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Impact of Sepsis Education for Emergency Department Staff:

A Quality Improvement Project

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Abstract

Background: Sepsis continues to be a critical issue worldwide. New sepsis guidelines instituted by the Centers of Medicare and Medicaid Services (CMS) list evidence-based standards to comply with regarding care for sepsis patients. To help a new acute care facility meet compliance, a sepsis educational program has been developed to assess staff knowledge and confidence in caring for these patients.

Methods: This quality improvement (QI) project was developed using a pre-post study design to assess the impact of implementing a sepsis educational program for emergency department staff at this new acute care institution. A sepsis educational program was derived from CMS's sepsis protocol SEP-1 Core Measures. The protocol calls for a series of evidence-based interventions to be completed within three and six hours.

Results: Post intervention data show that after completing the sepsis education program 69.3% of staff felt they were very confident or extremely confident in their care of sepsis patients.

Familiarity with sepsis had a statically significant increase $t(22) = 10.35, p < .0001, d = .06$. Data shows the increase in knowledge post sepsis education is statistically significant, $t(22) = 4.40, p < .0001, d = .92$.

Conclusions: Data show the participants gained familiarity and confidence from the sepsis education program. Knowledge improvement was significant after the standard of care guidelines education. Having staff trained in these interventions will not only increase compliance but, most importantly, improve patient outcomes.

Introduction

Problem Description

According to the Centers for Disease Control and Prevention (CDC), there are at least 1.7 million adults in America that develop sepsis each year, with it taking the lives of 270,000 individuals.¹ The Society of Critical Care Medicine (n.d) describes sepsis as a life-threatening organ dysfunction in response to an infection. Risk factors encompass a wide range of vulnerable patients. However, anyone can develop sepsis. More prevalent causes of severe sepsis cases have been COVID-19 and its variants. Sepsis also frequently results from infections acquired in the healthcare setting affecting hundreds of thousands of patients per year.²

Early triage, diagnosis, and recognition of the severity of sepsis is vital to overall outcomes. Patients arriving to emergency departments (ED) with sepsis-like symptoms including fever or low temperature, altered mental status, change in breathing, tachycardia, weak pulse, hypotension, low urine output, cyanotic or mottled skin, and or extreme discomfort should be immediately taken back for initiation of care.³ The mainstay of sepsis patient care is early identification, fluid resuscitation, and antibiotic administration which can improve patient outcomes.⁴ Delay in diagnosis leads to a domino effect of setbacks in treatments and life-saving measures such as lab draws, fluid administration, and appropriate antibiotic initiation. Emergency department registered nurses (RN) are at the frontline of care for early presentation of sepsis patients. This requires staff to be educated and trained in the newest guidelines of care.

Education programs have a positive association with knowledge about systemic inflammatory response syndrome (SIRS) and sepsis.⁷ Prior studies have shown that education on

a regular basis has a positive impact. Several studies demonstrated the impact education can have on nurses' knowledge for implementing sepsis care. A cross-sectional study showed educational programs that maximize nurses' ability to enhance their decision-making for appropriate sepsis care are needed.⁵ This study gave nurses an in-depth survey prior to the educational presentation. Many nurses in this study scored poorly on pre-educational questions. The educational intervention provided practical support to help nurses extend and mobilize their knowledge for decision-making. Nurses working in the ED expressed their own deficits in their capacity to recognize and respond to patients with sepsis, despite their vital role within the health care system.⁶ These nurses identified several sepsis knowledge care gaps that could be filled with a clinical enrichment educational presentation. Another important finding involved ED nurses over the age of 50 scoring significantly lower than their younger colleagues.⁷

A longitudinal, quasi-experimental study evaluated the effect of an interprofessional simulated patient sepsis video with educational "boosts" of knowledge for acute care nurses at a large academic health system.⁸ The "boosts" are described as revisiting previously learned content by answering a single question related to prior education. Findings suggest that this "boost" method may impact nurse knowledge retention, and potentially eliminating the need to repeat, costly, traditional educational efforts.⁸ Each study, no matter what form of educational presentation was used, resulted in significant positive effects on patient outcomes and nurse knowledge. The evidence shows support for the implementation of a sepsis educational event for emergency health care professionals.

Rationale

The knowledge-to-action (K2A) theoretical framework was chosen for this quality improvement (QI) project as it provided a stepping point for each intervention. This framework

was developed by the CDC to translate scientific knowledge to improve the public's health.⁹ The K2A framework added the high-level processes necessary to transition from discovery into action by using evidence-based practice.⁹ The framework identified three common components: research, translation, and institutionalization. The interaction between all three points was vital to the translation of knowledge to sustainable action. This framework was designed to be nonlinear, applicable regardless of the disease or type of intervention being considered, and supportive to research.

Specific Aims

The aims of this study were:

1. Evaluate the current ED staff knowledge regarding sepsis care at a new acute care facility.
2. Design a formal evidence-based sepsis educational program related to the Centers for Medicare and Medicaid Services SEP-1 Core Measure protocol to educate all ED staff using a team approach.
3. Increase staff familiarity, knowledge and confidence in triage and care of sepsis patients presenting to the ED.

Methods

Context

The study design for implementation of this QI project was a pre-post design which sought to determine if a specific educational intervention for ED staff resulted in improved care for sepsis patients. This design assisted in the understanding of the intervention's effectiveness while being feasible for the goals of this project. The project was an organization-based initiative to help fill an identified gap in their ED patient care.

This project was conducted at a nonprofit, physician-driven, hospital located in a rural area of a midwestern state. The hospital has 67 beds and opened to the public in July of 2020. The ED soon followed with the opening in November 2020. Many policies and procedures had not yet been established and followed at this acute care hospital for a multitude of reasons, including a change in the electronic health record (EHR), staff turnover and alignment with a larger tertiary organization. Prior to initiation of the QI project, a policy was not in place for standardizing care for sepsis patients. Staff carried out tasks only after the physician orders were placed in the EHR or verbal orders were given. Patients were not being triaged and given the timely care needed to improve their overall outcome. This problem was a significant issue because best practice relies on immediate treatment.¹⁰ Prior research has demonstrated that sepsis training regarding specific time-sensitive tasks can improve patient outcomes.¹⁰ Early recognition of sepsis patients along with early intervention of fluid and antibiotic administration leads to increased patient outcomes.⁴ Because the literature supports improved patient outcomes with sepsis training, the goal of this QI project was to determine if an educational program at this rural hospital would enhance staff knowledge and confidence when caring for sepsis patients.

This newly opened hospital serves both metropolitan and rural communities. However, sepsis-related deaths are higher in the rural patient population.¹ In the United States, rurality was associated with increased in-hospital sepsis deaths across multiple patient populations and locations.¹¹ The reason for this disparity is complex, ranging from physical distance to finances, provider shortages, comorbidities, and insurance status. This QI project is being implemented in a state where over half of the counties are considered rural.¹¹ The death rate from sepsis in this rural state is 6.9 per 164 individuals.¹²

Procedures

While the literature has a primary focus on nursing sepsis care, this QI project included all participants who might interact in the ED with patients presenting with sepsis. A larger group of participants was included to see if there were improved outcomes with more than just nursing staff education. Participants included quality improvement personnel, administration, ED staff, laboratory, pharmacy, and radiology staff. As a new facility opening in 2020, participants had been employed at this facility for a short time, between one to three years. A total of 80 participants from all departments were invited to participate. The head of each department was provided with an overview of the project in order to adequately inform all potential participants. Department heads were responsible for disseminating the email with the project's links to the surveys and educational presentation to their staff. Participants were given two months to complete the education presentation and surveys. All staff were emailed the presentation at baseline, three and six weeks.

Interventions

The primary intervention was to provide education on sepsis. Surveys were completed by staff members pre- and post-education presentation to assess levels of knowledge, confidence, and familiarity with sepsis care. The pre-test included nine general demographic questions, ten knowledge, confidence, and familiarity with sepsis assessment questions and one open ended question about potential barriers. The post-survey included the same questions on knowledge, confidence, familiarity, and barriers to sepsis care as the pre-survey. See Figure One for a list of survey questions. The survey questions used a combination of Likert scale options, multiple choice, true/false and free text response questions.

Once the pre-survey was completed, participants were then instructed to complete the education presentation. Integration of the "What, So What, Now What?" liberating structure

aided in keeping educational material up to date and evidence based.¹³ This liberating structure is used to define the issue, identify implications for change, and make the appropriate changes. Using this structure will allow appropriate updates to the educational presentation as new evidence becomes available. The education module was developed by the authors and included information on the definition of sepsis, the complications and severity of sepsis, signs and symptoms, patient triage, intervention time windows and standard treatment modalities. The module was implemented via an online narrated presentation.

To further support the presentation a paper screening tool, seen in Figure Two, was utilized and given to each potential participant. This screening tool was a shortened synopsis of interventions shown in the presentation module to aid in comprehension. This screening tool was available for participants to print off and use after completion of the education in their future practice.

Following the educational presentation, the post-survey was completed. Participants were given the option to complete an evaluation of the project. This evaluation consisted of seven questions to gauge the participants opinions on the project. The evaluation tool utilized a Likert scale on the first four questions that assessed participants satisfaction, degree of potential utilization in practice, and confidence. Participants were given the opportunity to give their input into possible changes they would make to the project to help further increase participation and completion.

Study of the Interventions

The development of the educational content presented to the participants was based on the SEP-1 Core Measures developed by the CMS. SEP-1 is a set of guidelines for treatment of sepsis patients. There are several key aspects to this measure including required interventions

within three hours and six hours of triage. When using the SEP-1 protocols, patients were 15% less likely to die from sepsis.¹⁴ Another study conducted in 2022 found that using the SEP-1 protocols also decreased patients' 30-day mortality rate.¹⁴ It can be challenging for facilities to achieve compliance with these protocols. A detailed outline of the SEP-1 interventions is shown in Figure Three. There are multiple steps at different hours during the patient's course of illness. This requires a multidisciplinary team that works together to accomplish these interventions swiftly.¹⁴

Ethical Considerations

To ensure that all ethical considerations were reviewed prior to implementation of the QI project, the institutional review board (IRB) at this midwestern university was accessed to determine if IRB approval was needed. The project was approved with no review needed. The hospital where the QI project took place did not require IRB approval.

Measures

Microsoft Forms was used to develop the pre, post, and evaluation surveys. This format provided a HIPAA compliant, easy to use, and readily accessible program for survey completion. Microsoft Forms electronically kept track of every participant's answer to each question and placed them in an Excel spreadsheet for viewing and statistical analysis.

The education module was provided via an online narrated PowerPoint that could be viewed at the participants leisure. An email was sent to department heads to forward it onto their staff. The email was sent via Microsoft Outlook and included all material to participate in the QI project. Outlook enabled participants to complete each step, in order, from pre survey to educational presentation to post survey and evaluation which aided in ease of use and efficiency.

Data Analysis

Data was downloaded from Microsoft forms and uploaded to SPSS v. 29 for cleaning and analysis. Missing data was evaluated but not imputed. Data distributions were explored for normality. Each statistical test was conducted at the $p=.05$ level. Descriptive statistics were used for the demographic, independent, and outcome variables. The knowledge, confidence, and familiarity with sepsis care surveys were summated. The differences between the pre- and post-surveys were assessed with paired t -tests.

Results

The 23 participants were 91% Caucasian, 4% Latino, 4% other; 96% female, 52% divorced, 26% married and 22% single. They were an average of 36.35 years old with a standard deviation of 9.27 years and a median of 35 years. They were 96% English speakers and 4% spoke both English and Spanish. They worked 96% full-time and 4% as needed (PRN). Their education background included 35% had a Bachelor of Science in nursing (BSN), 30% had an associate degree in nursing (ADN), 9% had a Master of Science degree in nursing (MSN) and 9% were lab technicians and 18% were radiology technicians. The average length of employment in health care was 13.8 years with a standard deviation of 9.79 and a median of 11 years. The average tenure at the facility was 1.92 years with a standard deviation of .23 and a median of 2 years. The range of the tenure was less than one month to 4 years.

Results demonstrated 69.3% of staff members felt their confidence levels increased, with the completion of the educational program. In addition, the majority stated they were very or extremely confident in their care of sepsis patients post education. Familiarity with sepsis had a statistically significant increase $t(22) = 10.35, p < .0001, d = .06$. Data shows the increase in knowledge post sepsis education was statistically significant, $t(22) = 4.40, p < .0001, d = .92$. On

pre-education survey most participants (56%) reported they were either familiar or very familiar with sepsis care, on posttest the majority (60.9%) reported being very familiar or an expert in sepsis care. When asked about correct criteria for triage of sepsis patients, only 56% of participants were correct on pre-evaluation and 100% were correct on post evaluation. Participants were tested on signs of worsening condition with 39% pre survey correct, and 56% on posttest correct. There were three questions where participants were correct, over 90% in both the pre and post survey showing there was prior knowledge. These questions were testing risk factors, lab results, and short-term interventions. The last question which tested the six-hour interventions had a poor outcome of 13% correct on pre survey and on 30% correct on post survey.

Thirteen of the 23 participants completed the project evaluation survey. Using the Likert scale, participants were asked their level of satisfaction with the project and 69% answered very satisfied and 23% stated they were mostly satisfied. Thirty eight percent indicated they were very likely to change their practice to utilize what they learned during the project to their patient care.

The final evaluation question asked about potential barriers to implementation of the SEP-1 guidelines as detailed in the education presentation. Answers varied, however, there were several responses commenting on how there is no program currently in the EHR to help with patient triage or alerting staff to potential sepsis. Another barrier identified was the lack of 24-hour pharmacy coverage. With only an on-call pharmacist available, the onset of antibiotic administration could potentially be delayed. The overwhelming majority of participants commented on the high rate of staff turnover. One participant stated it is hard to have structure and conformity when there are always staff leaving and new staff to be hired.

Discussion

Summary

We set out to determine if implementing an educational module would increase knowledge, confidence, and familiarity with sepsis care for those working in the ED. Data demonstrates that having the educational presentation positively influenced the familiarity, knowledge and confidence of staff at this rural facility for caring for sepsis patients. Sepsis education in place at institutions has demonstrated a higher adherence to carrying out timely and appropriate life-saving steps.¹⁴ Strengths of this project included eagerness of staff to improve, positive encouragement from facility administration, evidence-based data to support this project, and clear guidelines in which to base educational material. With the utilization of evidence-based practices for sepsis educational interventions, this facility will have a high potential to establish a solid foundation for implementing a sepsis protocol to improve patient outcomes.

Interpretation

An association between the educational intervention and increased staff knowledge, familiarity, and confidence was found. Our project adds to the existing literature that demonstrated an educational intervention is beneficial for ED staff and ultimately patient care. These additional resources for ED staff will benefit the organization and the care provided for sepsis patients. Staff can be more knowledgeable and comfortable with this patient population and can aid in being resources for new staff members in demonstrating how to conduct the best, evidence-based care to sepsis patients.

Limitations

Limitations to the project included low staff participation and a low sample size for pre- and post-intervention surveys. Communication between administration and staff to begin

implementation was lacking. There was increased staff turnover in administrative staff, quality improvement staff, educational personnel, and front-line ED staff since the beginning of the project. Due to the high turnover rate in staff, eight months lapsed from the beginning of this project to its implementation, delaying the timeline that was originally planned. Future studies could be conducted to analyze and compare patient outcomes pre-sepsis to post sepsis training.

Conclusions

Sepsis education increased staff's knowledge, familiarity, and confidence in their care of sepsis patients. Because of the positive response from this project, the sepsis screening tool and educational module will be implemented for future use at the facility. These results, along with the addition of a paper sepsis screening tool, will aid in the promotion of positive patient outcomes and the potential development of a standard of care for this facility.

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Figure One
Survey Questions

Question	Response Type
How familiar are you with sepsis? On a scale of 1-10, 1 being "I've never heard of the term" and 10 being, "I'm a clinical expert."	Likert Scale
How well do you know care interventions to implement for patients presenting with sepsis?	Likert Scale
How do you feel the teamwork is on your unit, regarding working together towards the betterment of patients?	Likert Scale
In screening adults over 18 years of age for sepsis, which of the following places them at an increased risk for infection?	Multiple Choice
A patient is positive for SIRS (systemic inflammatory response syndrome) if the following are present.	Multiple Choice, select all that apply
A patient may be positive for SIRS (systemic inflammatory response syndrome) if the following are present.	Multiple Choice, select all that apply
A lactic acid level over 2.0 is considered "critical" and requires physician notification and a redraw within 6 hours.	True or False
Organ dysfunction could be present in the patient if the following are present.	Multiple Choice, select all that apply
Care interventions that should be implemented by or before 3 hours of the patient presenting with signs/symptoms of sepsis include.	Multiple Choice
Care interventions that should be implemented within 6 hours of patient presentation include.	Multiple Choice, select all that apply
After receiving education on sepsis, what are some barriers or potential barriers you see at your workplace that would hinder your care of septic patients?	Open-ended/free text

*Survey questions were developed by the authors based on a compilation of data from articles found throughout the manuscript.

Figure Two Participant Handout

Sepsis Screen Adults ≥18 y/o

Pt Known or Suspect Infx	SIRS	Organ Dysfunction Criteria Present
Recent procedure/surgery	T > 101 or < 96.8 F	New/Unexplained Change in Mental status
Fever/Chills	RR > 20 or PaCO2 < 32	Platelets <100,000/uL
Cough/SOB	WBC <4k or >12k or Bands >10%	Blood Glucose >140 mg/dl (no DM)
Central Line	Pulse > 90	Creatinine > 2 mg/dl (if hx CKD - Crt elevated > 0.5 above baseline)
Abdominal Pain	Lactic Acid: _____ (Draw if 2+ above criteria met)	UOP < 0.5 ml/kg/hr for 2 hrs
Purulent Wound Drainage		Lactic Acid > 2 mmol/L
Cellulitis		Total Bilirubin > 2 mg/dl
On Abx (not prophylactic)		SBP < 90 or MAP < 65
		SBP decrease > 40 mmHg from baseline
		Serum CO2 < 20 mmol/L (on BMP)
		Acute Respiratory Failure
		INR > 1.5 or aPTT > 60s
		PaO2/FiO2 ratio <300
Time of Suspected/Known Infx	Time met at least 2+ above criteria (can be at diff. times - take latest)	Time met for at least 1 organ dysfunction
A Time: Initials:	B Time: Initials:	C Time: Initials:
B & C w/in 6 hrs? Y/N START TIME: Latest time of A, B, & C: _____ Initials: _____		

Sepsis Action Taken by Nursing: None required MD notified APP Notified MD Aware APP Aware

3 Hour Events Start Time + 3 Hours: _____				
	Time	Initials	Volume Resuscitation	Initials
Blood Cultures Drawn			TIME IV FLUIDS STARTED	
Lactic Acid Result: _____			Total Infused by EMS	
Antibiotic given (after blood cultures drawn)			Total Infused by ER	
30 ml/kg ordered			Total remaining to infuse	
			TIME IV FLUIDS FINISHED	

6 Hour Events Start Time + 6 Hours: _____		
Additional IVF needed following initial volume resuscitation? Y/N		
	Time	Initials
Lactic Acid Redrawn Result _____		
Pressor Started for Refractory Hypotension		

Figure Three

SEP-1 Core Measures

Required Action	Severe Sepsis		Septic Shock	
	3-Hr Bundle	6-Hr Bundle	3-Hr Bundle	6-Hr Bundle
Initial Lactate Collection	Yes	Must be completed within 3-hrs of Severe Sepsis Presentation		
Blood Culture Collection	Yes			
Initial Antibiotic Started	Yes			
Repeat Lactate Collection (if Initial Lactate is > 2)	N/A	Yes	Completed within 6-hrs of Severe Sepsis presentation	
30 mL/kg Crystalloid Fluids Started	N/A	N/A	Yes	Completed within 3-hrs of initial hypotension and/or septic shock
Vasopressor Given (if hypotension persists)	N/A	N/A	Completed within 6-hrs of septic shock	Yes
Repeat Volume Status Assessment	N/A	N/A		Yes

[14]