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SEPSIS SCREENING EDUCATION

A Project Submitted to the Graduate School in Partial Fulfillment of the Requirements
for the Degree of Doctor of Nursing Practice

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SEPSIS SCREENING EDUCATION

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SEPSIS SCREENING EDUCATION

An Abstract of the Scholarly Project by
Brittany Horn

Sepsis is a significant burden to the healthcare field with 1.7 million Americans annually diagnosed with this condition. Earlier diagnosis and treatment are the most effective ways of reducing morbidity and mortality related to sepsis. The current sepsis screening tool in place at Stormont-Vail Hospital, in Topeka, Kansas, is the systemic inflammatory response (SIRS) criteria; however, this screening tool has proven to be less effective than other screening tools available. The screening tools proven more effective than the SIRS criteria, are the quick sequential organ failure assessment (qSOFA) and the sequential organ failure assessment (SOFA). For this project, nursing staff on the cardiac unit at Stormont-Vail Hospital received education related to the qSOFA and SOFA screening tools for sepsis and were given a post-education survey to evaluate the education received. The demographic use in this study was a convenience sample of 28 participants, including 25 registered nurses (RNs) and three licensed practical nurses (LPNs) from the cardiac unit. The results of this study concluded that all participants were aware that the SIRS criteria is the current sepsis screening tool utilized by Stormont-Vail Hospital, and 92% of participants had never heard of the qSOFA and SOFA screening tools before. Of the participants, 85% reported they did not feel the current sepsis screening tool (SIRS criteria) was adequate. After education about the qSOFA and SOFA screening tools, 64% of participants reported feeling somewhat comfortable utilizing these screening tools in addition to the SIRS criteria when screening patients for sepsis.

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Chapter I

Introduction

Description of the Clinical Issue

Early detection of sepsis is key to survival in relation to recognition and treatment of an underlying condition causing an individual's significant response to infection. Completing research for this project brought to the attention of this researcher not all electronic health record (EHR) systems are equipped with a sepsis screening tool to alert the healthcare provider to the development of sepsis. This is where inspiration was gained for a project to educate nursing staff regarding other ways of detecting sepsis without relying on a computer-based system to notify a provider when a patient may be developing sepsis.

A study by Holder et al., (2016) reported "the mortality may be higher in those whose condition progresses in the hospital compared with those who present to the emergency department (ED) with organ dysfunction" (p. 2). Meaning, the earlier sepsis is detected, the earlier treatment can be initiated, decreasing sepsis morbidity and mortality. Nurses play a key role in the early detection of sepsis\ through observation of overall health status and use of appropriate screening tools.

The primary care provider is then alerted to any change in patient status the nurse detects, indicating signs and symptoms of sepsis.

Significance

The significance of this project to nursing was improvement in the quality of patient care and overall patient outcomes for a patient with or at risk for sepsis. By increasing early detection of sepsis in patients who present with signs and symptoms, their treatment can be expedited, and morbidity and mortality decreased.

By giving nurses more resources to screen patients for sepsis, nurses will be better prepared, relying less on computer systems to alert them to the possibility of sepsis. Although there is a sepsis screening tool in place, education regarding the qSOFA and SOFA screening tools will provide additional resources for nursing staff. The education of nursing staff regarding new ways to screen patients for sepsis will help improve the quality of care provided through use of these additional screening tools. This project utilized significant research completed by others in the field of early sepsis detection and treatment to determine the most appropriate screening tools to enhance nursing knowledge.

Specific Aims/Purpose

This project aimed to educate nursing staff on the cardiac unit at Stormont-Vail Hospital regarding newer sepsis screening tools. Reduction in morbidity and mortality will be observed through earlier diagnosis and treatment, when signs and symptoms of sepsis are recognized in a time efficient manner, utilizing new education provided. Resources utilized to educate nursing staff included the qSOFA and the SOFA sepsis screening tools

Currently, this unit is using the SIRS criteria to screen patients for sepsis. With this screening system, a best practice advisory (BPA) alert fires via the EHR when a patient meets criteria for possible sepsis, alerting the healthcare provider to further assess a patient. The goal of this scholarly project is to provide nursing education leading to expedited treatment of patients who meet sepsis criteria. An educational session was conducted for the nursing staff on the cardiac unit at Stormont-Vail to educate about the qSOFA/SOFA screening tools for sepsis. This provided them with additional resources when screening patients for sepsis.

Theoretical Framework

Betty Newman's Systems Model was chosen as a theoretical framework for this project. The goal of this model is stability and flexibility, allowing for holistic patient care (Alligood, 2016; Petiprin, 2016). These concepts lead to optimal health and integrity of an open system, interpreted by Newman as the interaction between the ever-changing environment and the individuals living in the environment (Alligood, 2014).

Advancement of sepsis screening tools utilized by the healthcare team is the crucial part of the open system in patient care providing advanced stability and flexibility. In this project, participants will utilize new aspects of the open system to achieve the intended goal of enhancing patient care. These changes will increase stability of the patient care system through advancement of education regarding available screening tools for sepsis and increasing patients' overall health outcomes. Strength and stability of the open system is also maintained through use of primary, secondary, and tertiary prevention techniques to attain and maintain overall system wellness (Petiprin, 2016). Adjustments throughout the process of providing care to a patient enclosed in this open system are

based on responses of the patient to the plan of care. A constant balance of adjustment and maintenance is the basis of the holistic concept of this model, allowing the nurse to guide patient care based on responses to the care and treatment provided.

Assumptions of this model applied to this scholarly project included “primary prevention is applied in patient assessment and intervention, in identification and reduction of possible or actual risk factors” (Petiprin, 2016, para. 9). A second assumption is “secondary prevention relates to symptomatology following a reaction to stressors, appropriate ranking of intervention priorities and treatment to reduce their noxious effects” (Petiprin, 2016, para. 10). The third assumption applied to this scholarly project was “tertiary prevention relates to adjustive processes taking place as reconstruction begins, and maintenance factors move them back in a cycle toward primary prevention” (Petiprin, 2016, para. 11). These assumptions use observation and intervention techniques to maintain balance within the given system. In applying this framework to practice, nurses can guide patient care by choosing the screening tool, either the qSOFA or SOFA, that best fits the patient situation.

Research Hypotheses

This research project hypothesizes the following:

- With the education about additional screening tools, nurses will recognize sepsis at earlier stages.
- With the earlier recognition and treatment of sepsis, there will be a decrease in overall sepsis morbidity and mortality.

Logic Model

The following is a logic model representation of this researcher's plan of implementation. This logic model demonstrates events and processes undertaken to complete this project. The reasonings for selecting this project and the need for its implementation are also noted within the logic model.

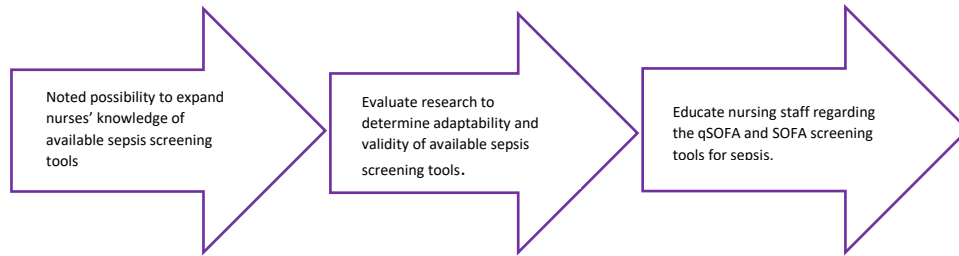


Fig. 1. Logic Model for Increasing Nursing Knowledge Regarding Sepsis Screening Tools

Conceptual Definitions

Education: “the knowledge and development resulting from the process of being educated” (Education, n.d.).

Electronic Health Record (EHR): “A longitudinal electronic record of patient health information produced by encounters in one or more care settings” (Nelson & Staggers, 2018, p. 632).

Health: “is a continuum of wellness to illness that is dynamic in nature. Optimal wellness exists when the total system needs are being completely met” (Alligood, 2014, p. 284).

Open System: “a system is open when there is a continuous flow of input and processes, output and feedback” (Alligood, 2014, p. 283).

Sepsis: “a clinical syndrome that has physiologic, biologic, and biochemical abnormalities caused by a dysregulated inflammatory response to infection” (Neviere, 2019, para. 1).

Stability: “a dynamic and desirable state of balance in which energy exchanges can take place without disruption of the character of the system, which points toward optimal health” (Alligood, 2014, p. 283).

Summary

This scholarly project aimed to educate nursing staff in the cardiac unit at Stormont-Vail regarding the qSOFA and SOFA screening tools for sepsis. This researcher hypothesized that there will be an earlier recognition of sepsis in patients, leading to earlier treatment after the education occurred. As previous research has shown, earlier intervention in the treatment of sepsis improves the patient’s overall outcome in terms of morbidity and mortality.

With the use of Betty Newman’s systems model, this researcher utilized the open system approach to strengthen the patient care system. Utilizing the open systems model allows for increased flexibility and strength in the care system, enabling nursing staff to apply a more appropriate sepsis screening tool, based on a specific patient scenario.

Increased evidenced base research (EBR) related to sepsis screening was the goal of this project. With many guidelines for the treatment and management of sepsis for review and EBR to support them, nursing education regarding this EBR will result in a decrease in sepsis morbidity and mortality.

There are many other opportunities for research that could build on ideas from this project. Recommendations would be made to transition the alert system within the

EHR at Stormont-Vail to that of the qSOFA and SOFA screening tools in addition to the SIRS criteria.

Chapter II

Literature Review

The literature review included the impact of screening tools on morbidity and mortality of diagnosed sepsis patients. More emphasis was placed, however, on education related to newer available screening tools for sepsis and utilizing the current sepsis screening tool already in place. Primary topics presented in this chapter are those of current evidence-based practice (EBP) related to screening for sepsis in patients residing on inpatient units in the hospital setting.

For this review, the researcher utilized nursing databases including Up-To Date, ProQuest Nursing, and Allied Health. Databases were accessed using the research tools available through the Pittsburg State University Axe Library. The qSOFA tool, the SOFA tool, and the SIRS criteria presented the most relevant and valid research related to sepsis screening. When searching the above-mentioned databases, search terms utilized were “sofa score AND qsofa score predictors of sepsis,” “sirs criteria AND qsofa score predictors of sepsis,” “sepsis criteria,” and “qsofa AND sofa scores screening for sepsis.” An internet search was also completed to research the qSOFA and SOFA criteria for predicting sepsis. In narrowing search results within the databases, tools were used to select only full text, peer-reviewed articles from scholarly journals. A date range from 2016 to the present was also used to narrow results.

Background

As defined by the Centers for Disease Control and Prevention (CDC) (2018), sepsis is “the body’s extreme response to an infection. It is a life-threatening medical emergency” (para. 1). Sepsis is defined by Chaney (2018) as “a dysfunctional host response to infection that leads to life-threatening organ dysfunction” (slide 3). A definition of sepsis as stated by Shah, Sterk and Rech (2018) is “a dysregulated host response to infection which may lead to organ dysfunction” (p. 1745). Gul, Arslantas, Cinel, and Kumar (2017), via the updated sepsis three criteria, report a very similar definition of sepsis. Sepsis is, ultimately, a host’s response to infection that leads to significant organ dysfunction and eventually, if not treated appropriately and in a time-efficient manner, to death.

It is also reported by the CDC (2016) that “each year, at least 1.7 million adults in America develop sepsis” (fig. 1), and “1 in 3 patients who die in a hospital have sepsis” (fig. 1). In an article by Neviere (2019), “it was reported that analysis of discharge records from hospitals in the US estimated an annual rate of more than 1,665,000 cases of sepsis between 1979 and 2000” (para. 4). Also reported by Neviere (2019), “in an analysis of 27 academic hospitals, between 2005 and 2014 rates of septic shock determined by clinical criteria increased from 12.8 to 18.6 per 1000 hospital admissions, and mortality decreased from 55 to 51 percent” (para. 7). This shows an increase in incidence of sepsis but a decrease in overall mortality. Sepsis has a significant financial burden on the healthcare system. According to Park, Won, Kim, Jung, and Byruk (2017), in 2011, sepsis accounted for more than \$20 billion in hospital costs in the United States.

Screening for Sepsis

Earlier sepsis detection is linked to earlier intervention, which leads to decreased morbidity. A study by Holder et al. (2016) reports “timely identification of patients with non-severe sepsis, i.e., those without organ dysfunction or shock, who later develop severe sepsis may impact patient morbidity and mortality” (p. 2.). This idea is also reported by Shah et al., (2018), as their research shows earlier identification and adherence to the Surviving Sepsis Campaign (SSC) guidelines decreases sepsis mortality.

Tools Available to Screen for Sepsis

There are multiple screening tools available when screening hospitalized patients for sepsis. More common is the SIRS criteria; however, the use of this predictor tool has been proven less favorable when compared to other screening tools. An article by Nevriere (2019) reports “SIRS is no longer included in the definition since it is not always caused by infection” (para. 13). An article by Gul et al. (2017), also reports that “inflammation is a very non-specific response to any insult from minor trauma to complicated autoimmune disease” (p. 130). Research by Shah et al., (2018) also reports, SIRS criteria is inferior to the SOFA score when screening for sepsis. Research by Park et al., (2017), reports, “there has been conflicting evidence regarding the value of SIRS with the SIRS criteria being criticized for having inadequate specificity and sensitivity” (p. 12). In light of this information, a goal became to find more up-to date screening tools for sepsis with increased sensitivity.

Other predictor tools available for use in screening for sepsis in the hospital setting include the qSOFA tool and the SOFA tool. The qSOFA screening tool collects patient data related to respiratory rate, mentation, and blood pressure readings (Nevriere,

2019; Gul et al., 2017). The SIRS criteria collects data related to body temperature, heart rate, white blood cell count, and respiratory rate. The SOFA score collects data related to respiratory status, coagulation status, liver status, cardiovascular status, central nervous system status, and kidney function (Salim, 2016), (Gul et al., 2017). The qSOFA score is better designed to detect early sepsis in patients outside the intensive care unit (ICU) setting. This is related to this tool's limited data collection variables. The limited data needed to compile a qSOFA score makes this method favorable for most bedside clinicians. Noted in an article by Kim et al. (2017), the qSOFA score is also limited and deemed not adequate when screening patients with febrile neutropenia or other forms of chronic infectious disease due to the lack of inflammatory response mechanisms.

In a meta-analysis completed by Song, Sin, Park, Shim, and Lee (2018) that a “positive qSOFA score had a sensitivity of 0.51 and a specificity of 0.83 for in-hospital mortality as compared with a sensitivity of 0.86 and specificity of 0.29 for positive SIRS scores” (p. 8). Looking at these results, the SIRS criteria is more sensitive in detecting true sepsis, however, the qSOFA score is more specific when ruling out sepsis. This was again reported in an article by Khwannimit, Bhurayanotachai, and Vattanavanit (2018), where the authors state “sepsis patients who did not meet SIRS criteria had the highest ICU and hospital mortality as well as more organ failure than those who did meet qSOFA and SOFA criteria” (p. 158). It was also reported in this article that the SOFA score is more precise and accurate in predicting both ICU and hospital mortality when compared to the SIRS criteria and qSOFA score (Khwannimit et al., 2018). Park et al., (2017) reported “the qSOFA was also superior to SIRS to predict the in-hospital mortality” (p. 14). The measurements Park et al., (2017) used to measure significance of their research

included the area under the receiver operating characteristic (AUROC). With their measurements being “0.6 to 0.7, 0.7 to 0.8, 0.8 to 0.9, and 0.9 or higher were considered poor, adequate, good, and excellent, respectively” in the measurement of organ failure development (p. 14). When comparing two screening tools, qSOFA was superior to SIRS with an AUROC of 0.814, compared to SIRS criteria with an AUROC of 0.662. In predicting ICU admission, the qSOFA outperformed SIRS as well with an AUROC of 0.717 and 0.587 respectively (Park et al., 2017, p. 14). However, Park et al., (2017) also report the qSOFA is not superior to the full SOFA score in terms of predicting in hospital mortality.

An article by Shah et al., (2018), reports there is a limited use of sepsis screening tools in some ED settings, leading to slower provider recognition of sepsis and delayed treatment intervention for these patients. Another finding in this study was, utilizing a sepsis screening tool in the ED setting also increased the rate of antibiotic administration within one hour of recognizing sepsis signs and symptoms. Administration of antibiotics within one hour versus three hours of sepsis recognition was found to increase survival from 60% to 79.7% (Shah et al., 2018).

What Makes a Positive Result

This section discusses each of the previously mentioned screening tools and how they are administered, including how sepsis is ruled in or ruled out utilizing each assessment.

SIRS

SIRS criteria have fallen out of favor in screening and diagnosing individuals with sepsis as a result of low sensitivity for ruling in sepsis as a definitive diagnosis. SIRS

criteria also been reported to falsely diagnose sepsis related to non-sepsis conditions (Neviere, 2019; Shah et al., 2018). The SIRS criteria consists of a group of measurements examining various aspects of a patient's overall health status, including respiratory rate, heart rate, temperature, and white blood cell (WBC) count. Parameters to meet sepsis criteria are as follows: respiratory rate >20 breaths per minute or $\text{PaCO}_2 <32\text{mmHg}$, temperature $<36^\circ\text{C}$ or $>38^\circ\text{C}$, heart rate >90 beats per minute, and WBC count $>12,000/\text{cu mm}$ or $<4,000/\text{cu mm}$. For a patient to be deemed positive for SIRS criteria, they must meet two of the above-mentioned parameters (Gul et al., 2017). There are also different severities of a sepsis diagnosis: sepsis, severe sepsis, and septic shock. Severe sepsis is defined as "sepsis associated with organ dysfunction, hypoperfusion, or hypotension. Hypoperfusion and perfusion abnormalities may include, but are not limited to, lactic acidosis, oliguria, or an acute alteration in mental status" (Gul et al., 2017, table 1).

When discussing hypoperfusion and other perfusion abnormalities related to SIRS criteria and sepsis screening, professionals are discussing the second revision of the SIRS criteria. Released in the early 2000s after being updated via a group effort by the Society of Critical Care Medicine (SCCM) and other physician-lead organizations (Gul et al., 2017), changes made in the definition of sepsis during this time was the addition of organ dysfunction to the diagnostic criteria for sepsis. This led to the addition of hypoperfusion and other perfusion abnormalities to the diagnostic criteria list. Diagnostic parameters included at this time consisted of: arterial hypotension with a systolic blood pressure $<90\text{mmHg}$, mean arterial pressure $<70\text{mmHg}$ or a systolic blood pressure decrease $>40\text{mmHg}$ in adults, and mixed venous oxygenation $>70\%$ (Gul et al., 2017). Organ

dysfunction parameters included at this time were, arterial hypoxemia with a $\text{PaO}_2/\text{FiO}_2 < 300$ mmHg, acute oliguria with urine output < 0.5 ml/kg per hour for at least 2 hours, or a creatinine increase ≥ 0.5 mg/dL. Coagulation abnormalities are also part of the organ dysfunction parameters with an international normalized ratio > 1.5 or activated partial thrombin time > 60 seconds. Other parameters included into the organ dysfunction assessment in the update of the SIRS criteria consisted of: an ileus or absent bowel sounds, thrombocytopenia, a platelet count $< 100,000$ /uL, or hyperbilirubinemia with a total bilirubin > 4 mg/dL. Hyperlactatemia with a lactate level > 3 mmol/L was also used as a measure of decrease tissue perfusion. Elevated blood glucose levels, > 110 mg/dL without a diagnosis of diabetes, significant edema or positive fluid balance > 20 mL/kg in 24 hours, and altered mental status were also added to the revision of the SIRS criteria at this time (Gul et al. 2017).

qSOFA

This score considers a patient's blood pressure, respiratory rate, and mental status when determining the overall score, all items being worth one point each, and a score of two or greater being grounds for further evaluation for sepsis (Kim et al., 2017; Gul et al., 2017). An elevated qSOFA score also correlates with a 3-14 fold increase in hospital mortality rate (Gul et al., 2017). The ease of completion at the bedside is what has led to the increase in popularity of this tool when screening patients for sepsis.

This tool has a significantly lower sensitivity for detecting sepsis and a higher specificity (Song et al., 2018). In a study by Luo et al. (2019), there was a “diagnostic accuracy of qSOFA outside of the ICU reported sensitivity of 47% (95% CI: 28%–66%) and specificity of 93% (95% CI: 88%–97%)” (p. 17).” Diagnostic criteria for the qSOFA

score include a respiratory rate >22 breaths per minute, systolic blood pressure <100 mmHg, and altered mental status with a Glasgow coma score of <15 (Gul et al., 2017). It is emphasized that the qSOFA score, though it may be positive with the patient exhibiting two out of the three diagnostic criteria, is not diagnostic for sepsis. It is purely a screening tool to be used at the bedside in the non-ICU setting to screen those patients who may develop sepsis.

SOFA

The SOFA score considers more specific physiologic data than does the qSOFA in screening for sepsis, focusing on overall organ dysfunction. These data points include PaO₂, platelet count, bilirubin level, blood pressure reading, Glasgow Coma score, creatinine level, and urine output. The SOFA score has a scoring system ranging from 1-4 points for each of the above stated measures of organ dysfunction. A table has been provided listing the scoring system for the SOFA screening tool as well as the physiologic measurements in each scoring level (table 1). Much like the SIRS criteria, this screening tool has been proven superior to both the qSOFA as well as the SIRS criteria in determining hospital mortality (Gul et al., 2017). However, in an article by Luo et al. (2019) they report, evaluation of all six components of the SOFA score is time consuming, labor intensive, and expensive, making this tool less suitable for use in the general ward setting and the qSOFA score more applicable. The qSOFA score can be calculated without the need for any blood tests and is easily repeated several times daily if necessary. Therefore, the qSOFA score is preferable on several medical units, and the SOFA score is more practical in the ICU setting where closer monitoring is available. It was reported by Gul et al. (2017) that the qSOFA score was not a good diagnostic tool

when applied in the ICU setting. However, the SOFA tool was proven to outperform the SIRS criteria in the ICU setting.

Barriers to utilizing the SOFA score in the general ward setting include the need for frequently updated lab results, as some labs are measured in one-hour increments. This makes the SOFA score much less financially beneficial when compared to the qSOFA score.

SOFA SCORE	1	2	3	4
Respirations PaO ₂ /FiO ₂ (mm Hg)	<400	<300	With respiratory support <200	With respiratory support <100
Coagulation Platelets ×10 ³ /mm	<150	<100	<50	<20
Liver Bilirubin (mg dL)	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular Hypotension	MAP <70	Dopamine ≤5 Dobutamine (any)	Dopamine >5 or Norepinephrine ≤0.1	Dopamine >15 or Norepinephrine >0.1
Central Nervous System Glasgow Coma Score	13-14	10-12	6-9	<6
Renal Creatinine (mg dL) or urine output mL	1.2-1.9	2.0-3.4	3.5-4.9 or <500ml	>5.0 Or <200ml

Table 1. *SOFA Screening Tool Scoring System* (Gul et al., 2017, table 2)

Key: MAP= mean arterial pressure

Dopamine and Norepinephrine dosages in µg/kg/min

Other Considerations

Research by Nevieri (2019), reported comorbid conditions such as advanced age (≥65), diabetes, obesity, immunosuppression, cancer, and even some genetic conditions can leave an individual more susceptible to sepsis. Reported in the same article, individuals 65 or over account for 60-85% of all sepsis cases in the United States (Nevieri, 2019). It is noted that most of these conditions involve an inflammatory

process that hinders the body's immune system when fighting off disease. When evaluating the overall health of an individual, the healthcare provider must take note of all other medical conditions at the given time of diagnosis.

Practice Change Appraisal

As this project is a quality improvement project, this researcher educated nursing staff on the cardiac unit at Stormont-Vail regarding newer updated screening tools for sepsis. This will give the nursing staff increased knowledge when monitoring a patient's progression throughout their hospital stay, providing additional resources to determine a patient's risk for developing sepsis. Practice change proposed related to this project is the use of the qSOFA and SOFA screening tools, in addition to the current sepsis screening tool at Stormont-Vail Hospital.

Summary

There are multiple screening tools available when screening for sepsis. Of the available screening tools, each is built with a specific patient population in mind. For patients outside the ICU setting or who are not in an immune compromised state, the qSOFA has greater specificity when ruling out sepsis. For patients in the ICU setting or some emergency department patients, the SOFA score with its more definitive diagnostic screening requirements is a better fit to rule in sepsis as a cause of illness due to its higher rate of sensitivity. Research supports, patients with multiple comorbidities can contribute to an individual's risk of developing sepsis. These comorbidities include obesity, diabetes, and immune suppression.

With more research and knowledge available to nurses regarding sepsis screening, more effective and expedited treatment will be initiated, minimizing sepsis morbidity and

mortality among many patients diagnosed with sepsis. Sepsis can be life altering or the cause of death if not diagnosed and treated within a timely manner. In order to ensure patients are properly diagnosed and treated for sepsis, this researcher intended to ensure that nursing staff on the cardiac unit are fully aware of the available screening tools for sepsis.

Chapter III

Methods

Project Design

The design of this scholarly project was a quantitative post-test design, involving a post-education survey after an education piece regarding the qSOFA and SOFA screening tools. This was an overall quality improvement research design project, to increase nurses' awareness of sepsis screening tools.

Target Population

The intended population of interest for this scholarly project was the nursing staff on the cardiac unit at Stormont-Vail Hospital in Topeka, Ks. This target population was chosen as a convenience sample due to the proximity to this researcher's home and workplace. These are the individuals who received education related to the qSOFA and SOFA screening tools.

Inclusion criteria for this project included being a registered nurse (RN) or licensed practical nurse (LPN) whose primary employment within Stormont-Vail Hospital is on the cardiac unit. Exclusion criteria included, being a RN or LPN within Stormont-Vail, employed to another unit other than the cardiac unit, or an RN or LPN

employed by another medical facility other than Stormont-Vail Hospital. Physicians, nurse practitioners, physician's assistants and other ancillary staff were excluded from this education activity at Stormont-Vail Hospital.

Procedure

Contact was made with the nursing staff manager for the cardiac unit, who previously served as the quality improvement nurse for the same unit, to discuss conducting this project at Stormont-Vail. The cardiac unit manager then gained approval from the director of the medical/surgical units. Although Stormont-Vail already has the SIRS criteria screening tool in place, the qSOFA, and SOFA screening tools will be an additional reference for nursing staff to utilize when assessing patients at risk for sepsis. Staff are still to follow the guidelines required regarding the SIRS criteria and any best practice advisory (BPA) that may require action based on the SIRS criteria.

This education took place as staff and this researcher were available, with the education piece via PowerPoint presentation followed by a post-education survey. Staff were educated in groups of two to five individuals at a time with a total of 28 staff educated. Staff who attended were given a copy of the presentation and followed along as this researcher delivered the education. Discussion after the education piece included staff comments regarding the use of the qSOFA and SOFA screening tools in addition to the current SIRS criteria. There was minimal fiscal liability for this project, including the expenses incurred for purchase of laminated cards to place on ID badges with the stated sepsis screening tool identifiers on them.

Instruments

Instruments utilized in this project included a questionnaire administered after each education session (Appendix A), and a PowerPoint presentation used to educate participants (Appendix C). The questionnaire was constructed using multiple choice answers as well as Likert-type scale answers, to evaluate the effectiveness of the education activity, and previous knowledge of the participants related to the qSOFA and SOFA screening tools. Copies of the qSOFA and SOFA instruments along with copies of the PowerPoint presentation, were given to the participants at the beginning of each education session, allowing them to follow along during the presentation. Data was also collected qualitatively after each education session, by this researcher talking with the participants to inquire their thoughts on the education and how the qSOFA and SOFA score benefits their practice.

Protection of Human Subjects

There was no involvement of patient identification in this project; therefore, exempt request for protection of human subjects was obtained by Pittsburg State University. There was no need to obtain written or verbal consent from participants as their participation in the education activity was voluntary, and completion of the post-education survey implies consent.

Ethical Considerations

Ethical principles upheld by the researcher included autonomy by allowing the nursing staff to decide to participate in the education activity. The ethical principle of beneficence, or to do good, and prevent or remove harm, was upheld by advancing the knowledge of nursing staff when evaluating patients for sepsis. The ethical principles of

veracity and fidelity were upheld through only providing nursing staff with truthful information and following through on this commitment (Hamric, Hanson, Tracy, & O'Grady, 2013).

Evaluation Plan

After all data was collected, results were evaluated by this researcher for analysis. Responses to each post-education survey question were analyzed and entered into a bar graph for presentation. Results of the post-education surveys were secured in a locked cabinet by this researcher and will be maintained for two years to ensure security of this study and information of the participants, then destroyed.

Plan for Sustainability

As this project was not designed to implement new processes or guidelines, sustainability will be related to furthering the education of the nursing staff regarding sepsis screening and encouraging the use of newly introduced screening tools. Staff were given a laminated card that is attachable to their ID badges, highlighting the aspects of both the qSOFA and the SOFA screening measurements for sepsis. This was provided as a reminder tool for staff that can be referred to if there are any questions after the education is completed. This was to also show appreciation for participating in the education activity. Data collected was also presented to the director of the cardiac unit at Stormont-Vail, with hope of applying the qSOFA and SOFA scores to sepsis screening policy, in addition to the SIRS criteria.

Summary

This was a quality improvement project regarding an education activity about the new qSOFA and SOFA screening tools for sepsis. The intended audience for this

education was the nursing staff on the cardiac unit at Stormont-Vail Hospital. With the SIRS criteria in place to screen for sepsis at this facility, this education will serve as a second resource for nursing staff to use when treating a patient they believe to be septic. It will increase their assessment skills and use of EBR for sepsis screening. Laminated cards were given to the nursing staff containing both the qSOFA, and SOFA screening tool guidelines to offer as a reference and encourage the use of these screening tools.

Chapter IV

Results

This project aimed to increase the knowledge of nursing staff on the cardiac unit at Stormont-Vail Hospital regarding different screening tools available for sepsis. Screening tools included in the education were the qSOFA and SOFA. Through increased knowledge for nurses screening patients for sepsis, it was hypothesized there would be earlier recognition of sepsis. Through earlier recognition and treatment of sepsis, a decreased overall sepsis morbidity and mortality was the second hypothesis.

Description of Participants

The sample of participants included 28 of the 35 nurses employed on the cardiac unit. Of the 28 participants, 25 responded that they were RNs, and three responded that they were LPNs. Eight participants responded they had worked in their current position at Stormont-Vail for <1 year, and 10 participants responded as working in their current position for one to five years. Eight participants have worked in their current position for five to 10 years, and two participants have worked in their current position for ≥ 10 years.

Key Terms

Key terms and variables of this project include, sepsis, qSOFA and SOFA screening tools, and education. Sepsis is a significant host response to infection that could lead to adverse health outcomes including death if not diagnosed and treated in a

timely manner. The improved awareness and knowledge of available screening tools, such as the qSOFA and SOFA sepsis screening tools, will allow nurses to quickly assess a patient at risk for developing sepsis.

qSOFA

The qSOFA screening tool is utilized in the non-ICU setting as a means of screening patients at risk for developing sepsis. This tool evaluates a patient's respiratory status by measuring their respiratory rate, mentation using the Glasgow Coma Score, and their cardiovascular function by measuring their systolic blood pressure. The patient is then given a qSOFA score of zero to three points, indicating to the caregiver the risk of the patient developing sepsis.

SOFA

The SOFA score is similar to the qSOFA score; however, this score looks at more specific measurements of organ dysfunction. These measurements include: PO₂/FiO₂ to measure respiratory function; platelets to measure coagulation status; bilirubin to measure liver function; mean arterial pressure to measure cardiovascular function; a Glasgow Coma Score to measure central nervous system function; and creatinine levels along with the amount of urine production to measure kidney function. With these specific measurements for organ dysfunction, the SOFA score is more applicable in the ICU setting when evaluating a patient who is believed to be developing sepsis or septic shock.

Analysis of Research Hypotheses

To achieve the stated hypotheses, this researcher educated nurses on the cardiac unit, regarding further screening tools for sepsis. Data collection took place in small

groups, with two to five nurses participating in each education session. Participants were given a copy of the PowerPoint presentation at the beginning of the education session, followed by completion of the post-education survey. Full data collection took place over the course of five weeks with a total of 10 teaching sessions. With only five to six nurses on duty per shift, and some having already participated in this project, data collection took longer than expected. After the education sessions, laminated cards with the qSOFA and SOFA screening tools were handed out to participants as additional reminders of the education and to show appreciation for participation. This was the only minimal fiscal liability reported for the project. Collected data, after being compiled, was stored on a secure thumb drive only accessed by this researcher. Hard copies of the post-education surveys were locked in a secure filing cabinet once analyzed and will be maintained for two years then destroyed.

Education and Earlier Recognition

Measurement of earlier recognition was completed by evaluating the number of responses to questions two, five, and seven on the post-education survey. These questions evaluated the participants' comfort level in using the qSOFA and SOFA screening tools, whether the participants had any knowledge of these screening tools before, and participants' opinions on whether the current screening tool used at Stormont-Vail is appropriate.

Participants responses to question two evaluating their comfort level in using the qSOFA and SOFA screening tools, revealed 64% (n=18) of the participants felt comfortable using the new tools. There was a smaller percentage, 17%, who reported being very comfortable using the new tools, with the remainder of participants reporting

they were not very comfortable using the screening tools. These responses showed many of the participants gained adequate knowledge from this education to begin using these tools in their nursing practice.

Responses to question five, evaluating if the respondents had ever heard of the qSOFA and SOFA screening tools before, showed 92% were unaware of these tools before this education. This demonstrates, through this education participation, participants gained knowledge they could use to recognize earlier signs and symptoms of sepsis.

Responses to question seven demonstrated, 85% did not feel the current screening tool in place at Stormont-Vail is adequate. This information was utilized in presenting results to upper management regarding use of the qSOFA and SOFA screening tools at Stormont-Vail

Earlier Recognition: Decreased Morbidity and Mortality

Decreased morbidity and mortality was measured using qualitative data analysis. Data was collected via talking with participants after the education sessions, learning their thoughts and feelings related to using the qSOFA and SOFA scores as additional tools when screening patients for sepsis. General opinions revealed from these discussions demonstrated, after the education, nursing staff felt more confident screening patients for sepsis using the qSOFA and SOFA screening tools, in addition to SIRS criteria. Previous research reports that “sepsis patients who did not meet SIRS criteria had the highest ICU and hospital mortality as well as more organ failure than those who did meet qSOFA and SOFA criteria” (Khwannimit, Bhurayanotachai, & Vattanavanit, 2018, p. 158).

Additional Data Analysis

Other data points collected by evaluating the post-education survey included the number of patients in the last 12 months treated by the participant for sepsis. Participants awareness of the current sepsis screening tool in place was also evaluated. This data is deemed pertinent to this study due to needing an understanding of previous knowledge of the participants to show professional growth through the education piece of this project.

The number of participants who had treated <10, 10-20, and 20-50 patients with sepsis or septic shock in the last year were equal with n=9 responses for each variable. There was one participant who reported having treated 50-100 patients with sepsis or septic shock in the last year. All participants were aware of the SIRS criteria being the current sepsis screening tool in place at Stormont-Vail.

Summary

Through education regarding different sepsis screening tools, participants in this study gained knowledge that will be useful in reducing the morbidity and mortality of patients who are septic. Participants also reported feelings that the current screening tool in place for sepsis is not adequate due to its lack of specificity in ruling out sepsis. Based on this information, further research can build on this study for later studies to advance sepsis screening and nursing education at Stormont-Vail Hospital.

Chapter V

Discussion

Relating Outcomes to Research

The purpose of this study was aimed at increasing the knowledge of nursing staff related to sepsis screening tools, the qSOFA and SOFA screening tools specifically. Through this education, it was this researcher's goal to reduce adverse outcomes in those patients diagnosed with sepsis.

This was completed through education, followed by a post-education survey to evaluate participants reactions and knowledge gained. This survey revealed that very few participants, 8%, had been exposed to these screening tools previously. A large percentage (85%) of participants also felt the current screening tool in place was not adequate in ruling out sepsis. After the education piece, 64% reported feeling somewhat comfortable utilizing these screening tools in their nursing practice. Given these results and the intended outcomes of this study, this researcher deems this education project a success. One hopes this education would decrease the adverse outcomes in patients diagnosed with sepsis.

Education and Earlier Recognition

It was hypothesized, through further education, there would be an increase in the nursing staff's ability to recognize a patient who may be developing sepsis on the cardiac

unit at Stormont-Vail. This is supported via results of this project through a lack of knowledge related to the qSOFA and SOFA screening tools amongst the participants. Through the project presentation, the nursing staff were educated on these screening tools, increasing their knowledge of more effective means to screen patients for sepsis. Research by Gul et al., (2017); Nevriere (2019); Park et al., (2017) and Shah et al., (2018) supports that the SIRS criteria currently in place is not the most effective tool in ruling out sepsis when compared to the qSOFA and SOFA screening tools due to lower specificity.

Earlier Recognition: Decreased Morbidity and Mortality

Results supporting this hypothesis are the qualitative results revealing learned feelings and opinions of participants. Participants reported feeling more confident in screening a patient for sepsis, when utilizing the qSOFA and SOFA screening tools in addition to the SIRS criteria. Responses to the post-education survey that revealed participants feelings the current sepsis screening tool is not adequate also supports this hypothesis.

General Observations

Until conducting research for this project, this researcher had never heard of the qSOFA or SOFA screening tools for sepsis; the SIRS criteria had been the only sepsis screening tool utilized. Many participants (92%) also reported not having knowledge of the qSOFA and SOFA screening tools. Many of the participants reported feelings the current screening tool (SIRS criteria) is not effective enough when screening patients for sepsis and had not felt the need to do anything about this, was another noteworthy point in this project, as utilizing EBR is the basis of providing high quality nursing care.

Theoretical Framework Evaluation

Betty Newman's systems model was used as a theoretical framework for this project and was supported in the findings of increased participant knowledge. Participants in this project increased their knowledge regarding sepsis screening through further education, strengthening the patient care system. This system is noted to be an open system as mentioned in Newman's model, with ever-changing interactions between the individuals living in the environment (healthcare workers), and the ever-changing healthcare environment. Additional knowledge gained through the education provided, will increase stability and flexibility in the open system of patient care, allowing nurses who screen for sepsis to adapt a screening tool appropriate and best fit to the patient's condition by using either the SOFA or qSOFA screening tool.

The assumptions most beneficial in reaching the determined hypotheses were the primary and secondary prevention assumptions. These assumptions guide the researcher and the participants in ways to prevent conditions such as sepsis and ways to avoid these types of conditions from progressing. The tertiary prevention assumption in this model would be most effective at maintenance, rather than prevention of an ongoing chronic condition.

Logic Model Evaluation

The logic model for this project demonstrated a linear representation of how this work was developed and its purpose, meeting all expected outcomes stated in the logic model. However, there was no real defined end point in the logic model allowing for evaluation of the education performed. The end point of the logic model was education of the nursing staff on the qSOFA and SOFA screening tools. The logic model would be

redefined and remastered if this project were to be reconducted, incorporating a means to evaluate the education outcome. This would include a goal percentage of staff educated and a goal percentage of knowledge gained from the education.

Limitations

Trying to find a time to conduct the education portion of this project was the major limitation. The education was performed when staff and this researcher were available, leading to instruction of smaller groups. This yielded a more interactive instruction between the researcher and participants; however, data collection took longer than expected.

The education piece for this project served its purpose; however, it could have been delivered more effectively. In attempting to educate as many nursing staff as possible, there were multiple education sessions held in small groups. If there had been a way to deliver the education sessions to larger groups, there could have been a larger sample of participants and more effective content delivery.

The post-education survey provided effective feedback to this researcher related to the effectiveness of the education and basic demographic information about the participants. However, delivery of the education and data collection could have been simplified by delivering the education in larger groups or via an online format. It felt as though participants were pressed for time when filling out their surveys after the education sessions, which may have hindered their responses.

Not all staff were able to participate in the education piece for various reasons, leading to a somewhat limited sample of 28 total participants of the approximately 35

staff. The sample of participants for this project was also a convenience sample, which could have introduced bias due to the participants having known this researcher.

Future Project/Research Implications

Results of this project provided an indication that further research and consideration of additional sepsis screening tools for patients at Stormont-Vail may be appropriate. Results of conducting this research and education on a larger scale could result in policy change within Stormont-Vail, utilizing the qSOFA and SOFA screening tools as an additional means of screening patients for sepsis. When presenting this education to a larger population, the use of Talent Connect, the education portal used for Stormont-Vail employees, would facilitate education participation and evaluation. An audio PowerPoint presentation would be developed and uploaded to Talent Connect, allowing all employees assigned access to the education at their leisure. Following completion of the education, employees would then complete the post-education survey to represent completion of the education activity. The results of this study and further implications for research were discussed with the director of the cardiac unit at Stormont-Vail, with positive feedback related to the presented findings.

Future Policy Implications

Policy change utilizing the qSOFA and SOFA screening tools in addition to the SIRS criteria is a potential outcome of future research that could be completed based on results of this project. Considering there was minimal knowledge reported of the qSOFA and SOFA screening tools in this project, further education and research would need to be completed prior to implementation of any policy change. When implementing policy change, one also must consider how the change will be utilized in the intended user's

workflow. In research reported by Barton et al. (2019) detection of sepsis is possible up to 48 hours earlier utilizing a machine learning algorithm (MLA) incorporating measurements of the SIRS criteria and qSOFA/SOFA into one program routinely scanning the patient's EHR, when compared to using only one of these tools to screen for sepsis. Through incorporation of a MLA that utilizes measurements of the SIRS criteria and the qSOFA/SOFA screening tools, nurses would have the benefit of all three sepsis scoring systems at their fingertips, without disruption in their daily workflow.

Conclusion

This goal of this project was to increase the knowledge of nurses on the cardiac unit at Stormont-Vail Hospital about sepsis screening, specifically, the use of the qSOFA and SOFA sepsis screening tools. Through advancing the nursing staff's knowledge regarding sepsis screening, this project enhanced their evidence-based practice when providing care to those patients believed to be septic. Responses to the post-education surveys demonstrated an increase in participants knowledge related to the qSOFA and SOFA screening tools for sepsis. This project also provides a starting point for future research and further education of the nursing staff at Stormont-Vail Hospital, potentially leading to a policy change related to sepsis screening. It is the belief of this researcher that, through the use of a MLA utilizing measurements of the SIRS criteria and the qSOFA/SOFA screening tools to routinely scan a patient's EHR, earlier recognition of developing sepsis would occur. This is the proposed future of this project, to educate additional nursing staff at Stormont-Vail regarding the qSOFA and SOFA screening tools, leading to their implementation along with the SIRS criteria, into a MLA within the EHR, therefore leading to earlier sepsis recognition. This MLA tool would allow nurses

to monitor their patients more closely for developing sepsis without having to alter their current workflow as well.

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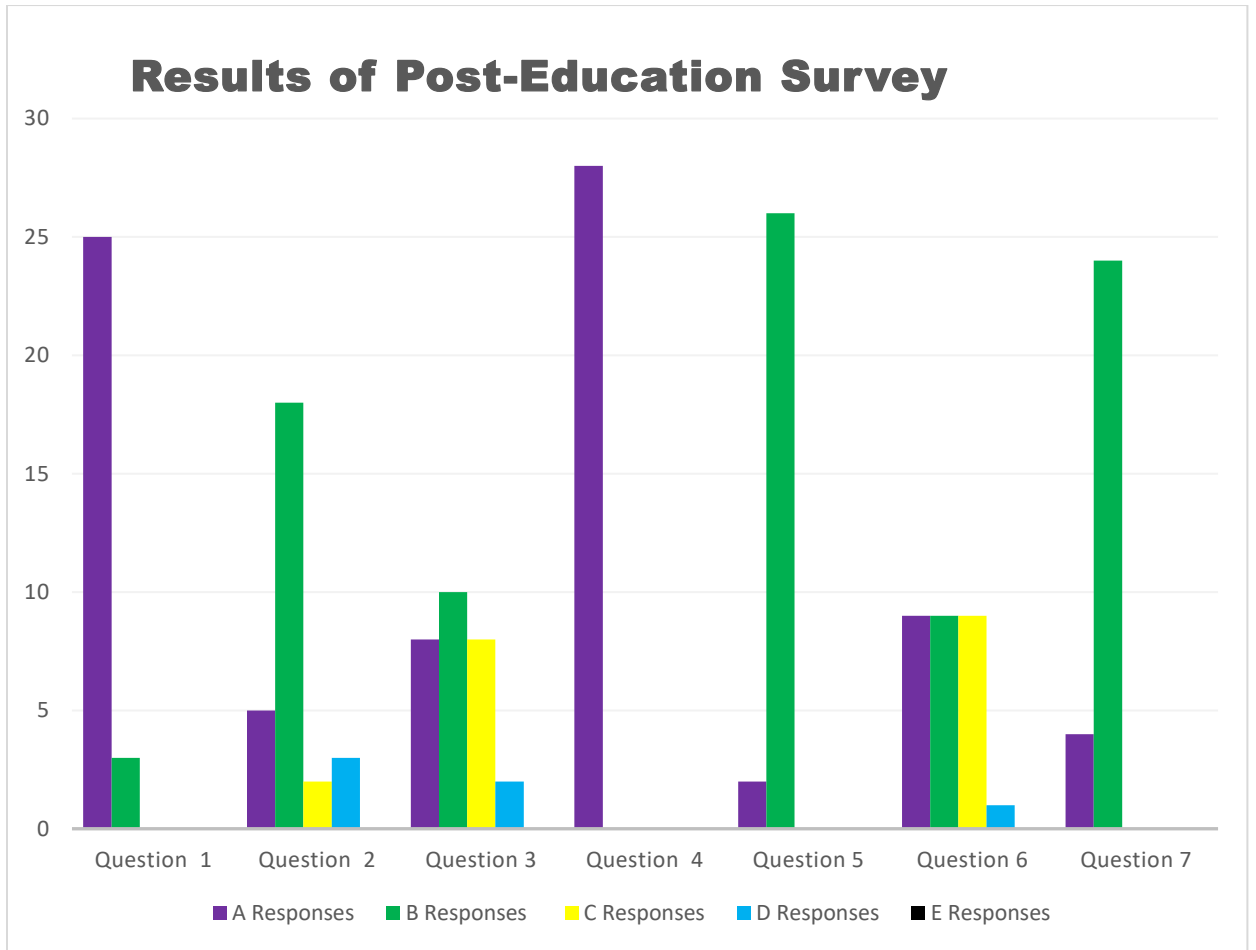
APPENDIX

Appendix A

Screening questionnaire enquiring nursing knowledge regarding the qSOFA/SOFA screening tool.

1. What is your role within Stormont-Vail Health?
 - a. RN
 - b. LPN
2. How comfortable are you in screening a patient for signs/symptoms of sepsis or septic shock using the qSOFA, SOFA screening tool?
 - a. Very comfortable
 - b. Sort of comfortable
 - c. Undecided
 - d. Not very comfortable
 - e. Not comfortable at all
3. How long have you been in your current role at Stormont-Vail Health?
 - a. <1 year
 - b. 1-5 years
 - c. 5-10 years
 - d. ≥ 10 years
4. What screening tool is currently in place at Stormont-Vail health to screen patients for sepsis?
 - a. SIRS criteria
 - b. qSOFA, SOFA criteria
 - c. MEWS
 - d. I am not sure
5. Have you ever heard of the qSOFA, SOFA sepsis screening tools before today?
 - a. Yes
 - b. No
6. Approximately how many patients have you treated in the last 12 months while working at Stormont-Vail Health or another medical facility, that have been diagnosed with sepsis or septic shock?
 - a. <10
 - b. 10-20
 - c. 20-50
 - d. 50-100
 - e. ≥ 100
7. Do you feel that current screening tool in place to screen patients for sepsis is adequate?
 - a. Yes
 - b. N

Appendix B



Appendix C



Using the qSOFA and SOFA Screening Tools for Sepsis Screening

BY: BRITTANY HORN

What is Sepsis?

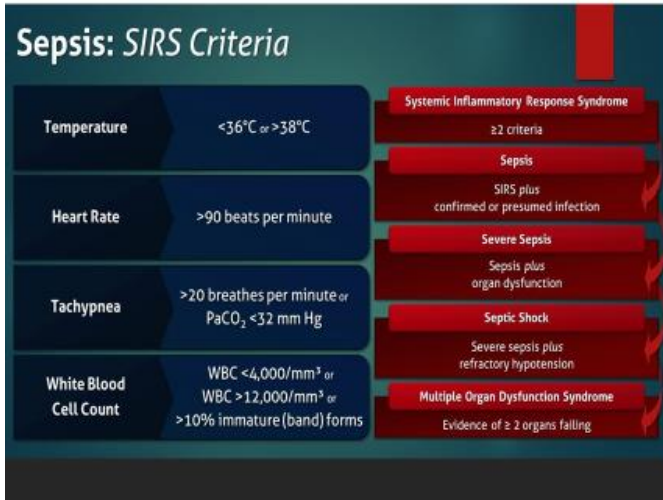
"A dysregulated host response to infection which may lead to organ dysfunction" (Shah et al., 2018, p. 1745).

"A dysfunctional host response to infection that leads to life-threatening organ dysfunction" (Chaney, 2018, slide 3).

"The body's extreme response to an infection. It is a life-threatening medical emergency" (CDC, 2018, para. 1)



Screening for Sepsis



“Timely identification of patients with non-severe sepsis, i.e., those without organ dysfunction or shock, who later develop severe sepsis may impact patient morbidity and mortality” (Holder et al.2016, p. 2)

Systemic Inflammatory Response Syndrome (SIRS)

Quick Sequential Organ Failure Assessment Score

Sequential Organ Failure Assessment Score

Screening for Sepsis Cont...



qSOFA Score

Screening for Sepsis Cont...

SOFA Score

Typically calculated 24hrs after admission to ICU then every 48hrs after admission

Endorsed by the Society of Critical Care Medicine

(Kelley, 2020)

Table 1 The Sequential Organ Failure Assessment (SOFA) score^a

Organ system	SOFA score				
	0	1	2	3	4
Respiratory, PO_2/FIO_2 , mmHg (kPa)	≥ 400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation, Platelets, $\times 10^9/mm^3$	≥ 150	<150	<100	<50	<20
Liver, Bilirubin, mg/dL	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular	MAP ≥ 70 mmHg	MAP <70 mmHg	Dopamine <5 or dobutamine (any dose) ^b	Dopamine 5.1-15 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1 ^b	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1 ^b
Central nervous system, Glasgow Coma Scale	15	13-14	10-12	6-9	<6
Renal, Creatinine, mg/dL. Urine output, mL/d	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 <500	>5.0 <200

^a, adapted from Vincent et al. (7); ^b, Catecholamine doses are given as $\mu g/kg/min$ for at least 1 hour. FIO_2 , fraction of inspired oxygen; MAP, mean arterial pressure; PO_2 , partial pressure of oxygen.

Which Screening Tool is Best?



"Inflammation is a very non-specific response to any insult from minor trauma to complicated autoimmune disease" (Gul et al., p. 130).

"There has been conflicting evidence regarding the value of SIRS with the SIRS criteria being criticized for having inadequate specificity and sensitivity" (Park et al. 2017, p. 12).

How to Choose a Tool



Where is your patient admitted?

- ICU vs. in-patient medical unit
- SIRS criteria has been show to not be as specific in ruling out sepsis.
- qSOFA tool is more suitable for in-patient units vs. ICU
- SOFA tool more suitable for ICU setting

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