Sepsis Educational Intervention for Emergency Department Nurses

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Abstract

Background & Significance: Sepsis is a life-threatening complication of infection. Early recognition and treatment are crucial to improving patient outcomes.
Problem: The current sepsis treatment compliance of fluid bolus administration of crystalloids within 30 minutes of severe sepsis/septic shock at a hospital Emergency Department (ED) in the suburb of New York City, is lower than the state average, which is the benchmark for sepsis care.
Methods: One group, pre/post test, quality improvement evaluation of an educational intervention targeting emergency department registered nurses (RNs). RN sepsis knowledge was measured 2 weeks prior and within 2 weeks after the intervention. Hospital reports of fluid metrics for the ED were compared for the quarter preceding and following the intervention for patients identified with severe sepsis/septic shock in the ED. The fluid metric was the average time from severe sepsis/septic shock identification to fluid administration.
Results: Sixty-one RNs participated in the educational intervention while the survey was completed by 35 prior and 33 following the intervention. Though there were no significant changes in overall RNs' knowledge, there was improvement in nurses anticipating interventions to prevent complications and selecting the correct amount of fluids. The nurses voiced concerns during the intervention concerning system-level opportunities for improvement in sepsis outcomes.
Implications for practice
Although education is not usually sufficient to make a major impact in changing care, it is the first step to empower nurses to engage in system-level solutions. Future projects should follow hospital data for longer than 3 months. Recommend continual educational reinforcement and follow up posttest evaluation.

Keywords: sepsis education, emergency department nurses, quality improvement, and education

Background

Sepsis is a life-threatening complication resulting from an infection or Systemic Inflammatory Response Syndrome (SIRS). It manifests when cytokines released into the bloodstream to fight off an infection trigger inflammatory responses throughout the body. This inflammation can activate a cascade of changes that can damage multiple organ systems causing organ failure, and can even be fatal.[1]

Sepsis is a serious condition that can lead to organ failure and death. Between 15% and 30% of sepsis patients die, which makes it one of the most common causes of death in the United States. Sepsis is responsible for over 750,000 hospitalizations annually; causing more deaths annually than prostate cancer, breast cancer, and HIV/AIDS combined.[2, 3] There is a 10-fold greater risk of death from post-surgery sepsis in patients than from a heart attack or pulmonary embolism[2]. Sepsis must always be treated as an emergency.[4] Time is of the essence in sepsis treatment; early patient assessments, tests, fluid bolus and antibiotics are life-saving measures.

Most patients exhibiting sepsis symptoms receive initial care in the emergency department, and their short-term mortality is 20% or greater.[5] The Healthcare Association of New York State (HANYS) members report that around 75% of patients with sepsis in New York are admitted through the ED, and those who survive sepsis are more likely to require long-term care than patients recovering from other acute conditions.[6] The CDC reports that sepsis occurs most often in people over 65 years but also in infants less than one year of age

due to their immature immune systems.[8] The estimated cost of sepsis burden in the United States was $14.6 billion in 2008; this has risen annually by 11.9%[6].

Several interventions have independently demonstrated improved survival rates in severe sepsis. This includes Early Goal-Directed Therapy (EGDT), which is recombinant human Activated Protein C (rhAPC), corticosteroids, and early administration of broad spectrum antibiotics.[10] For early severe sepsis management, the Institute for Healthcare Improvement (IHI) and the Surviving Sepsis Campaign (SSC) Guidelines[11,12] recommend implementation of a 6-hour resuscitation bundle in patients presenting with sepsis at the ED. This resuscitation bundle includes early diagnosis, early antibiotic administration, and fluid administration to meet EGDT. The treatment of sepsis is time-critical; it requires timely diagnosis and prompt initiation of appropriate treatment options. The Centers for Medicare and Medicaid Services (CMS) mandated that hospitals were to begin reporting adherence to the “SEP-1” sepsis management bundle October 1, 2015. The SEP-1 bundle requires health care providers to measure serum lactate, obtain blood cultures, and administer broad-spectrum antibiotics within 3 hours of sepsis onset or hospital presentation (“time zero”). Providers must recheck serum lactate within 6 hours if the initial level was elevated. For a patient with septic shock, clinicians also must administer at least 30 mL/kg of crystalloid within 30 minutes, administer vasopressors, and record the patient's response to fluid resuscitation.[13]

Even with current quality initiatives, sepsis remains the most expensive condition treated in US Hospitals. Although approximately $20.3 billion was spent

in the US in 2011 to treat the problem, mortality rates for patients with severe sepsis and septic shock ranged from 10 to 50%.[14]

This quality improvement project focuses on improving sepsis management at a hospital in a suburb of New York City, which is part of a large health system that is a regional healthcare provider. The hospital is a trauma center offering both general medical and surgical procedures with a bed capacity of 300 and 17,737 inpatient admissions in 2016. The hospital's Sepsis Task Force oversees sepsis processes and outcomes, including a sepsis champion program that encourages staff to establish best practices then to share with system hospitals'. The hospital's rates for all aspects of sepsis management meets state averages except for sepsis patients receiving fluid bolus administration within 30 minutes of identification of severe sepsis/septic shock. The purpose of this quality improvement project was to develop and then evaluate an educational program for ED nurses to improve the nurses' knowledge and adherence to all aspects of current national guidelines. The secondary aim was to improve fluid bolus administration within 30 minutes for severe sepsis/septic shock in the ED to the benchmark set by best practice guidelines (CMS,[15] CDC,[16] HANYS,[17] IPRO,[18] and The Joint Commission[19]).

Methods

This was a prospective, one-group, pre-post test quality improvement project.

Setting/Sample

In 2015 the emergency department of the participating hospital cared for 71,012 patients, 318 of which were diagnosed and treated for severe sepsis/septic

shock. All 65 emergency department registered nurses (RNs) were targeted for this educational intervention.

Project Protocol

All ED RNs received an email from nursing administration inviting them to an in-person sepsis education session and to voluntarily complete an online survey before attending the education intervention. ED RNs were offered six opportunities to attend the on-site training. Within a week after all trainings were completed, RNs were emailed to voluntarily complete the same survey.

Intervention

The authors created the educational training module for the ED RNs based on nationally established guidelines for sepsis identification and treatments (CMS,[15] CDC,[16] HANYS,[17] IPRO,[18] and The Joint Commission[19]). The education included sepsis definition; patients at risk, and evidence-based treatments delivered to groups of 2 to 9 RNs during a change of shift in the ED break room. A 20-minute power point educational program and a written pocket guide (HANYS Sepsis Guide) were given to each nurse. To maximize participation, six education sessions were offered, two at 7am, two at 11am and two at 7pm.

Measures/**Knowledge**. Prior to and following the educational intervention RN knowledge of early sepsis identification, fluid bolus administration treatment and sepsis care were measured using a tool created by the participating hospital. There was no psychometric validation of the tool but the hospital administrators choose the tool since and it was found useful in prior sepsis quality improvement projects.

The tool included two clinical scenarios, A and B, followed by five and three multiple-choice questions, respectively. Scoring was based on the total number of correct responses. Scenario A focused on the identification of symptoms, priority for lab tests ordered, intervention priority, interventions to prevent major complications, and the correct amount of fluids to administer to patients. Scenario B focused on priority interventions, expected prescribers' orders, patient symptom identification and management. The pre-survey included one demographic question (years of ED experience),

Clinical practice outcomes. Fluid metrics in the ED are trended monthly for the average time to fluid administration. Fluid metrics were aggregated for the prior quarter (February 2017 to April 2017) and the following (June 2017 – August 2017) the educational intervention.

Program Satisfaction. The nurse participants were asked to complete an online evaluation of the educational program.

Analysis

Pre- and post-test results from the knowledge survey were scored as an overall percentage correct and incorrect. A Chi-square analysis was used to examine the difference between the percentages correct and incorrect on the RN participants' knowledge level related to sepsis before and after the educational intervention. Fluid metrics for the quarter prior to and following the intervention were analyzed for patients identified with severe sepsis/septic shock in the ED. Fluid administration was defined as minutes between severe sepsis/septic shock identification and start of fluids with the expectation to occur within 30 minutes.

Over 50% of patients received fluids prior to the identification of severe sepsis/septic shock resulting in the average fluid administration time being an average of -23.2 minutes. To avoid biasing results, all patients that received fluids prior to severe sepsis/septic shock identification were converted to 0 minutes. Because of the six sessions spread out during the month of May 2017, this month was excluded from the data collection period.

Human Subjects and Project Approvals

Permission for conducting this project was obtained by the Nurse Manager of the ED, Sepsis Coordinator, and the Directors of Nursing Education and Quality Management Departments. An attendance form for ED RNs was retained by nursing administration, and only the total numbers of participants were provided to the project directors. The survey did not contain any personal identifiers. An IRB waiver was obtained from the hospital review board and the City University New York (CUNY) – Hunter Human Research Protection Program determined this project as exempt for a full review.

Results

Nearly all (94%) ED RNs (n=61) attended the educational sessions over four weeks during May 2017. Among the 61 RNs that participated in the sepsis education program, 35 completed the pre-survey while 33 completed the post-survey (57.3% and 54.1% response rate, respectively). More than a third of respondents had less than 1 year RN experience (13 or 37.1%) while 6 (17.1%) had between 1 to 3 years, 4 (11.4%) between 3 and 5 years, 2 (5.7%) between 5 years and 10 years and10 (28.6%) had more than 10 years of RN experience.

Table 1 provides the results of the individual (8) knowledge questions and the total score for the RNs participants completing the pre- and post-tests. For the 35 RNs that completed the pre-survey and 33 that completed the post-survey, the percentage answering correctly was consistent between the pre (X=83.2, SD=16.9) and post (X=86.4, SD=11.4) intervention administrations of the survey. There was an increase in scores for three items: the anticipation to prevent major complications, the correct amount of fluids to administer and expectations for the next order from the prescriber. There was a non- statistically significant improvement in selecting the correct amount of fluids to administer to the patient (χ= 0.44, p=0.51), and expectations for the next prescribers order (χ= 1.59, p=0.21), and a significant improvement for RNs anticipating interventions to prevent major complications (χ= 4.01, p<0.05). There was an overall, non-significant decrease in responses to what the nurse should do next (χ= 0.23, p=0.63), and what choice describes the symptoms (χ= 0.48, p=0.49).

Table 1: Pre-Test and Post-Test Scenarios and Results

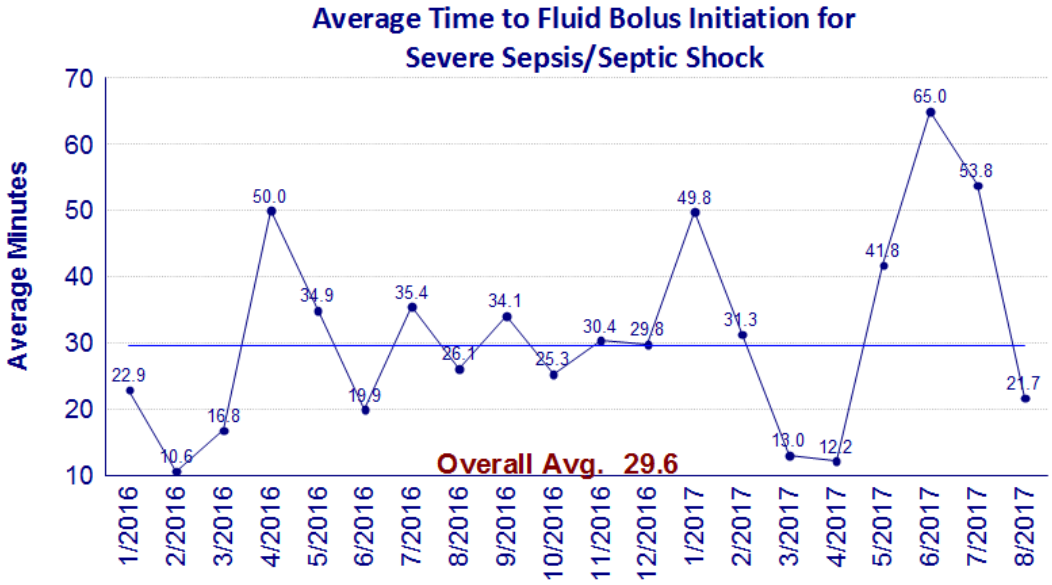
	Pre-Test		Post-Test	
Scenarios	n	%	n	%
A. Mr. Smith is a 59-year-old male and has had SOB and cough for one week. He was admitted today with general malaise, fever and increased SOB. Upon admission, his vitals were HR>100, temp=101.3 orally, RR=22 and BP 120/80. At present, he is alert and orientated, Identify the symptoms				
a. Elevated Temp	2	5.7	1	3.0
b. Heart Rate	0	0.0	0	0.0
c. Increased Respirations	0	0.0	0	0.0
d. All of above	33	94.3	32	97.0
If these lab tests were ordered, which one would you consider a priority for this patient?				

a. CBC, CMP and Lactate	2	5.7	2	6.1
b. Blood cultures, CBC, and Lactate	33	94.3	31	93.9
c. Echocardiogram and Chest X-ray	0	0.0	0	0.0
d. EKG, echocardiogram and blood cultures	0	0.0	0	0.0
Which interventions would be considered a priority?				
a. Initiation of antibiotic therapy and fluid resuscitation	34	97.1	33	100.0
b. Fluid resuscitation then insert a Foley	0	0.0	0	0.0
c. Echocardiogram and chest x-ray	0	0.0	0	0.0
d. EKG, echocardiogram and blood cultures	1	2.9	0	0.0
Which interventions would you anticipate to prevent the major complications of this condition?				
a. Strict I and O's	2	5.7	0	0.0
b. Frequent turning & positioning	2	5.7	0	0.0
c. Vital signs every 15 minutes	0	0.0	0	0.0
d. A and C	31	88.6	33	100.0
What is the correct amount of NS or LR bolus to administer to this patient?				
a. 10ml/kg	1	2.9	0	0.0
b. 20ml/kg	9	25.7	7	21.2
c. 30ml/kg	24	68.6	25	75.8
d. 50ml/kg	1	2.9	1	3.0
B. Mrs. Jones is a 42-year-old female who has been admitted to the hospital for diverticulitis. Upon arrival to the ED her vitals are BP=130/72, HR=72, RR=16, and Temp=98.6. Six hours later she becomes lethargic, her vitals are BP=100/50, HR=120, RR=20 and Temp=102. What should the nurse do?				
a. Call patient’s primary physician	0	0.0	1	3.0
b. Initiate fluid bolus	3	8.6	3	9.1
c. Call code sepsis	32	91.4	29	87.9
d. Go on break	0	0.0	0	0.0
After a fluid bolus, Mrs. Jones vitals are Temp=102 orally, HR=110, BP=90/40, RR=26, what would you expect the next order from the doctor will be?				
a. Give Tylenol for her fever	10	28.6	6	18.2
b. Give another bolus of .9 NS over 15-30 minutes	24	68.6	27	81.8
c. Send the patient for a CT of the head	0	0.0	0	0.0
d. Draw a SMA 7	1	2.9	0	0.0

Your patient is going to the ICU. Her oral temperature is 102, pulse 110, respirations 38 and her systolic BP is 80 after two liters of normal saline. Here lactate level is 8. What is the best choice below to describe her symptoms?				
a. Complicated sepsis	3	8.6	4	12.1
b. Septic shock	22	62.9	18	54.5
c. Severe sepsis	10	28.6	11	33.3
d. Uncomplicated sepsis	0	0.0	0	0.0

The run chart (Figure 1) for fluid administration within 30 minutes shows monthly variability in average minutes during the year prior to the intervention. During the pre-intervention quarter (February 2017 – April 2017), there were a total of 120 patients where 61 (50.8%) patients received fluids prior to the identification of severe sepsis/septic shock. This resulted in an average time to fluid administration of -23.2 (SD = 101.25) minutes. There were 34 patients identified during the post-intervention quarter (June 2017 – August 2017) 10 patients (29.4%) received fluids prior to the identification of severe sepsis/septic shock. This resulted in an average time to fluid administration of 35.8 (SD = 89.63) minutes. When converting all negative time values to 0 the average time to fluid administration prior to the intervention was 17.0 (SD = 46.3) minutes and after was 46.1 (SD = 81.0) minutes. The average time to fluid administration after the intervention was significantly higher than prior to the intervention (χ^2= 4.9, $p<0.05$).

Figure 1: Average Time to Fluid Administration



At the conclusion of the education session, of the 33 RNs that completed the post-test, 17 (51.5%) rated the quality of the educational program as helpful, and 16 (48.5%) rated the quality of the educational program as very helpful. Another result of the education program was that RNs provided feedback to the presenter of their views regarding sepsis processes in their ED. RNs voiced concern for more physician participation in the Sepsis Task Force, the need for a process to address IV access for patients with difficult venous access, the lack of pressure bags needed for rapid IV fluid administration, the lack of communication tools for all RNs (Vocera), the delay of lab reporting lactate results to nurses/physicians, and a need for regular sepsis process updates. After all educational session were completed, these concerns were communicated with Hospital leadership that resulted in several new processes.

Discussion

The main focus of the past two years for this participating hospital's ED was to improve compliance with the CMS SEP-1 and New York State Department of Health mandates for treatment of severe sepsis/septic shock patients. Multiple plan-do-study- act (PDSA) cycles were conducted that resulted in improved practice except the timely administration of fluids. The variability for the average fluid administration (figure 1) from January 2016 to April 2017 demonstrates inconsistency in the fluid administration process. This was likely due to changes in staff, turnover among sepsis champions, and construction in the ED. Of those that completed the survey, 13 or 37.1% ED RNs' reporting having less than one year of experience, which may have contributed to the variability of the results. The sepsis champion program has been found effective for RNs except new hires that lack knowledge and experience. The ED has been under construction for the last year, with only phase one of three completed. The ED improvements when completed will increase the space to accommodate 10,000 more visits per year, however the construction process changed the location of supplies. Such disruptions likely influenced practice, including fluid administration.

The formalized educational initiative implemented in May 2017 reviewed current guidelines with a focus on the importance of timely fluid administration. There was significantly higher time to fluid administration after the intervention, which may be partly due to the short post-intervention data collection period. Given the variability in the fluid metrics in the previous year, it would seem reasonable that additional monthly data should be used for a more

comprehensive and accurate examination of change over time. Others[10] have compared 1 year of data prior to and following a sepsis education program.

The knowledge survey findings were fairly consistent for both the pre- and post-tests, with only slight improvements on individual questions. This indicates that RNs' were knowledgeable about treating sepsis, however, there was room for improvement. Given the high percentage of correct responses prior to the intervention, a more sensitive tool to measure knowledge is needed. The discussion during the educational session may indicate that the tool accurately assesses their knowledge but the below-standard fluid metrics reflected system issues that prevented optimal practice.

The sepsis intervention inadvertently led to changes in care processes since the post education discussion prompted the participating RNs to express their opinions of what is needed to improve care. Nursing leadership responded to these concerns. For example, nurse leadership received information regarding lack of Voceras, which are portable devices that allow the health care team to communicate instantly by voice or secure text without having to know phone numbers or names). By October 2017 additional devices were purchased and implemented in the ED. The manager then communicated this at staff huddles. An additional ED physician joined the Sepsis Task Force as a co-leader in October 2017. It is expected that the ED physician will monitor with nursing leadership and report on real time feedback for deficiencies in fluid administration and other metrics. All of these immediate responses to concerned nurses'

improved morale since the staff felt heard. Nursing leadership is recommending that the Sepsis Task Force will provide solutions for IV access.

The sepsis educational sessions and the post group discussions seemed to reflect the participants' confidence level in critically evaluating their own practice and the overall practice environment. Education empowers RNs thus making them confident in their practice. However, for RNs to adequately impact patient outcomes, additional changes need to be implemented to the existing workflow. The education program supported reflection and brainstorming that facilitated the RNs to feel more empowered to voice barriers in their practice and assist in promoting effective changes in their work processes. Low confidence level among RNs in the delivery of emergency services to sepsis patients, affects their ability to provide and achieve quality patient outcome.[11] Educational interventions enhance understanding of the importance of complying with the current national guideline and thus encourages RNs to think of ways to improve the institution's processes that effect their practice.[13]

Limitations

Evaluation of the sepsis educational intervention to improve knowledge was limited by a low response rate (50%) among those that participated in the educational intervention. Participants were invited by email from nursing leadership to complete survey link without any positive or negative incentives, which may not have motivated RNs to complete. Another concern is that the validity and reliability of the survey tool was not evaluated. Since this was administered as an anonymous survey we were not able to assess paired,

individual changes in responses. This was a convenience sample and we were unable to randomly assign RNs to different educational initiatives. Although education was found to be helpful, there were many other initiatives (i.e., performance improvement work, sepsis task force, etc.) that could not be controlled and were likely also to influence the effectiveness of the educational intervention.

Implications for ED nurses

Educating RNs can facilitate improvements in patient outcomes and sepsis care. It can improve RNs' knowledge, promote behavior change, identify process deficits and enhance RNs level of confidence, thus impacting positively on sepsis care delivery. This educational intervention promoted RNs knowledge and allowed RNs to voice their perceptions of how to improve care processes to impact patient outcomes. For successful outcomes, it is important to combine nursing education with organizational interventions.[20]

Conclusion

Although the sepsis educational intervention did not result in significant improvement in nurse knowledge or fluid metrics, the voiced concerns of the participants described opportunities for improvement in care processes and resources to improve sepsis outcomes. Often education alone is not the solution to change but is the first step toward process change and workflow initiatives.

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