Objectives and instructions for completing the evaluation and statements of disclosure can be found on page 277.

Knowledge and Recognition of SIRS And Sepsis among Pediatric Nurses

Alvin D. Jeffery, Karen Steffen Mutsch, and Lisa Knapp

Background: A large amount of research demonstrates the importance of key interventions in reducing mortality rates of pediatric patients with sepsis (Dellinger et al., 2008). Assessment and recognition of declining status must occur for interventions to be initiated. Of health care practitioners, nurses typically spend the most time with patients, and they must be knowledgeable in recognizing the systemic inflammatory response syndrome and sepsis while also being aware of the importance of prompt intervention. The literature does not discuss pediatric nurses' knowledge of systemic inflammatory response syndrome (SIRS)/sepsis recognition.

Objectives: The purpose of this study was to assess the knowledge of acute and critical care pediatric nurses of SIRS diagnostic criteria, sepsis guidelines, and the importance of SIRS recognition.

Methods: This cross-sectional, quantitative, correlational descriptive study included 242 acute and critical care pediatric nurses at a 490-bed urban pediatric hospital. Participants completed an original questionnaire with face and content validity regarding SIRS criteria, sepsis guidelines, priority interventions, and attitude toward the importance of SIRS recognition.

Results: Findings demonstrated a significant knowledge deficit among participants in several key areas of SIRS/sepsis recognition. The mean score was 60.8% ± 7.4%. Item analyses demonstrated nurses easily recognize septic shock but have difficulty recognizing patients in earlier stages of the sepsis continuum. Significant confusion was evident regarding the role of blood pressure and serum lactic acid levels in diagnosing sepsis.

Conclusion: It is recommended that an educational intervention be created for acute and critical care pediatric nurses to aid them in recognizing sepsis in its earlier stages.

Although information regarding pathophysiology and management of sepsis in patients across the lifespan abounds in medical and nursing literature, the ability of clinicians to accurately and efficiently recognize sepsis, especially in its earlier stages, remains relatively undetermined (Fernandez et al., 2005; Nelson, LeMaster, Plost, & Zahner, 2009; Poeze, Ramsay, Gerlach, Rubulotta, & Levy, 2004; Robson, Beavis, & Spittle, 2007). Current research performed confirms that well-defined, timely interventions in the care of patients with sepsis have drastically decreased adult and pediatric patient mortality rates. The Surviving Sepsis Campaign has resulted in a marked decrease in mortality rates among adults with sepsis (Dellinger et al., 2008), and one study found a 49.4% decrease in patient mortality rates (Zubrow et al., 2008). With these findings and many others (Dellinger et al., 2008; de Oliveira, 2010; Goldstein, Giroir, & Randolph, 2005; Khilnani et al., 2010; Watson & Carcillo, 2005), the significance of prompt recognition and intervention in both pediatric and adult patients experiencing sepsis is undisputable. However, one must also acknowledge that management of sepsis can only begin *after* appropriate assessment and diagnosis have been made.

Alvin D. Jeffery, MSN, RN-BC, CCRN, FNP-BC, *is an Education Consultant, Cincinnati Children's Hospital Medical Center, Cincinnati, OH.*

Karen Steffen Mutsch, DNP, RN, CDE, *is an Associate Professor, Northern Kentucky University, Highland Heights, KY, and Case Manager, Saint Elizabeth Health Care, Edgewood, KY.*

Lisa Knapp, MSN, MEd, RN, CCRN, *is an Instructor, Northern Kentucky University, Highland Heights, KY, and a Registered Nurse, Pediatric ICU, Cincinnati Children's Hospital Medical Center, OH.*

Nurses who care for patients at the bedside spend the greatest amount of time assessing their patients. These nurses are in an advantageous position to recognize critical status changes, indicating a patient experiencing sepsis. Four key indicators occurring together early in sepsis are known as the systemic inflammatory response syndrome (SIRS). Criteria include a) temperature greater than 38.5 or less than 36 degrees Celsius, b) tachycardia, c) tachypnea or mechanical ventilation for an acute process, and d) elevated or depressed leukocyte count, or greater than 10% immature neutrophils (Goldstein et al., 2005). If a suspected or known infection of any origin is present with SIRS, this is defined as *sepsis*. As organ dysfunction becomes widespread, the patient is declared as having *severe sepsis*, and once cardiovascular dysfunction ensues, this is defined as *septic shock*, the final stage of the sepsis continuum (Goldstein et al., 2005).

Purpose and Questions

The purpose of this study was to indirectly measure acute and critical care pediatric nurses' knowledge of SIRS diagnostic criteria, sepsis guidelines, and the importance of SIRS recognition. An indirect measurement was used due to the complexity of measuring nursing knowledge expressed as practice and because practice strongly correlates with knowledge (see Conceptual/Theoretical Framework).

The following research questions were asked:

- Among acute and critical care pediatric nurses, what is the current

level of knowledge of SIRS diagnostic criteria, sepsis guidelines, and the importance of SIRS recognition?
- What are factors related to nurses' knowledge of SIRS/sepsis?

Review of Literature

The majority of sepsis research has focused on pathophysiology and management of the disorder. In the review of literature, three key articles addressed health care providers' knowledge in recognizing sepsis. Two of these studies surveyed physicians (Fernandez et al., 2005; Poeze et al., 2004), and one study surveyed nurses (Robson et al., 2007). In their study of 73 adult ward nurses, Robson and colleagues (2007) identified a knowledge deficit related to SIRS/sepsis, especially regarding the significance of hypothermia, neutropenia, and elevated lactate levels. Although serum lactic acid levels are not one of the SIRS criteria, this laboratory value is important in recognizing and managing sepsis because it is a key indicator of tissue perfusion and should be determined in the initial resuscitation phase of severe sepsis (Dellinger et al., 2008). Robson et al. (2007) added that many nurses also did not realize a normotensive patient could be experiencing severe sepsis. The studies surveying physicians noted similar findings. As a result of the small amount of literature available on the topic of nursing knowledge/recognition of SIRS/sepsis, this article sought to add new information to the corpus of knowledge.

Conceptual/Theoretical Framework

The Theory of Nursing Knowledge/Wisdom and Nursing Praxis by Van Sell and Kalofissudis (2010) was used as the organizing framework of this study because it demonstrates the correlation between practice and knowledge. This theory uses the mathematical equation (NKW) (IB) = NP, where NKW symbolizes nursing knowledge (composed of the areas of *Nursing Foundation*, *Methodology*, *Nursing Essence*, and *Disciplined Inquiry*), IB symbolizes an individual nurse's assimilation of NKW, and NP symbolizes the scope and intricacy of nursing praxis. Therefore, as NKW or IB increases or decreases, NP increases or decreases, respectively. In the case of SIRS/sepsis in this study, NKW is assessed by the instrument, and NP would be assessed by observing the care provided to actual patients with SIRS/sepsis. If a participant scores lower on the instrument as a result of missing questions related to early recognition of SIRS/sepsis, it is possible he or she is not recognizing these signs in actual patients.

The theory of Nursing Knowledge/Wisdom and Nursing Praxis (Van Sell & Kalofissudis, 2010) demonstrates a clear direct correlation between knowledge and practice, assuming an individual nurse's ability to assimilate this knowledge remains constant. Based on this theory, a low score on this study's questionnaire would correlate with poor practice. Although it would have been ideal, it is much more difficult to observe nurses using knowledge related to SIRS/sepsis identification because it would require many research hours waiting for a variety of patients to deteriorate. Therefore, this theoretical model provides for an indirect measure of practice.

Methods

Using a cross-sectional, quantitative, descriptive, correlational design, a survey was administered to acute and critical care pediatric nurses at a 490-bed urban pediatric hospital in a Midwestern state. All inpatient (including intensive, progressive, and general care units), emergency department, and transport team nurses whose primary work was currently being done at the bedside were eligible to participate. Nurses who did not primarily work at the bedside, such as those nurses in the operating room, outpatient clinics, home health, and hospice, along with nurse managers who had not been in practice at the bedside in the last year, were excluded.

Three critical care nurses and three physicians developed a tool to measure nurses' knowledge of SIRS/sepsis in pediatric patients. The clinicians included physicians performing research in pediatric sepsis, nurses functioning as unit-based educators, a nurse involved in quality improvement work, and nurses certified in pediatric critical care nursing. This provided content and face validity.

Demographic information in the instrument included gender, age, years of experience as a nurse and as a pediatric nurse, highest educational degree, number and type of certifications, professional organizations with which they were affiliated, and the types of patients for whom they cared (see Table 1). These demographic data were used to analyze if the aforementioned factors resulted in differences in the participants' knowledge. The questionnaire contained a variety of questions regarding SIRS recognition and sepsis guidelines, as well as case studies presenting priority intervention questions. The format was similar to the tool developed by Robson et al. (2007). The final portion of the questionnaire attempted to determine nurses' attitudes towards the importance of SIRS recognition by using 5-item Likert scales (Strongly Agree, Somewhat Agree, Neutral, Somewhat Disagree, and Strongly Disagree).

A pilot test of a heterogeneous group of 10 nurses from critical care, emergency department, and medical-surgical units in the institution was collected. Their years of experience as a pediatric nurse spanned less than one year to greater than 20 years. Results were submitted to a statistical consultation service at a local university for analysis of internal consistency reliability. A Cronbach's alpha score was calculated and found to be very low (0.248). Because the score was low, an item analysis was performed, and alpha increased when removing items the researchers hypothesized would be more frequently missed. This low score could be due to

Table 1.
Significant Demographic Data

Demographic	*n* (%)
Female gender	230 (95)
BSN as highest degree	138 (57)
Possessed a nursing certification	89 (36.8)
Belonged to a nursing organization	123 (51)
Worked in pediatric non-cardiac critical care unit	56 (23)
Worked in general medical-surgical unit	51 (21)

Table 2.
List of First Set of Scenarios Asking Respondents to Indicate Whether or Not the Child Was Experiencing Sepsis

	Scenario	Correct Answer	Responses (%)
1	Seven-year-old admitted to the floor for pneumonia. Temp – 38.7 degrees Celsius. HR – 160. RR – 35. BP – 112/68. O2 sat – 96% on room air. Productive cough. No retractions. Cap refill 2-3 seconds. White blood cell (WBC) count – 10.8. Playful. ***Rationale:*** *Hyperthermia, tachycardia, and tachypnea present (3 of 4 SIRS criteria) with known infection (pneumonia).*	Yes	Yes = 18.6 No = 75.2 Unknown = 6.2
2	Nine-month-old who presents to the emergency department with altered mental status. Temp – 36.2. HR – 150. RR – 38. BP – 80/40. O_2 sat – 96% on room air. Cap refill 3 seconds. WBC – 6.1. Playful. ***Rationale:*** *Temperature and WBC are within normal limits – SIRS not present.*	No	Yes = 30.2 No = 56.2 Unknown = 13.6
3	Two-year-old who is being transferred outside emergency department to rule out appendicitis. Temp – 39. HR – 185. RR – 42. BP – 72/35. O_2 sat – 90% on non-rebreather. Cap refill 5 seconds. Lethargic. ***Rationale:*** *Hyperthermia, tachycardia, and tachypnea present (3 of 4 SIRS criteria) with suspected infection (rule-out appendicitis).*	Yes	Yes = 96.7 No = 0.4 Unknown = 2.9
4	Twelve-year-old who has been on the general care ward overnight for altered mental status and suddenly has a seizure. After lorazepam (Ativan®) administration and awaiting transfer to the ICU, you check vital signs. Temp – 35.7. HR – 92. RR – 10. BP – 108/70. O_2 sat – 93% on 100% FiO_2 per non-rebreather. Cap refill 3 seconds. ***Rationale:*** *Temperature is the only altered vital sign (only 1 of 4 SIRS criteria). There is no indicator of suspected/known infection.*	No	Yes = 25.6 No = 58.3 Unknown = 16.1
5	Two-week-old infant being transported from outside hospital for increased work-of-breathing. Temp – 37.2. HR – 170. RR – 65. BP – 78/40. O_2 sat – 87% on 100% FiO2 per blow-by. Cap refill 2 seconds. WBC – 5.1. Lethargic. ***Rationale:*** *Temperature and WBC are within normal limits; therefore, SIRS cannot be present.*	No	Yes = 42.6 No = 42.1 Unknown = 15.3
6	15-year-old in the Intensive Care Unit (ICU) following a craniotomy. Temp – 37.5. HR – 110. RR – 34. BP – 115/82. O_2 sat – 96% on room air. Cap refill 2 seconds. WBC – 16.8. Complains of headache. ***Rationale:*** *Tachycardia, tachypnea, and elevated WBC are present (3 of 4 SIRS criteria) along with suspected infection (post-operative patient).*	Yes	Yes = 21.5 No = 71.5 Unknown = 7

a wide variety of topics included in the instrument, as well as significant confusion regarding content areas among participants. It was determined that inferential analyses would not be reported at this time due to the descriptive nature of the study, as well as the low reliability of the instrument. No revisions were made to the instrument.

After obtaining Institutional Review Board approval, the survey was administered via a web-based survey administration site over a four-week period.

Analyses and Interpretations of Data

Demographic

Among the 1,500 nurses in the organization who were eligible to participate, 242 participants completed the survey, resulting in a 16% response rate. Females comprised 95% of the total participants, and the ages of participants ranged from 20 to 69 years. The majority (57%) listed Bachelor of Science in Nursing as their highest degree. Eighty-nine participants (36.8%) held a nursing certification, the most frequent being the Certified Pediatric Nurse. Fifty-one percent of the participants belonged to at least one professional nursing organization, the most frequently being Sigma Theta Tau and American Association of Critical Care Nurses. The highest-ranking type/population of pediatric patient with whom the nurse worked were for pediatric non-cardiac critical care (n = 56) and general medical-surgical (n = 51). Table 1 displays this significant demographic data.

Analysis

The non-Likert questions comprised a total of 50 items. The mean number of correct responses was 30.4 ± 3.7 (60.8% ± 7.4%) with a range of 18-39 (36% to 78%).

The first set of scenarios asked participants to report whether or not the child was experiencing sepsis (see Table 2). These scenarios demonstrated participants were able to recognize septic shock but were unable to identify the earlier stages of the sepsis continuum. The questions that followed asked participants to select all of the signs/symptoms that indicate a child is experiencing SIRS or sepsis (see Table 3).

Next, participants were asked to select the diagnostic tests that should be ordered in the initial management (within one hour) of a patient experiencing SIRS/sepsis. The majority of participants correctly identified CBC with differential, oxygen saturation, blood gas, and serum glucose level. However, only 43% of the participants chose to order a serum lactate level.

Participants were then asked to select the objective data used in determining whether or not a patient is experiencing SIRS. Heart rate, temperature, and WBC count (chosen by 97%, 96%, and 91% of participants, respectively) were correctly identified and chosen by most participants. However, respiratory rate was only chosen by 77% of participants, and the need for mechanical ventilation was only chosen by 45% of participants. Table 4 displays responses assessing application of knowledge using case studies developed by the researchers and validated by the aforementioned experts.

Finally, participants were asked to use a Likert scale to rate several statements regarding recognition and nursing management of the patient with SIRS/sepsis. The statement that resulted in the greatest number of disagreements regarded the comfort level of recognizing SIRS, with only 57.9% of participants stating they agreed to feeling comfortable recognizing SIRS (see Table 5).

In summary, the mean test scores of the population indicated relatively poor knowledge with only 60% of questions answered correctly. The most commonly unrecognized objective assessment was serum lactate level, followed closely by low WBC count, hypothermia, and respiratory rate. Although fewer respondents indicated they feel comfortable recognizing SIRS, sepsis, and septic shock, greater than 90% of respondents agreed that patients experiencing SIRS, sepsis, or septic shock were high-priority patients and felt comfortable initiating the chain-of-command.

The patient populations with whom the participants primarily worked were grouped into larger categories in various ways according to similarities in units/departments to allow for comparison. The only grouping that yielded a mean score difference of greater than 1 was when those who worked with critically ill and injured patients (which included those who worked in all critical care areas, the emergency department, and in transport, n = 94) were compared to those who worked in all of the other areas combined (n = 104). The critical care group had a slightly higher overall mean score than those in the non-critical care group (30.9 ± 4.2 vs. 29.6 ± 3.5).

Responses from Likert scales demonstrated that increases in the number of years of experience as a nurse or as a pediatric nurse increased the likelihood of choosing an Agree or Strongly Agree statement. Most significantly, those participants with less than one year of experience were far less likely to select a Strongly Agree or Somewhat Agree response to the statements regarding their comfort level of SIRS/sepsis recognition (see Figure 1).

Table 3.
List of indicators to which respondents were to select all that indicate SIRS or sepsis. Sorted by correctly identified indicators.

	Indicator	Correct Answer	Percentage Answering Correctly
1	Temperature great than 38.5 degrees Celsius	Yes	95.0
2	Suspected/Known Infection	Yes	90.1
3	Heart rate greater than 140 BPM in a child	Yes	88.4
4	White blood cell count greater than 12 X $10^3/mm^3$	Yes	87.5
5	Heart rate greater than180 BPM in an infant	Yes	81.4
6	Respiratory rate greater than 30 in a child	Yes	69.8
7	Respiratory rate greater than 50 in an infant	Yes	68.6
8	Immature neutrophils (“bands”) greater than 10%	Yes	66.1
9	Temperature less than 36 degrees Celsius	Yes	64.9
10	Heart rate less than 60 BPM in an infant	Yes	62.8
11	Mechanical ventilation for an acute process	Yes	55.4
12	White blood cell count less than 4 X $10^3/mm^3$	Yes	50.8
13	Heart rate less than 60 BPM in a child	No	47.9
14	Respiratory rate less than 20 in an infant	No	45.5
15	Respiratory rate less than 10 in a child	No	44.5

Notes: BPM = beats per minute; mm = millimeter.
Source: Goldstein et al., 2005.

Implications and Discussion

Implications

In regard to research, the survey should be conducted at additional pediatric facilities to ensure the results can be generalized. It would also be beneficial to include a psychometrician to review and possibly revise the tool to ensure psychometric reliability. Preparing the tool for improved reliability analysis will ensure that future research designs of pretest-intervention-posttest construction will provide a reliable indicator of intervention effectiveness.

Based on the research performed by Hynes-Gay et al. (2002) and Nelson et al. (2009), the most important factor in decreasing mortality is recognizing SIRS and sepsis before they develop into severe sepsis and septic shock. Hynes-Gay et al. (2002) found the highest incidence of mortality was present in those patients who have moved farther along the path from SIRS to septic shock. Nelson et al. (2009) mentioned a minimal chance of survival among patients who have progressed to septic shock and are not already in an intensive care unit. Therefore, additional research should be geared toward developing and assessing an effective educational intervention.

In regard to practice, the most noteworthy recommendation is the development of an education program that will assist pediatric acute care nurses in recognizing SIRS/sepsis and understanding immediate management. The methodology and details of implementation is beyond the scope of this paper, but it is highly recommended that education be

continued on page 276

Table 4.
Case Studies

Case Study 1: B.R., a two-year-old female, has just been admitted to the floor after a 1 week history of upper respiratory tract infection symptoms (rhinorrhea and cough with intermittent nasal flaring). She has had cultures drawn and is on broad-spectrum intravenous (IV) antibiotics as well as maintenance IV fluids. The mother says, "She just isn't acting right." Temp – 38.6 degrees Celsius. HR – 182. RR – 31. BP – 78/50. O_2 sat – 98% on room air. Cap refill 4 seconds. Of the following options, what would your priority intervention be?

Options		Correct Answer	Percentage who Selected Option
A	Give the available PRN Tylenol and monitor temperature.	No	13.6
B	Notify MD/NP and anticipate an order for normal saline (NS) fluid bolus.	Yes	83.9
C	Apply bi-nasal cannula (BNC) at 1 to 2 L/minute.	No	1.7
D	No intervention required. Reassure mother the patient is fine.	No	0.4

Case Study 1 Rationale: Due to the patient's hyperthermia and tachycardia (two of four SIRS criteria) along with known infection, she is experiencing sepsis. The delayed capillary refill time and altered mental status indicate she is moving into severe sepsis, and more aggressive treatment is needed. A fluid bolus would be indicated to ensure adequate hydration and can be given before the patient becomes hypotensive. Although administering acetaminophen (Tylenol®) could be appropriate, the current degree of hyperthermia would not be harmful to the patient and is therefore not a priority. Oxygen administration could also be appropriate, but because the patient's oxygen saturation is normal on room air, this also would not be a priority at this time.

Case Study 2: J, a 16-year-old male, is on your floor following an open fracture of his right radius during a football game. On your final assessment of the day, you notice the arm looks a little more reddened than previously. Temp – 37.6 degrees Celsius. HR – 98. RR – 30. BP – 110/75. O_2 sat – 99% on room air. Alert and oriented X 3. Cap refill 3 seconds. His most recent labs are as follows: Sodium – 140, Potassium – 4.2, Glucose – 92, BUN – 12, Creatinine – 0.5, WBC – 18.5, Hematocrit – 49%, Platelets – 225

Case Study 2, Question 1. You have a "gut feeling" that he's not doing well. You tell the physician your concerns, and she doesn't feel anything appears important enough to require an intervention. Which of the following responses would be the most important findings in justifying the need for an intervention (or at least a much higher degree of assessment)?

Options		Correct Answer	Percentage who Selected Option
A	Capillary refill and platelet count.	No	9.9
B	Glucose level, temperature, and respiratory rate.	No	4.1
C	Sodium level, potassium level, and white blood cell count.	No	6.2
D	White blood cell count and respiratory rate.	Yes	79.3

Case Study 2, Question 1 Rationale: WBC and respiratory rate are the only listed options that are abnormal findings, and their presence indicates SIRS. All other values are within normal limits.

Case Study 2, Question 2. After describing the patient situation, background, and assessment to the physician, what would you recommend she order to further investigate the problem or treat it? (Select all that apply.)

Options		Correct Answer	Percentage who Selected Option
A	Draw blood cultures.	Yes	87.2
B	Apply oxygen.	No	14.5
C	Administer 20 mL/kg of NS intravenously.	No	39.7
D	Draw a lactate level.	Yes	34.7
A/D	Selected BOTH of the correct options		12.0

continued on next page

Table 4. (continued)
Case Studies

Case Study 2, Question 2 Rationale: Because the patient has two of four SIRS criteria along with a suspected infection (open fracture with increasing redness), sepsis is present. No other abnormalities exist that indicate the patient is progressing to severe sepsis or septic shock. Therefore, aggressive treatment is not needed at this time. Drawing blood cultures and a lactate level will allow the clinicians to prescribe appropriate antibiotics and determine if the tissues are being adequately perfused, respectively. Oxygen and intravenous fluids are not needed at this time because heart rate, blood pressure, and oxygen saturation are within normal limits.

Prioritization Scenario. Which of the following patients would you be most likely to notify the physician of ***first*** because the patient may be ***septic***?

Options		Correct Answer	Percentage who Selected Option
A	Four-year-old rule out meningitis. Temp – 37.4. HR – 165. RR – 22. BP – 90/55. O_2 sat – 99% on room air. WBC – 10.0. WBC Bands – 7.	No	15.3
B	Two-month-old with pneumonia. Temp – 36.2. HR – 158. RR – 32. BP – 78/50. O_2 sat – 97% on bi-nasal cannula (BNC) at 1 L/min. WBC – 14.5. WBC Bands – 18.	No	35.5
C	Eight-year-old post-op appendectomy. Temp – 35.8. HR – 130. RR – 24. BP – 86/45. O_2 sat – 97% on room air. WBC – 3.2. WBC Bands – 11.	Yes	48.8

Prioritization Scenario Rationale: Patient C is the highest priority patient because the WBC is depressed indicating potential bone marrow failure, a later sign of a severely decompensating patient. This is in addition to the hypothermia and tachycardia (totaling 3 of 4 SIRS criteria) with suspected infection (post-operative patient). Patients A and B are not experiencing SIRS (only have 1 of 4 SIRS criteria).

Table 5
List of Likert Statements and the Percentage of Respondents Who Selected Various Responses to the Statements

	Statement	Strongly/Somewhat Agree (%)	Neutral (%)	Strongly/Somewhat Disagree (%)
1	I feel comfortable recognizing when a patient is experiencing SIRS.	57.9	22.3	19.4
2	I feel comfortable recognizing when a patient is experiencing sepsis.	73.2	14.0	12.0
3	I feel comfortable recognizing when a patient is experiencing septic shock.	77.7	10.7	9.9
4	I feel comfortable notifying a physician/nurse practitioner that one of my patients is experiencing SIRS/sepsis based solely on my assessment of the patient.	74.4	13.6	10.3
5	If I have a patient who I feel is experiencing SIRS/sepsis (or even septic shock), I feel this is a high-priority patient necessitating immediate action by a physician/nurse practitioner.	94.6	2.5	2.0
6	If I have a patient who I feel is experiencing SIRS/sepsis or septic shock, I feel comfortable calling or initiating the chain-of-command if the patient's physician/nurse practitioner isn't ordering appropriate and safe interventions (including additional labs/tests, fluid boluses, medications, etc.).	90.5	5.4	3.3
7	I know what to do with a patient in septic shock until the additional support (MDs, RNs, RTs) arrives.	81.8	12.5	4.9

continued from page 274

more strongly emphasized among nurses. More focus also needs to be placed on educating nurses who do not routinely work with critically ill and injured patients as emphasized by Dodge (2010), who stated, "Placing greater emphasis upon skill acquisition by the medical-surgical nurse allows the patient who is at risk for acute deterioration in health status to receive safe, effective care in the medical-surgical setting" (p. 14).

Lack of knowledge, however, is not the only problem that surfaced in this study. The responses from the Likert statements demonstrated that the majority of nurses agree to statements that read "I feel comfortable recognizing when a patient is experiencing SIRS/sepsis/septic shock" (see Table 5). This presents a problem because nurses feel comfortable recognizing the

Figure 1.
Percentages of Various Responses to the Statement: "I Feel Comfortable Recognizing When a Patient Is Experiencing Sepsis" Based on Years of Experience as a Pediatric Nurse

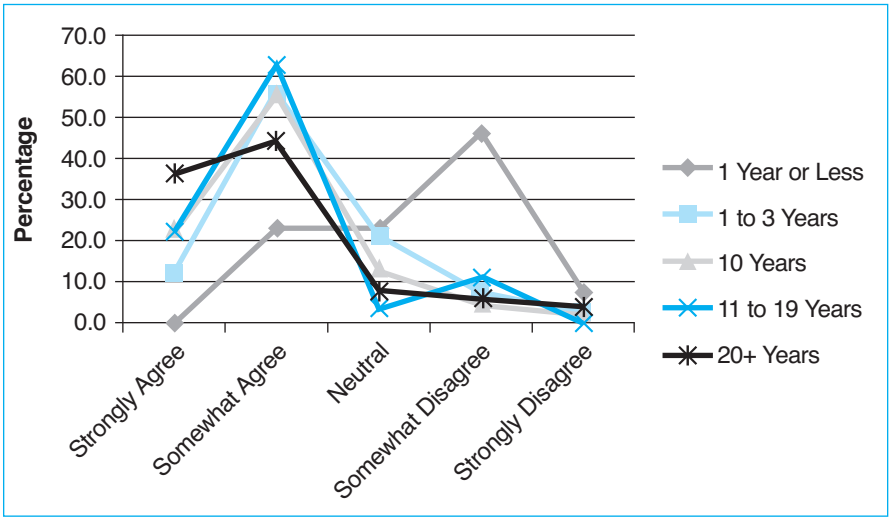

Table 6
Comparison of Practice Impact as It Relates to Confidence and Knowledge of Nurses

	High Confidence	Low Confidence
High knowledge	High-quality outcomes	May not practice at highest level
Low knowledge	Potential for low-quality outcomes	Potential for practicing at lower level

signs/symptoms of this disease state, yet they may not actually have the required knowledge to be correct in their assessment (see Table 6). This provides further support for the development of an educational program for pediatric nurses.

Limitations

With only 16% of the organization's nurses participating, there is the possibility that the results are not representative of the entire organization.

To assess internal consistency reliability, a Cronbach's (coefficient) alpha was calculated to be very low (0.373). This could be attributed to the multidimensionality of the study's design because not all items in this survey measured the same aspect of SIRS/sepsis. Topics included recognition/identification, management, anticipation of prescribed orders, and others.

Discussion

Sepsis among pediatric patients can yield high rates of mortality and morbidity. Many times, outcomes can be significantly improved with early treatment of sepsis in its earliest stage, SIRS. Although the participants appeared to easily recognize septic shock, results from this study demonstrated a significant knowledge deficit among participants in several key areas of SIRS/sepsis recognition, especially in recognizing patients in earlier stages of the sepsis continuum. Significant knowledge deficit was evident regarding the role of blood pressure and serum lactic acid levels in diagnosing sepsis. These findings are similar to studies of physicians and nurses managing adult patients (Fernandez et al., 2005; Poeze et al., 2004; Robson et al., 2007), but it is the first of its kind in exploring knowledge of nurses caring for pediatric patients.

Therefore, it is highly recommended that an educational intervention be implemented for acute and critical care pediatric nurses to aid them in recognizing sepsis in its earliest stages. If an effective educational interven-

continued on page 278

Instructions For Continuing Nursing Education Contact Hours

Knowledge and Recognition Of SIRS and Sepsis among Pediatric Nurses

Deadline for Submission:
December 31, 2016

PED 1308

To Obtain CNE Contact Hours

1. For those wishing to obtain CNE contact hours, you must read the article and complete the evaluation through ***Pediatric Nursing*'s Web site** at **www.pediatricnursing.net/ce**
2. Evaluations must be completed **online** by the above deadline. Upon completion of the evaluation, your CNE certificate for **1.3** contact hour(s) will be mailed to you.

Fees – *Subscriber:* Free *Regular:* $20

Goal

The purpose of this article is to provide an overview of systemic inflammatory response syndrome (SIRS) diagnostic criteria, sepsis guidelines, and the importance of SIRS recognition.

Objectives

1. Define systemic inflammatory response syndrome (SIRS).
2. Discuss findings from this review study that indicate there is a knowledge deficit in the recognition of SIRS by pediatric nurses.
3. Explain the importance of educational interventions for increasing awareness of SIRS recognition in the pediatric nursing community.

Statement of Disclosure: The author(s) reported no actual or potential conflict of interest in relation to this continuing nursing education activity.

The *Pediatric Nursing* Editorial Board members reported no actual or potential conflict of interest in relation to this continuing nursing education activity.

This independent study activity is provided by **Anthony J. Jannetti, Inc.** (AJJ).

Anthony J. Jannetti, Inc. is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

Anthony J. Jannetti, Inc. is a provider approved by the California Board of Registered Nursing, Provider Number, CEP 5387.

Licenses in the state of California must retain this certificate for four years after the CNE activity is completed.

This article was reviewed and formatted for contact hour credit by Rosemarie Marmion, MSN, RN-BC, NE-BC, Anthony J. Jannetti, Inc., Education Director; and Judy A. Rollins, PhD, RN, *Pediatric Nursing* Editor.

tion can be implemented, there is a high potential for decreasing mortality and morbidity of pediatric patients. Further study of pediatric nurses' knowledge of sepsis should be performed.

References

Dellinger, R.P., Levy, M.M., Carlet, J.M., Bion, J., Parker, M.M., Jaeschke, R., & Vincent, J.L. (2008). Surviving sepsis campaign: International guidelines for management of severe sepsis and septic shock. *Critical Care Medicine, 36*(1), 296-327. doi:10.1007/s00134-007-0934-2

de Oliveira, C.F. (2010). Early goal-directed therapy in treatment of pediatric septic shock. *Shock, 34*(7), 44-47. doi:10.1097/SHK.0b013e3181e7e6d5

Dodge, M.R. (2010). SIRS: A systematic approach for medical-surgical nurses to stop the progression to sepsis. *MEDSURG Nursing, 19,* 11-15.

Fernandez, R., Boque, M., Galera, A., Rodriquez, W., Torres-Palacios, A., Rodriquez-Vega, G., & Rive-Mora, E. (2005). Sepsis: A study of physicians' knowledge about the surviving sepsis campaign. *Critical Care Medicine, 33*(12), A160. Retrieved from http://journals.lww.com/ccmjournal/pages/default.aspx

Goldstein, B., Giroir, B., & Randolph, A. (2005). International pediatric sepsis consensus conference: Definitions for sepsis and organ dysfunction in pediatrics. *Pediatric Critical Care Medicine, 6,* 1-8. doi:10.1097/01.PCC.0000149131.72248.E6

Hynes-Gay, P., Lalla, P., Leo, M., Merrill-Bell, A., Nicholson, M., & Villaruel, E. (2002). Understanding sepsis: From SIRS to septic shock. *Journal of the Canadian Association of Critical Care Nurses, 13*(1), 17-26. Retrieved from http://www.caccn.ca/en/publications/dynamics/index.html

Khilnani, P., Singhi, S., Lodha, R., Santhanam, I., Sachdev, A., Chugh, K., … Deopujari, S. (2010). Pediatric sepsis guidelines: Summary for resource-limited countries. *Indian Journal of Critical Care Medicine, 14*(1), 41-52. doi:10.4103/0972-5229.63029

Nelson, D.P., LeMaster, T.H., Plost, G.N., & Zahner, M.L. (2009). Recognizing sepsis in the adult patient. *American Journal of Nursing, 109*(3), 40-45. doi:10.1097/01.NAJ.0000346928.90369.10

Poeze, M., Ramsay, G., Gerlach, H., Rubulotta, F., & Levy, M. (2004). An international sepsis survey: A study of doctors' knowledge and perception about sepsis. *Critical Care, 8*(6), R409-R413. doi: 10.1186/cc2959

Robson, W., Beavis, S., & Spittle, N. (2007). An audit of ward nurses' knowledge of sepsis. *Nursing in Critical Care, 12*(2), 86-92. doi:10.1111/j.1478-5153.2007. 00210.x

Van Sell, S.L., & Kalofissudis, I.A. (2010). *The evolving essence of the science of nursing: A complexity nursing theory* (2nd ed.). Chania, Crete, Greece: The Authors.

Watson, R.S., & Carcillo, J.A. (2005). Scope and epidemiology of pediatric sepsis. *Pediatric Critical Care Medicine, 6*(3), S3-S5. doi:10.1097/01.PCC.0000161289.22464.C3

Zubrow, M.T., Sweeney, T.A., Fulda, G.J., Seckel, M.A., Ellicott, A.C., Mahoney, D.D., … Farraj, M.B. (2008). Improving care of the sepsis patient. *The Joint Commission Journal on Quality and Patient Safety, 4,* 187-191.