ordering each piece of the bundle, (2) provide a comparative literature review with support for and against the SEP-1 bundle as it pertains to patient outcomes for providers and nurses in effort to create buy-in and trust in the SEP-1 program, (3) create accountability of making ordering of the SEP-1 bundle mandatory among providers when sepsis is identified, (4) create a documentation template tool (macro) for providers in efforts to reduce missed documentation during dictation (5) use artificial intelligence software to identify the SIRS signs, organ dysfunction, and potential source leading to a diagnosis of sepsis in minutes to hours prior to traditional methods, (6) digitizing push notification alerts for SEP-1 nursing tasks when due times are near to reduce missed or forgotten tasks, (7) practice face-to-face closed loop communication between providers and nurse when sepsis orders are being place, (8) development of a sepsis team or provider to respond and follow-up on all septic patients (9) reduce antibiotic treatment timeframe from three hours to one to further decrease mortality, LOS, and cost of care. The program evaluation multidisciplinary team believes all recommendations are reasonable and attainable for this institution.

Limitations

Several limitations were encountered during the program evaluation. First, sample size was limited to 10% of total septic population due to auditing policy and chart unavailability.

Second, survey sampling was done by convenience sampling due to the anonymous nature of the evaluation and inability to contact staff if not in the building. Third, retrospective chart analysis was utilized for data analysis creating level III evidence. Fourth, patient comorbidities nor evidence of advanced directives were analyzed in relation to patient LOS, mortality, or cost of care. Fifth, inability to acquire actual cost of sepsis care pre- or post-implementation led to the assumption that cost of care is directly related to LOS. Lastly, medical providers contribution to the low compliance rate by means of limited ordering of the SEP-1 bundle is outside the nursing sphere of patient care influence. Nurses cannot be liable for completion of the SEP-1 bundle if it is not ordered.

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Appendix A

SWOT Analysis

An onsite strength, weakness, opportunities, and threat (SWOT) analysis was performed on 6/15/2022 in the environment of the quality improvement sepsis documentation tool. The results are as follows:

Strengths

- Strong nurse accountability for acknowledging the signs of sepsis at triage and activating "code Sepsis" over head
- There are several seasoned nurses with 5+ years in department
- New nursing manager with 5+ years' experience at level one hospital
- 64 bed hospital seeing 180-220 patients/day
- Strong support from ED Manager, director, and Chef Nursing Officer

Weaknesses

- 30-40% of staff are travel contract nurses and not direct hospital employees
- Majority of staff nurses are under two years from license date
- No full-time quality personnel in the ED
- No current process exists for sepsis improvement

Opportunities

- The ED is currently hiring more full-time RN staff with 14 spots to fill
- Newly hired CNS now oversees Sepsis, Trauma, STEMIs, and CVAs in the ED
- Nurses are still new enough where change comes readily
- No process exists for sepsis improvement means that all options are open

Threats

- Consistently not hitting CMS benchmarks
- Loss of funds due to reduced reimbursement
- Large underinsured and lack of insured patients
- Other institutions have full time quality teams that only look at the ED
- Lack of reimbursement directly correlates to lack of staff and adequate/updated supplies

Appendix B

Nurse Sepsis Care Process Satisfaction Survey

Please describe the current sepsis documentation tool.

1. **Compared to previous sepsis care processes, how would you rate the ease of use of the current sepsis documentation tool?**

   1 = Very difficult, 2= Difficult, 3=No change, 4= Easier, 5=Much easier

Please rate your stance with the following statements.

2. **I have the resources necessary to complete the SEP-1 bundle in a timely manner.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

3. **The current sepsis documentation tool assisted you in tracking the timely completion of the SEP-1 Bundle.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

4. **The sepsis documentation tool increased your knowledge of current best practices for sepsis care.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

5. **The sepsis documentation tool increased your confidence that you are completing the SEP-1 bundle.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

6. **The sepsis documentation tool increased your confidence that you are consistently delivering best practice sepsis care.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

7. **Completion of the SEP-1 bundle leads to a reduction in sepsis mortality.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

8. **Completion of the SEP-1 bundle leads to a reduction in hospital length of stay.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

9. **Completion of the SEP-1 bundle leads to a reduction in associated sepsis treatment cost.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

Please rate your satisfaction.

10. **How would you rate your overall satisfaction with the sepsis process?**

    1=Very Dissatisfied, 2=Dissatisfied, 3=No opinion, 4=Satisfied, 5=Very Satisfied

11. **How would you rate your overall satisfaction with the sepsis documentation tool?**

    1=Very Dissatisfied, 2=Dissatisfied, 3=No opinion, 4=Satisfied, 5=Very Satisfied

12. **What barriers, if any, did you encounter using this documentation tool?**

    _____

    _____

    _____

13. **What suggestions do you have that could further increase our SEP-1 bundle completion rate?**

    _____

    _____

    _____

Appendix C

Provider Sepsis Care Process Survey

Please rate your familiarity with the following processes, protocols, or tools.

1. **How familiar are you with the SEP-1 Sepsis Bundle treatment plan?**

   1=Not familiar, 2=Not very familiar, 3=Somewhat, 4=familiar, 5=Very familiar

2. **How familiar are you with the nurse driven sepsis protocol here at SJMH?**

   1=Not familiar, 2=Not very familiar, 3=Somewhat, 4=familiar, 5=Very familiar

3. **How familiar are you with the sepsis documentation tool here at SJMH?**

   1=Not familiar, 2=Not very familiar, 3=Somewhat, 4=familiar, 5=Very familiar

Please rate your stance with the following statements.

4. **Completion of the three- and six-hour SEP-1 Bundle leads to a reduction in sepsis mortality.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

5. **Completion of the three- and six-hour SEP-1 Bundle leads to a reduction in the length of hospital stay.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

6. **The completion of the three- and six-hour SEP-1 Bundle leads to a reduction in associated sepsis treatment cost.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

7. **A provider focused documentation tool would be helpful if easily retrieved and utilized.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

8. **A provider focused sepsis reference sheet would be helpful if easily retrieved and utilized.**

1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

9. **A provider focused sepsis care algorithm would be helpful if easily retrieved and utilized.**

   1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

10. **Timely completion of the SEP-1 Bundle has increased in the last three months.**

    1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly Agree

Please rate your confidence for each statement below.

11. **How confident are you that completing the SEP-1 bundle is best practice for sepsis care?**

    1=Very unconfident, 2=Unconfident, 3=Neither, 4= Confident, 5= Very confident

12. **How confident are you that nurses will complete the SEP-1 bundle as ordered?**

    1=Very unconfident, 2=Unconfident, 3=Neither, 4= Confident, 5= Very confident

Please rate your comfortability with the following statement.

13. **How comfortable are you placing a nurse recommend order for the SEP-1 Sepsis bundle when sepsis is suspected on your patient?**

    1=Very Uncomfortable, 2=Uncomfortable, 3=Neither, 4= Comfortable, 5= Very comfortable

Please rate your usage for the following statement.

14. **How often do you use the sepsis power plan when sepsis is suspected?**

    1=Never, 2=Almost Never, 3= About half the time, 4= Almost every time, 5= Every time

Please rate your satisfaction with the following statement.

15. How would you rate your overall satisfaction with the current sepsis process with the new nurse driven documentation tool.

1=Very Dissatisfied, 2=Dissatisfied, 3=No opinion, 4=Satisfied, 5=Very Satisfied

16. What suggestions do you have that could further increase our SEP-1 bundle completion rate?

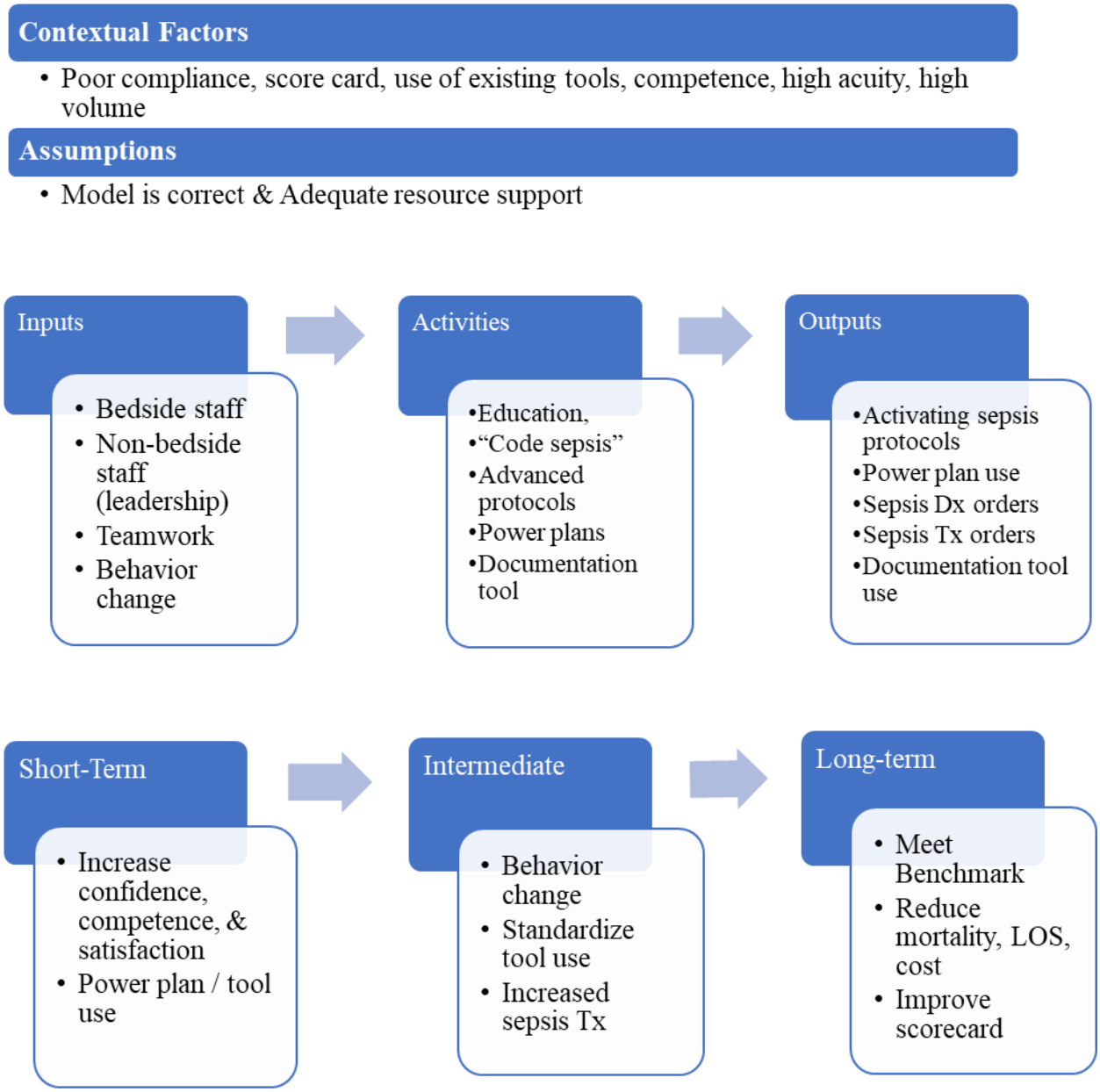
_____

_____

_____

Appendix D

Logic Model



Appendix E

Table E1

Nurse Sepsis Care Process Satisfaction Survey

Nurse Sepsis Care Process Satisfaction Survey								
Likert Scale Answer	1 Unfavorable	2	3	4	5 Favorable	**Total**		
Question #1	0	3	9	22	7	**41**		
Question #2	0	7	4	24	6	**41**		
Question #3	0	3	6	23	9	**41**		
Question #4	0	1	9	25	6	**41**		
Question #5	0	2	5	24	10	**41**		
Question #6	0	1	7	24	9	**41**		
Question #7	0	0	14	15	12	**41**		
Question #8	0	1	14	16	10	**41**		
Question #9	0	1	16	14	10	**41**		
Question #10	0	2	7	28	4	**41**		
Question #11	0	1	9	26	5	**41**		
Total	**0**	**22**	**100**	**241**	**88**			
Nursing Answers	N/A	Communication	Ratios	Charting	SEP-1 Confidence	Education	Code-Team	**Total**
Question 12-13 Themes	30	4	3	1	1	1	1	**41**

Table E2

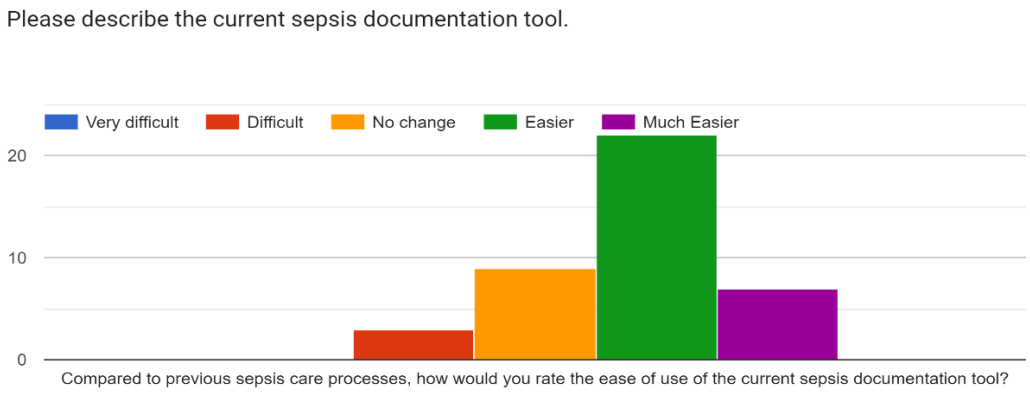
Provider Sepsis Care Process Survey

Provider Sepsis Care Process Survey							
Likert Scale Answer	1 Unfavorable	2	3	4	5 Favorable	**Total**	
Question #1	1	1	1	4	9	**16**	
Question #2	3	2	3	4	4	**16**	
Question #3	1	0	5	2	8	**16**	
Question #4	0	2	2	9	3	**16**	
Question #5	0	1	6	7	2	**16**	
Question #6	0	1	5	6	4	**16**	
Question #7	0	1	3	5	7	**16**	
Question #8	0	4	6	3	3	**16**	
Question #9	0	2	1	7	6	**16**	
Question #10	0	2	2	11	1	**16**	
Question #11	0	1	4	11	0	**16**	
Question #12	0	1	7	5	3	16	
Question #13	0	0	1	10	5	16	
Question #14	0	0	7	9	0	16	
Total	**5**	**18**	**53**	**93**	**55**		
Provider Answers	N/A	Communication	Ratios	Order Completion	Power Plan	SEP-1 Education	**Total**
Question 15-16 Themes	7	2	3	2	1	1	16

Appendix F

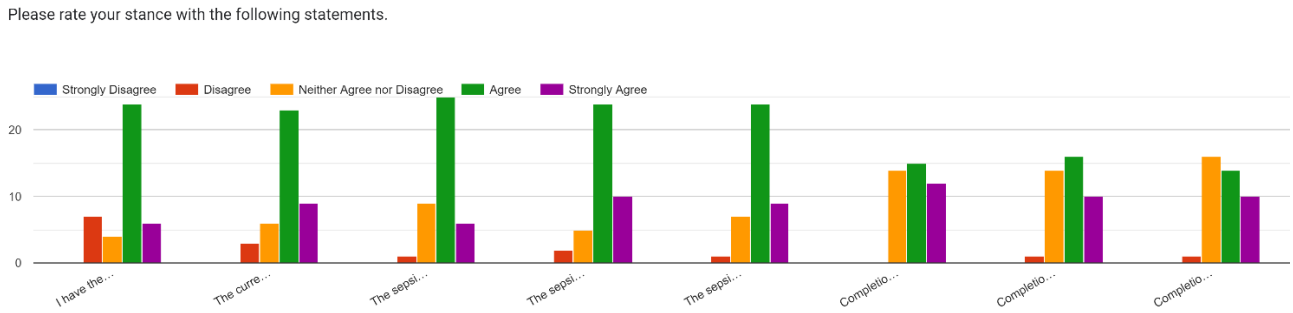
Graph F1

Nurse Sepsis Care Process Satisfaction Survey Question 1



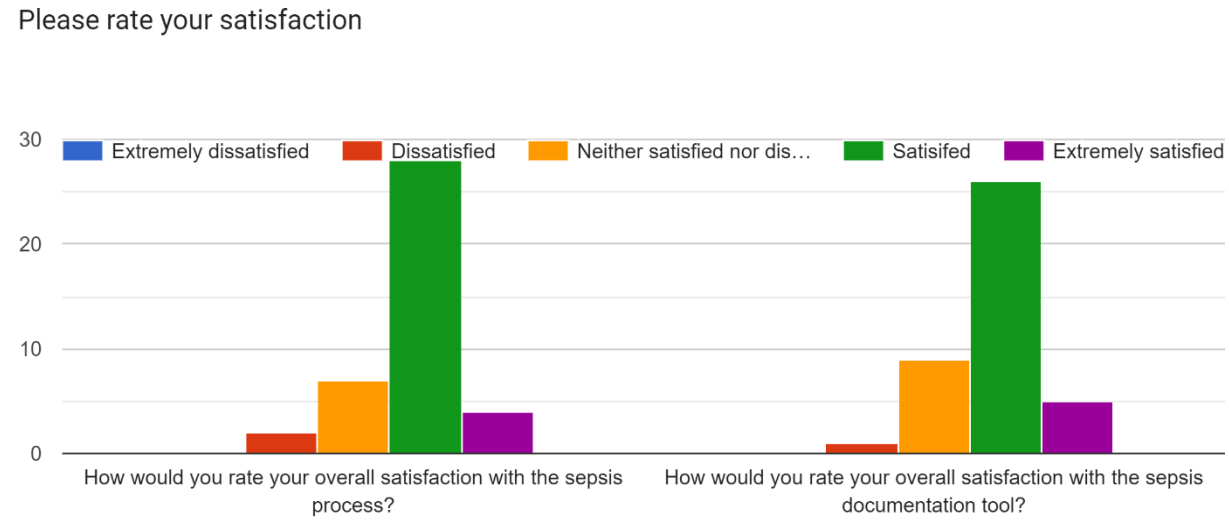
Graph F2

Nurse Sepsis Care Process Satisfaction Survey Questions 2-9



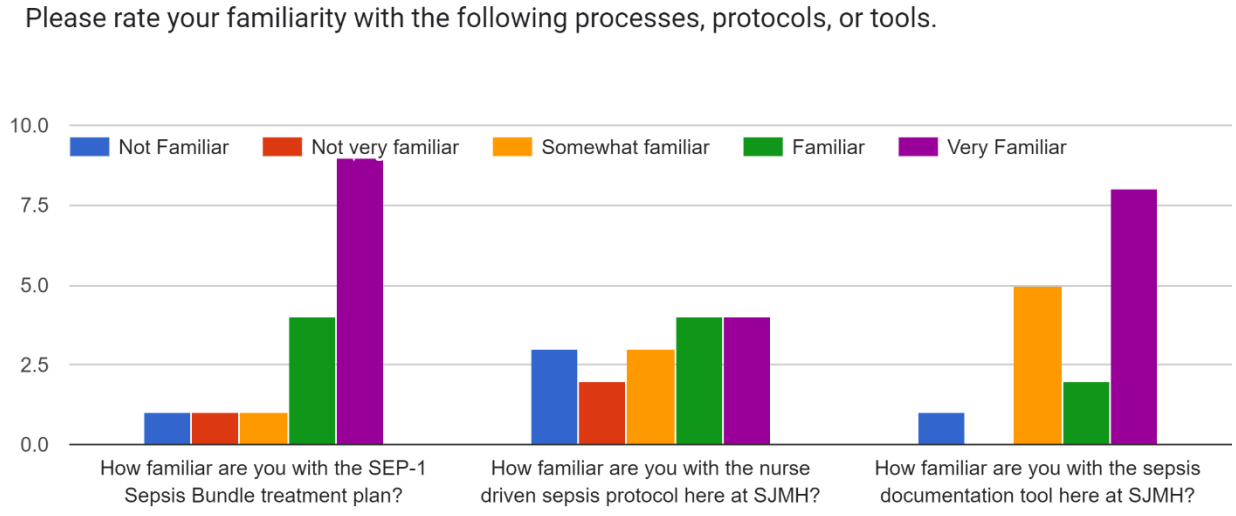
Graph F3

Nurse Sepsis Care Process Satisfaction Survey Questions 10-11



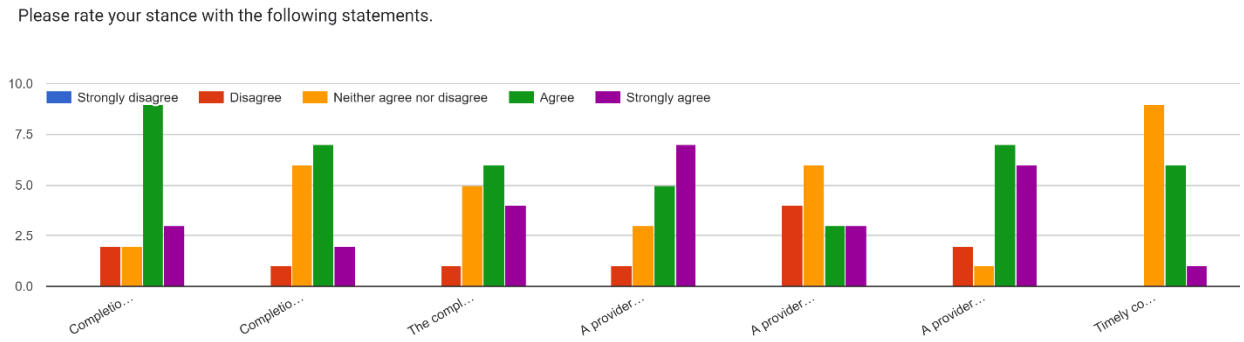
Graph F4

Provider Sepsis Care Process Satisfaction Survey Questions 1-3



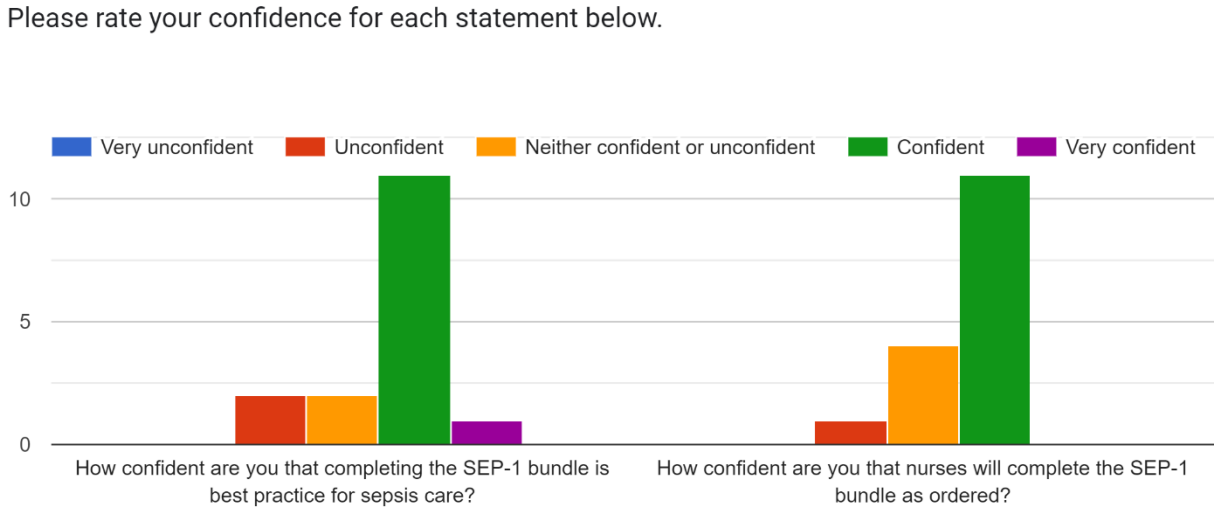
Graph F5

Provider Sepsis Care Process Satisfaction Survey Questions 4-10



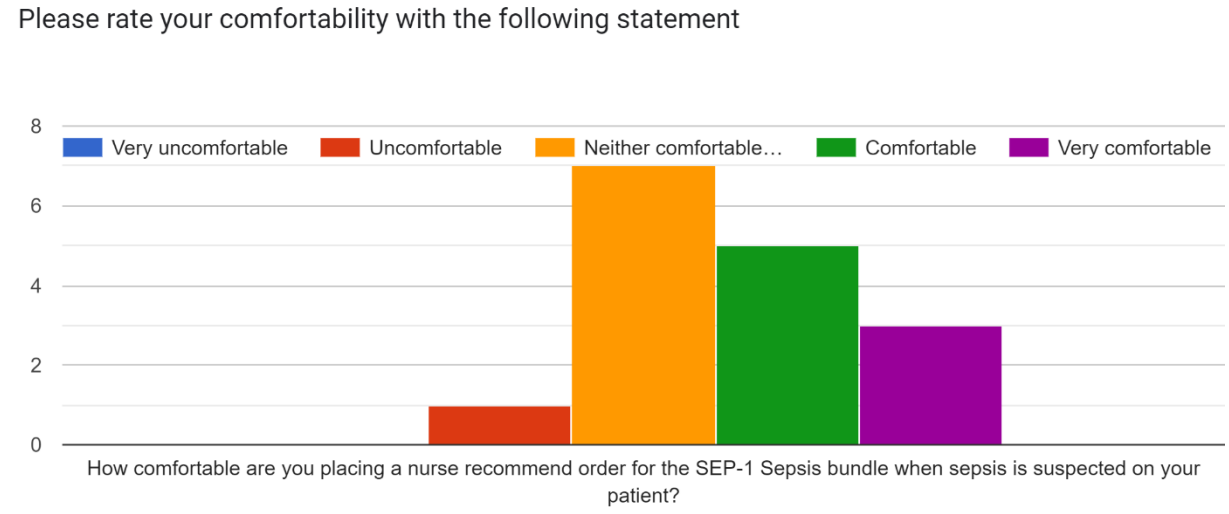
Graph F6

Provider Sepsis Care Process Satisfaction Survey Questions 11-12



Graph F7

Provider Sepsis Care Process Satisfaction Survey Question 13



Graph F8

Provider Sepsis Care Process Satisfaction Survey Question 14

Graph F9

Provider Sepsis Care Process Satisfaction Survey Question 15

Please rate your usage for the follow statement