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Sepsis Knowledge in Undergraduate Nursing Students

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SEPSIS KNOWLEDGE IN UNDERGRADUATE NURSING STUDENTS

by

KELSEY E. TILTON

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Nursing
in the College of Nursing
and in The Burnett Honors College
at the University of Central Florida
Orlando, Florida

Summer Term, 2019

Thesis Chair: Dr. Francisco Guido-Sanz

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ABSTRACT

Background

Sepsis is the most common cause of death in critically ill patients in settings other than cardiovascular intensive care units (ICUs). Research shows that early detection is the best way to prevent sepsis progression and improve patient outcomes. Nurses can play a critical role in the treatment of sepsis using their knowledge and resources to detect the presence of sepsis at the earliest possible point in the progression of the syndrome. Baccalaureate nursing students were surveyed to assess students' comfort, beliefs, and knowledge of sepsis and to examine the gaps in students' abilities to identify sepsis.

Methodology

An instrument consisting of 46 items was developed and administered as a survey. The survey contained demographic questions, belief statements, knowledge questions on sepsis, and an unfolding case study designed to gauge students' understanding and recognition of sepsis. Data were analyzed for descriptive statistics. Participants were undergraduate nursing students recruited from baccalaureate programs across three campuses at the University of Central Florida.

Results

The sample consisted of 40 participants. Over 75% (n=31) of participants were females, 42.5% (n=17) were over 27 years old, and 45% (n=18) had five to six years of previous college experience. Only 22% (n=11) of participants selected the three best measures to screen for sepsis at the bedside, and 60% (n=24) identified the correct definition of sepsis. In the knowledge application section, 40% (n=16) of participants identified the correct patient in the

beginning of the case study (i.e., most likely for developing sepsis or showing signs and symptoms of sepsis).

Discussion

Most students reported that they felt relatively comfortable with their abilities to identify sepsis in the clinical setting. However, there were some clear gaps in students' understanding of sepsis, particularly related to general knowledge about sepsis and recommended bedside screening measures. Education on sepsis is key to provide timely care to septic patients and to provide them with the best care possible.

Conclusion

This study identified gaps in baccalaureate nursing students' understanding of sepsis. Addressing these knowledge deficits could provide students with the ability to identify sepsis earlier and improve patient outcomes in their future practice.

DEDICATIONS

This dissertation is dedicated to a friend who passed away from sepsis while I was working on this project. It was impossible to work on this project and not think of the countless people affected by this syndrome. I hope that awareness of sepsis continues to spread and that nurses everywhere can make a difference.

ACKNOWLEDGEMENTS

To my committee, who spent countless hours helping me shape and develop this final product and whom I cannot ever possibly thank enough for their individual contributions:

Dr. Frank, thank you for being my thesis chair. This experience has been one of the best and most formative educational experiences of my life, in no small part to you.

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Dr. Peach, your passion for sepsis and spreading knowledge about it is inspiring, and I cannot thank you enough for taking your time to help me understand the complexities and nuances of this topic.

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INTRODUCTION

Statement of the Problem

Sepsis has been researched for nearly half a century (Cohen et al., 2015), with greater emphasis of study over the last 30 years. Sepsis is an ever-evolving topic of discussion and understanding for researchers, bedside clinicians, and nurses alike (Singer et al., 2016). There are no specific targeted therapies or medications for sepsis, and a confluence of factors contribute greatly to its complexity (Cohen et al., 2015; Kleinpell, Schorr, & Balk, 2016). Sepsis contributed a burden of \$23 billion in healthcare costs in the United States in 2013 (Torio & Andrews, 2016), accounting for mortality rates of 20-30%, and of 40-50% in patients with septic shock (Vincent et al., 2014). Of the estimated 300 cases per 100,000 population, close to half of the cases occur in settings outside of intensive care units (Mayr, Yende, & Angus, 2014). Due to the complex nature and non-specific testing for sepsis, it is critical for healthcare to recognize and evaluate patients' condition and to monitor for the development or presence of sepsis in all types of clinical settings. Amid significant advances to better understand and define sepsis, research consistently shows that the best way to prevent and treat sepsis is early identification of the syndrome (Garg, Otter, & Healy, 2017; Schorr, 2018). Likewise, early detection by nurses is critical to provide prompt attention and treatment of sepsis and contributes greatly to patient outcomes (Schorr, 2018).

For much of its history, sepsis was strongly linked to bacterial infection in the blood. In 1989, sepsis was formally defined as a syndrome including hypothermia or hyperthermia (temperature less than 96 degrees Fahrenheit or greater than 101 degrees Fahrenheit), tachycardia (heart rate greater than 90 beats per minute), tachypnea (respiration rate greater than 20 breaths per minute), and clinical evidence of infection with end-organ dysfunction (Bone,

Fisher, Clemmer, Slotman, & Balk, 1989). However, this definition also applied to patients who did not have sepsis, such as those with acute pancreatitis or trauma (Riedemann, Guo, & Ward, 2003). In 1991 at a conference held in Chicago, Illinois, the American College of Chest Physicians and the Society of Critical Care Medicine introduced the terms SIRS (systemic inflammatory response syndrome), severe sepsis (sepsis with organ dysfunction), and septic shock (sepsis-induced hypotension) (Balk, 2014). At this time, sepsis was thought to be an inflammatory response manifested in response to an infection in a host. The outline of this definition was later called “Sepsis-1”.

In 2001, several organizations (i.e., the Society of Critical Care Medicine, European Society of Intensive Care Medicine, American College of Chest Physicians, American Thoracic Society, and the Surgical Infection Society) broadened the definition of sepsis. This definition included new diagnostic criteria and parameters related to inflammation, organ dysfunction, hemodynamic stability, and tissue perfusion (Mayr et al., 2014). This adoption was known as “Sepsis-2”.

In 2016, a task force was assembled to update the definition of sepsis based on improved understanding of the syndrome, giving consideration to each prior definition and new information gained about the nature of the syndrome and pathobiology (Singer et al., 2016). Based on the understanding that the SIRS criteria can be observed in patients with or without sepsis, or even a severe systemic infection (Churpek, Zdravetz, Winslow, Howell, & Edelson, 2015), SIRS is not included in the definition of sepsis presented by the task force and accepted by the Society of Critical Care medicine and the European Society of Intensive Care Medicine (Singer et al., 2016). Additionally, they deemed that the term “severe sepsis” was redundant and recommended that sepsis be classified either as “sepsis” or “septic shock” (Singer et al., 2016).

Sepsis is now defined as a “life-threatening organ dysfunction caused by a dysregulated host response to infection” (Singer et al., 2016, p. 804). Additionally, they included the use of SOFA (Sequential [Sepsis-related] Organ Failure Assessment) for operationalization of the new definition in the clinical setting. This assessment takes into account respirations, coagulopathy, liver and cardiovascular function tests, the Glasgow coma scale, and renal functioning (Singer et al., 2016). This definition, along with the SOFA screening measure, is called “Sepsis-3”.

Even with this new definition and screening tools in place, a SOFA score could be potentially difficult to obtain in certain settings. Another assessment tool, the qSOFA (quick SOFA), was recommended for use in non-ICU settings (Kleinpell, et al., 2016; Singer et al., 2016). The qSOFA screening considers: a respiratory rate of 22 breaths per minute or fewer, altered mental status, or systolic blood pressure of less than 100 mmHg indicators that further investigation is warranted for possible sepsis.

The desire to develop a reliable screening tool to detect the presence of sepsis in patients is understandable. According to an epidemiological survey of sepsis, it is among the leading causes of death around the world (Schorr, 2018) and the most common cause of death in patients who are critically ill in settings other than cardiovascular ICUs (Mayr et al., 2014). In 2018, an “hour-1 bundle” was published as an addition to previous Surviving Sepsis bundles (the action arm of the SCCM). It outlines appropriate actions to take within the first hour after the detection of sepsis. Implementation of this bundle has been associated with improved outcomes, including a reduction in mortality rates (Rivers et al., 2016). The hour-1 bundle highlights specific relevance to nursing practice, including the critical role nurses play in early detection of sepsis, to provide prompt treatment (Schorr, 2018). In fact, many studies have explicitly listed early detection as a critical component in promoting better outcomes to treat sepsis (Cohen et al.,

2015; Davis & Hayes, 2018; Garg et al, 2017; Schorr, 2018). Therefore, it is essential that nurses be well trained to recognize sepsis, its manifestations, and progression while they provide care at the bedside (Davis et al., 2018). This process begins with education of nursing staff in the clinical setting and especially in institutions of higher learning that prepare future nurses, including education about screening tools such as qSOFA (Peach, 2017).

Studies that have evaluated nurses' abilities to identify sepsis have found that nurses struggle to identify early signs of sepsis (Jeffery, Mutsch, & Knapp, 2014). Qualitative data from nurses in the emergency department showed that nurses desired evidence-based education in sepsis recognition to promote early detection and prompt treatment (Harley et al., 2019). To date, knowledge about sepsis indicators has not been examined in nursing students. Therefore, this study aimed to evaluate student nurses' recognition of sepsis signs and symptoms and to identify patients with sepsis and septic shock based on the Sepsis-3 definition. The purpose of this study was to explore baccalaureate undergraduate nursing students' knowledge on signs and symptoms of sepsis, beliefs about sepsis identification, comfort level recognizing sepsis, and practical recognition of sepsis in an example scenario.

PURPOSE OF STUDY

The purpose of this study was to explore baccalaureate nursing students' beliefs, knowledge, and comfort with identification of sepsis.

Research Aims:

1. Explore nursing students' knowledge about signs and symptoms of sepsis.
2. Explore nursing students' beliefs about sepsis identification.
3. Explore nursing students' comfort level recognizing sepsis.
4. Explore nursing students' ability to recognize sepsis.

METHODS AND PROCEDURES

Design

This study used a cross-sectional, descriptive, exploratory design. A questionnaire was developed by the investigators and published on Qualtrics®. The survey measured undergraduate nursing students' comfort with identification of sepsis, beliefs about sepsis, and assessed students' knowledge and application of knowledge related to sepsis. Research was conducted at the University of Central Florida College of Nursing on the Orlando, Cocoa, and Daytona campuses in the summer of 2019. This research was conducted through the Honors in the Major program under the supervision and guidance of the thesis' chair and thesis' committee members.

Inclusion and Exclusion Criteria

Inclusion criteria: Participants in this study were required to be at least 18 years of age, a student in a Bachelor of Science in Nursing program at the University of Central Florida, and enrolled in either Nursing Care of the Adult II or Critical Care Nursing courses.

Exclusion criteria: Graduate nursing students or students not enrolled in Nursing Care of the Adult II or Critical Care Nursing courses were excluded from this study.

Subjects

All students were in the last semester of their Bachelors of Science in Nursing programs and enrolled and recruited from Critical Care Nursing classes, which is a course offered after Nursing Care of the Adult II. The original intent of this study was to recruit participants from both Nursing Care of the Adult II and Critical Care Nursing classes; however, Nursing Care of the Adult II was not taught the semester this survey was distributed, so participants were recruited from Critical Care Nursing classes on the various campuses. This study was not part of the Critical Care Nursing course curricula; these courses only served as a recruitment pool for

participants. This convenience sampling method was selected because students, at the time of the survey, had been educated to some extent about sepsis. Additionally, students may have had the opportunity to see cases of sepsis in clinical practice or have completed a sepsis screening during their clinical rotations.

Procedures

This study was approved by the Institutional Review Board (IRB) at the University of Central Florida (Appendix A). Permission to present this project in class and recruit participants to take part in this study was obtained by the investigator from the instructors who taught the Critical Care Nursing courses.

The investigator presented the study to students enrolled in Critical Care Nursing before their live class on the three University of Central Florida campus locations to distribute an IRB-approved explanation of research (Appendix B), to explain the aims of this study, and how to participate. The investigator emphasized that participation in the study was voluntary, not a requirement of enrollment in the course, and that not participating in the study would have no impact on the students' course grade.

After the presentation, an IRB-approved announcement (Appendix C) was published on Webcourses by an instructor from each section of Critical Care Nursing. This announcement was available to all students enrolled in the aforementioned courses and provided a link to the survey (Appendix D) on Qualtrics[®]. The first part of the survey contained a consent/introduction section and was a verbatim copy of the explanation of research (Appendix B), outlining that participation in the survey was voluntary, that no identifiable information would be collected, a list of the inclusion criteria, estimated time obligation to complete the survey, and contact information for the investigator's thesis chair. After the explanation of research, there was

response section that asked participants to proceed with the survey by selecting “Yes,” signifying that the participants wished to proceed with the survey. The participants were not able to proceed to the survey without making a selection (“Yes” or “No”). Data were analyzed using IBM® SPSS® Statistics 24 and reported as aggregate to minimize potential identification of the participants. Participation was anonymous and the investigators were unable to associate participants with their answers at any time. Data were abstracted and analyzed by the investigator and shared only with the committee members at their request.

Instruments

This study used a 46-item survey developed by the investigator under the guidance of the thesis committee. Items contained questions about comfort and beliefs about sepsis, general knowledge about sepsis, and original unfolding case studies written for this study. Items were based on the Sepsis-3 definition (Singer et al., 2016). The survey was developed over several weeks by the investigator using a peer-reviewed journal article as a reference (Singer et al., 2016) and presented to committee members for revisions and feedback.

The survey (Appendix D) included five sections: demographics, comfort with identification of sepsis, beliefs about sepsis, general knowledge about sepsis and sepsis screening, and recognition of sepsis and its progression.

Using multiple choice questions, the demographic section collected data on gender, age, number of years of upper level education completed (including bachelors, masters, and doctorate education), number of semesters of nursing school completed, previous experience with sepsis during clinical rotations, and comfort with identification of sepsis.

The section that measured students’ comfort included questions related to comfort in four categories: identifying patients at risk for sepsis, identifying a patient who might be septic,

identifying signs and symptoms associated with sepsis, and caring for a patient with sepsis. Participants responded using a 5-point Likert scale from “Very comfortable” to “Very uncomfortable.”

The next section measured students’ beliefs regarding: the nurse’s role in identification of sepsis, the impact their actions can make, the impact of early identification of sepsis, and the students’ interest in learning more about sepsis. Participants responded using a 5-point Likert scale from “Strongly agree” to “Strongly disagree.”

The general knowledge and application portion of this study was based on the Sepsis-3 definition (Singer et al., 2016). In the general knowledge section, participants were presented with true or false and multiple-choice questions related to facts about sepsis and clinical decisions by the nurse. The knowledge application section utilized the unfolding case studies developed for this study and prompted students to identify which patient they believed to be septic or at risk for developing sepsis, as well as identify indicators of sepsis present in the patient they selected using multiple choice and select-all-that-apply questions.

The survey was available for two weeks at the beginning of the summer 2019 school semester. Participants were not forced to answer any of the questions and could exit the survey at any time. Data was downloaded from Qualtrics® and analyzed using IBM® SPSS® Statistics 24, encrypted, and kept on a password protected computer available only to the investigator and the committee members for abstraction and analysis of data.

Data Analysis

This study used descriptive statistics (frequencies) to analyze data using the SPSS® Statistics 24 software.

FINDINGS

The findings of this survey are presented in in Table 1 (Appendix E).

Sample Characteristics

Of the 53 total participants that responded to the survey, only 40 completed the survey in its entirety. Data from participants that did not complete the survey in its entirety were not included in data analysis (n=13). Of the 40 participants, 77.5% (n=31) were female, 42.5% were over 27 years of age (n=17), 45% had 5-6 years of prior college experience (n=18), and 75% completed three semesters (n=30) of nursing school before participating in the survey. All participants were recruited from their Critical Care Nursing course, and 24 participants reported that they participated in both Nursing Care of the Adult II and their Practicum clinicals by the time they completed the survey. When asked the highest acuity setting participants cared for patients during their clinicals, 55% (n=22) of the students reported intensive care units (ICU) followed by progressive care units (PCU) (n=15), and Medical/Surgical units (n=3). Two participants selected “Other” and used the free-text option to submit “NICU” and “Labor and delivery” as their responses. These responses fell into the categories provided and therefore were coded as “ICU” and “Medical/Surgical,” respectively. Forty-five percent (n=18) of the participants responded that they had never completed a sepsis screening while charting in the clinical setting, 62.5% (n=25) reported that they had not cared for a patient with a positive sepsis screening, and 55% (n=22) never cared for a patient with sepsis.

Comfort

Based on participants’ responses, students seemed relatively comfortable overall with identifying and providing care for a patient with sepsis. When asked, “How comfortable are you with identifying a patient at risk for developing sepsis?” 50% of respondents answered,

“Somewhat comfortable” (n=20). Results were more split when asked, “How comfortable are you identifying a patient who might be septic?” The majority of the participants (n=14) responded, “Somewhat comfortable,” followed by “Neither comfortable or uncomfortable” (n=13), and “Somewhat uncomfortable” (n=11). Only two participants responded that they were “Very comfortable.” Over 50% of participants (n=22) said that they were “Somewhat comfortable” identifying signs and symptoms associated with sepsis, while the rest said they were “Neither comfortable nor uncomfortable” (n=9), “Somewhat uncomfortable” (n=6), and, “Very comfortable” (n=3). Finally, when asked how comfortable participants were caring for a patient with sepsis, most said, “Neither comfortable nor uncomfortable” (n=14), followed by, “Somewhat comfortable” (n=13), “Somewhat uncomfortable” (n=8), then, “Very uncomfortable” (n=3). The fewest respondents responded, “Very comfortable” (n=2).

Beliefs

Participants responded similarly about their beliefs regarding their role in sepsis detection. The majority of the participants (87.5%; n=35) said they “Strongly agree” when asked if they believed that nurses play an integral role in detecting sepsis. The other 12.5% (n=5) said they “Agree.” Similarly, 95% of participants indicated they “Strongly agree” that their actions as a nurse can improve outcomes for patients. The rest of the participants (n=2) said they “Agree.” All of participants (100%) indicated that they “Strongly agree” that early identification of sepsis can improve patient outcomes. Lastly, 90% (n=36) of participants responded “Strongly agree” when asked if they would like to learn more about sepsis and identification of sepsis. The rest responded “Agree” (n=3) or “Neither agree nor disagree” (n=1).

Knowledge

Overall, none of the participants correctly answered every question in the knowledge assessment and applications sections. Regarding the knowledge assessment section, the majority of participants (60%; n=24) identified the correct definition of sepsis, “a systemic response defined by life-threatening organ dysfunction caused by a dysregulated host response to infection” (Singer et al., 2016). The other 40% (n=16) selected the SIRS definition of sepsis, “a host’s uncontrolled systemic inflammatory response to an infection” (Singer et al., 2016). Only 22% (n=11) of participants correctly identified the best bedside screening measures for sepsis, based on the qSOFA sepsis bedside screening tool (Singer et al., 2016).

Out of 20 general knowledge questions, the best score achieved was 19 out of 20 correct (n=2), the lowest score achieved was 11 out of 20 correct ($M = 15.6$). The most frequently missed question (n=29) regarded the best bedside screening measures for sepsis (Singer et al., 2016) based on the qSOFA criteria (respiration rate greater than 22, systolic blood pressure less than 100 mmHg, and altered mental status). The most commonly missed question of the true or false questions (65% incorrect, n=26) was “Inflammation is the hallmark of sepsis,” which is false, based on the new Sepsis-3 definition (Singer et al., 2016). The participants’ responses reflected thinking related to systemic inflammatory response syndrome (SIRS), which is no longer a part of the sepsis definition. The only question 100% of participants answered correctly regarded screening patients for sepsis if they presented with an infection and an altered mental status.

In the knowledge application section, only 40% (n=16) of participants indicated that they were concerned about sepsis in the correct patient at the beginning of the unfolding case study. By the end of the second part of the scenario in the knowledge application section, 80% of

participants realized that the patient in room 2 was exhibiting signs and symptoms of sepsis (organ dysfunction). Furthermore, students did not demonstrate an understanding that organ dysfunction is linked to the definition of sepsis or the best bedside screening measures for sepsis.

The results of this survey suggested that students were theoretically more comfortable identifying patients at risk for sepsis than they were practically. For example, half of the participants responded, “Somewhat comfortable” when asked, “How comfortable are you with identifying a patient at risk for developing sepsis?” however, 60% (n=24) of respondents did not correctly identify the patient with the greatest risk of developing sepsis in first section the unfolding case study. Half the participants (50%, n=20) selected the patient in room 3 (a patient with a known infection who was responding to antibiotics) as the patient they were most concerned about developing sepsis or showing signs and symptoms of sepsis after the first section of the knowledge assessment scenario.

The participants responses are reported in Table 1 (Appendix E).

DISCUSSION OF FINDINGS

The only study found during a literature review related to nursing students' knowledge of sepsis was not available in English (dos Santos, Pavinski Alves, & Stabile, 2012). Several studies have examined SIRS/sepsis knowledge in professional nurses, including a qualitative study among nurses in the emergency department (Harley et al., 2019), and several quantitative studies, including a study among nurses in the emergency department (van den Hengel, Visseren, Meima-Cramer, Rood, & Schuit, 2016), pediatric nurses (Jeffery, et al., 2014), nurses in an adult ward (Robson, Beavis, & Spittle, 2007), nurses in mother-infant and neonatal intensive care unit (NICU) settings (Boettiger, Viola, & Hagan, 2017), and "Phase 1" of a study among nurses in a medical/surgical unit (O'Shaughnessy, Grzelak, Dontsova, & Braun-Alfano, 2017).

Although it is difficult to make a one-to-one comparison to these studies because some the scales used are based on SIRS, the severe sepsis definition, and other clinical findings associated with sepsis (Boettiger, et al., 2017; Jeffery, et al., 2014; Robson, et al., 2007), these studies highlighted an important aspect of care of patients with sepsis, which is timely initiation of screening and treatment. In order to accomplish this end, nurses must recognize sepsis as early as possible, utilizing the recommended bedside screening tools (qSOFA). As mentioned at the beginning of this discussion, only 11 of the participants identified the best screening tool measures, leaving room to question whether or not timely identification and action would be provided to future patients in real-life scenarios. Additionally, a quantitative study among pediatric nurses found that participants were able to recognize septic shock, but were less to identify sepsis (SIRS) in earlier stages (Jeffrey et al., 2014).

Participants' responses in this study indicated the overwhelming majority believed that nurses play an integral role in detection of sepsis and that nurses' actions in early identification

can improve patient outcomes. The findings in this study were similar to a qualitative study among nurses in the emergency department (Harley et al., 2019). This qualitative study found that nurses frequently voiced their belief that nurses play a key role in timely sepsis identification and timely initiation of treatment. These nurses acknowledged their responsibility in not only recognition of sepsis, but also reporting findings expediently and escalating care to properly manage sepsis. The belief statements examined in this study are all consistent with recommendations made to reduce morbidity and mortality related to sepsis (Schorr, 2018). Strong belief in the importance of dutifully carrying out nursing responsibilities will hopefully lead to better patient outcomes as nurses take initiative, screen their patients for sepsis, and notify providers in a timely manner.

LIMITATIONS

This study was limited by the scope and generalizability of its findings. The participants were limited to students at the University of Central Florida enrolled in classes in the Summer 2019 semester. Perhaps a better understanding of student knowledge could be gained if participants from other schools over several semesters were included. As such, these results are not widely generalizable until further investigation has been completed to assess the ability of other nursing students to detect sepsis.

Results reflect responses from students enrolled in Critical Care Nursing classes. Originally, the intent of this project was to examine students' knowledge in students enrolled in Nursing Care of the Adult II and Critical Care Nursing; however, due to time constraints, data was collected during a semester in which Nursing Care of the Adult II was not taught, limiting the number of total available participants.

This study did not investigate clinical decisions in response to suspected sepsis or knowledge of recommended actions from a provider to be implemented by the nurse as outlined in a sepsis bundle (Schorr, 2018). This study also did not investigate students' knowledge of laboratory findings, such as serum lactate, because this study was focused on assessing student knowledge about initial identification of sepsis.

The tool used in the survey was not statistically validated, rather one developed by the investigator and content experts. Because the scale has not been tested, it is unclear if the questions asked were statistically reliable and if improvements to the scale would provide responses that more accurately represent participants' level of comfort with knowledge of sepsis, and beliefs and knowledge regarding sepsis.

Another limitation was the number of participants in the survey. While 40 participants out of 150 students invited to take the survey reflects good attrition (26.7%), this is still a relatively small sample size to fully assess students' understanding of sepsis and their ability to identify it in a clinical setting. Furthermore, there were 13 students who did not complete the survey in its entirety and whose responses were not included in the data analysis.

NURSING IMPLICATIONS

This study revealed some important gaps in students' understanding about sepsis. Students who participated will presumably graduate and peruse diverse paths in the nursing field where they might encounter undiagnosed sepsis in their patients. Despite sepsis being a frequent topic of discussion in critical care circles, the syndrome can present in a broad range of patients in a wide-range of clinical settings and is not specific to intensive care units. As such, more education is needed so that 100% of participants answer affirmatively to statements such as, "I would screen my patient for sepsis if they were experiencing mild organ dysfunction (e.g., elevated liver enzymes)." This question should have garnered a higher affirmative response rate to indicate that participants truly understand the definition of sepsis since organ dysfunction is now a part of the accepted definition of sepsis. Greater emphasis should be placed on teaching students about the hallmarks of sepsis and the best bedside screening measures for sepsis.

In order to improve students' knowledge about sepsis, sepsis should be integrated more into the baccalaureate nursing students' curricula. For example, electronic health records (EHR) used in education settings to familiarize students with charting should include sepsis screenings that students can routinely fill out. Additionally, realistic sepsis scenarios should be incorporated into hands on learning exercises, such as simulation.

Due to the lack of studies related to sepsis knowledge in undergraduate nursing students, future studies should investigate this topic further. Additionally, this study did not investigate students' knowledge related to care of patients with sepsis, which is another critically important topic related to improving patient outcomes.

SUMMARY

Sepsis is an issue of critical importance because can occur in any patient on any floor of any hospital. Because of the complex nature of sepsis, it is crucial that students preparing for a career in nursing are familiar with the essential aspects of the syndrome and how to appropriately screen for sepsis at the bedside. This study suggests the need for additional teaching regarding key components of sepsis, such as organ dysfunction. Educators should place more emphasis on these essential components during their presentation of information regarding sepsis. Increased awareness of these key areas could impact student knowledge about sepsis and improve future patient outcomes.

APPENDIX A: IRB APPROVAL LETTER



UNIVERSITY OF CENTRAL FLORIDA

Institutional Review Board

FWA00000351
IRB00001138
Office of Research
12201 Research Parkway
Orlando, FL 32826-3246

EXEMPTION DETERMINATION

April 18, 2019

Dear Francisco Guido-Sanz:

On 4/18/2019, the IRB determined the following submission to be human subjects research that is exempt from regulation:

Type of Review:	Initial Study, Category 2(i)
Title:	Sepsis Knowledge in Undergraduate Nursing Students
Investigator:	Francisco Guido-Sanz
IRB ID:	STUDY00000371
Funding:	None
Grant ID:	None

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made, and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request so that IRB records will be accurate.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

A handwritten signature in black ink, appearing to read "AS" or similar initials, written in a cursive style.

Adrienne Showman
Designated Reviewer

APPENDIX B: EXPLANATION OF RESEARCH



UNIVERSITY OF
CENTRAL FLORIDA

EXPLANATION OF RESEARCH

Title of Project: Sepsis Knowledge in Undergraduate Nursing Students

Principal Investigator: Frank Guido-Sanz

Other Investigators: Kelsey Tilton, Victoria Loerzel, Brian Peach

You are being invited to take part in a research study. Whether you take part is up to you.

The purpose of this research is to explore undergraduate nursing students' knowledge and experience with sepsis.

You will be asked to complete a questionnaire about sepsis, related to attitudes, knowledge, and ability to apply knowledge related to sepsis and sepsis identification. Research will take place online through a Qualtrics® survey.

The questionnaire is expected to take you approximately 20 minutes to complete.

Your participation in this study is voluntary. You are free to withdraw your consent and discontinue participation in this study at any time without prejudice or penalty. Your decision to participate or not participate in this study will in no way affect your relationship with UCF, including continued enrollment, grades, employment or your relationship with the individuals who may have an interest in this study.

No private identifiable information will be collected at any time during this study. The responses from this survey will be kept a minimum of 5 years, in compliance with UCF policies.

You must be 18 years of age or older, a student in a Bachelor of Science in Nursing program at the University of Central Florida and enrolled in either Nursing Care of the Adult II or Critical Care to take part in this research study.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, please contact Dr. Frank Guido-Sanz at Frank.Guido-Sanz@ucf.edu

IRB contact about your rights in this study or to report a complaint: If you have questions about your rights as a research participant, or have concerns about the conduct of this study, please contact Institutional Review Board (IRB), University of Central Florida, Office of Research, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901, or email irb@ucf.edu.

APPENDIX C: IBR-APPROVED WEBCOURSES ANNOUNCEMENT

You are receiving this e-mail because you have been invited to participate in a research study that is being conducted at the University of Central Florida College of Nursing as part of an Honors in the Major thesis project. The purpose of this study is to explore undergraduate nursing students' knowledge and experiences with sepsis in the classroom and the clinical setting. You must be at least 18 years old to participate, and you must be enrolled in either Nursing Care of the Adult II or Critical Care. Participation in this study is completely voluntary and anonymous and will not impact your performance in the class you were recruited from.

If you have any questions, please contact the Principal Investigator, Dr. Francisco Guido-Sanz, at Frank.Guido-Sanz@ucf.edu or contact the Honors in the Major student, Kelsey Tilton, at Tilton.Kelsey@knights.ucf.edu.

APPENDIX D: SURVEY QUESTIONS

Title of Project: Sepsis Knowledge in Undergraduate Nursing Students

Principal Investigator: Frank Guido-Sanz

Other Investigators: Kelsey Tilton, Victoria Loerzel, Brian Peach

You are being invited to take part in a research study. Whether you take part is up to you.

The purpose of this research is to explore undergraduate nursing students' knowledge and experience with sepsis.

You will be asked to complete a questionnaire about sepsis, related to attitudes, knowledge, and ability to apply knowledge related to sepsis and sepsis identification. Research will take place online through this Qualtrics® survey.

The questionnaire is expected to take you approximately 20 minutes to complete.

Your participation in this study is voluntary. You are free to withdraw your consent and discontinue participation in this study at any time without prejudice or penalty. Your decision to participate or not participate in this study will in no way affect your relationship with UCF, including continued enrollment, grades, employment or your relationship with the individuals who may have an interest in this study.

No private identifiable information will be collected at any time during this study. The responses from this survey will be kept a minimum of 5 years, in compliance with UCF policies.

You must be 18 years of age or older, a student in a Bachelor of Science in Nursing program at the University of Central Florida and enrolled in either Nursing Care of the Adult II or Critical Care to take part in this research study.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints, please contact Dr. Frank Guido-Sanz at Frank.Guido-Sanz@ucf.edu

IRB contact about your rights in this study or to report a complaint: If you have questions about your rights as a research participant, or have concerns about the conduct of this study, please contact Institutional Review Board (IRB), University of Central Florida, Office of Research, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901, or email irb@ucf.edu.

Please select “yes” to continue to the survey. Thank you for your participation in this study.

Yes

No

Demographics

1. Gender

Male

Female

Other

2. What is your age?

18-20

21-23

24-26

27+

3. Years of previous college experience as a student, including bachelors, masters, and doctorate degrees.

1-4

5-6

7-8

More than 8

4. How many semesters have you completed of nursing school, not including the one you're currently enrolled in?

3

4

5

6

More than 6

5. What course(s) are you currently enrolled in?

Nursing Care of the Adult II

Critical Care

Both Nursing Care of the Adult II and Critical Care

Neither

6. Which clinical(s) have you participated in?

Nursing Care of the Adult II

Practicum

Both Nursing Care of the Adult II and Practicum

7. What is the highest acuity setting you have cared for patients in during clinicals?

ICU

PCU

Medical/Surgical unit

Other (Please specify) – free text

8. During your clinicals, have you ever completed a sepsis screening while charting?

Yes

No

9. During your clinicals, have you ever cared for a patient whose sepsis screening score was positive, indicating they might have sepsis?

Yes

No

10. During your clinicals, have you ever cared for a patient with sepsis?

Yes

No

11. How comfortable are you with identifying a patient at risk for developing sepsis?

Very comfortable

Somewhat comfortable

Neither comfortable nor uncomfortable

Somewhat uncomfortable

Very uncomfortable

13. How comfortable are you identifying a patient who might be septic?

Very comfortable

Somewhat comfortable

Neither comfortable nor uncomfortable

Somewhat uncomfortable

Very uncomfortable

14. How comfortable are you identifying signs and symptoms associated with sepsis?

Very comfortable

Somewhat comfortable

Neither comfortable nor uncomfortable

Somewhat uncomfortable

Very uncomfortable

15. How comfortable are you caring for a patient with sepsis?

Very comfortable

Somewhat comfortable

Neither comfortable nor uncomfortable

Somewhat uncomfortable

Very uncomfortable

16. I believe that nurses play an integral role in detecting sepsis.

Strongly Agree

Agree

Neither agree nor disagree

Disagree

Strongly Disagree

17. I believe that my actions as a nurse can improve outcomes for patients.

Strongly Agree
Agree
Neither agree nor disagree
Disagree
Strongly Disagree

18. I believe early identification of sepsis can improve patient outcomes.

Strongly Agree
Agree
Neither agree nor disagree
Disagree
Strongly Disagree

19. I would like to learn more about sepsis and identification of sepsis.

Strongly Agree
Agree
Neither agree nor disagree
Disagree
Strongly Disagree

General Knowledge Assessment

1. Which are the best indicators to screen patients at the bedside for possible sepsis? Select all that apply.

Creatinine clearance

Respiration rate

Altered mental status

Systolic blood pressure less than or equal to 100 mmHg

Low urine output

2. Sepsis is... (select one)

- defined by a host's uncontrolled systemic inflammatory response to an infection
- defined by an allergic reaction to an infectious agent that causes a systemic response
- defined by life-threatening organ dysfunction caused by a dysregulated host response to infection

3. I would screen my patient for sepsis if they were experiencing mild organ dysfunction

(e.g., elevated liver enzymes).

Yes

No

4. I would evaluate my patient further for sepsis if they presented with an infection and have an altered mental status.

Yes

No

5. I would evaluate my patient further for sepsis if they had a systolic blood pressure of 100 mmHg or less.

Yes

No

6. I would evaluate my patient further for sepsis if they had a respiration rate of 22 or more.

True

False

7. I would evaluate my patient further for sepsis if they had a Glasgow Coma Scale of 6.

Yes

No

8. Sepsis is the primary cause of death from infection.

True

False

9. Sepsis is influenced by gender, race, and age.

True

False

10. Sepsis is influenced by the type of pathogen that infects a host.

True

False

11. Sepsis should be considered in any patient that presents with an infection.

True

False

12. Sepsis can occur in any patient on any floor in the hospital.

True

False

13. Sepsis can only be screened for by a physician.

True

False

14. Patients in the hospital with organ dysfunction presenting with abnormal labs have a higher risk for death than patients who present with ST-segment elevation myocardial infarctions.

True

False

15. Sepsis can progress into septic shock.

True

False

16. Inflammation is the hallmark of sepsis.

True

False

17. Inflammation with a known cause (e.g., a recent surgery) can still be classified as sepsis.

True

False

18. Autoimmune disorders (e.g., lupus) are a type of sepsis.

True

False

19. While heartrate might indicate physiologic changes in the patient first, blood pressure is more reliable for determining concern for sepsis and the need for further screening.

True

False

20. Sepsis is better classified as a (select one)

Disease

Syndrome

General Knowledge Application

The incoming nurse received handoff report from the outgoing nurse. The outgoing nurse reported the following:

Patient in Room 1

“57-year-old patient with a past medical history of type 2 diabetes mellitus, hypercholesterolemia, hypertension and peripheral neuropathy was admitted to the emergency department last night with chest pain. The patient underwent an angioplasty with a stent for a coronary artery blockage. The patient experienced excessive bleeding at the catheter insertion site (groin) that was controlled in the operating room. The patient is currently in bed watching TV while waiting for their breakfast tray. The patient’s current medications include a statin, subcutaneous insulin injections on a sliding scale, a beta-blocker, and gabapentin. Normal saline solution is infusing intravenously (IV) at 125 mL/hr. The patient’s vital signs are: Blood pressure (BP) 137/92 mm Hg; heart rate (HR) 74 beats per minute; respiratory rate (RR) 18 breaths per minute; temperature (T) 98.6°F; oxygen saturation (SpO₂) 99% at room air. Laboratories (labs): hemoglobin (Hgb) 14.2 g/dL; hematocrit (Hct) 42%; platelets (Plts.) 215,000/μL; serum sodium (Na⁺) 141mEq/L; serum potassium (K⁺) 3.8 mEq/L; serum chloride (Cl⁻) 97 mEq/L; serum creatinine (Creat.) 1.1 mg/dL; urea nitrogen in blood (BUN) 18 mg/dL; white blood cells (WBC) 8.2/μL.”

Patient in Room 2

“49-year-old patient with a past medical history of polycystic kidney disease and underwent a kidney transplant 6 years ago presented to the emergency department with shortness

of breath, chest discomfort, and fatigue. A chest x-ray revealed left lower lobe pneumonia. They were started on empiric antibiotics and 2 L of oxygen. They are enjoying a visit with a family member. Their medications include antibiotics, anti-rejection medication, and a daily vitamin. They have an IV with normal saline running at 125 mL/hr. The patient's vital signs are: BP 110/74, HR 82, RR 24, T 99.2, SpO₂ 94% on 2L O₂ via nasal cannula (NC). Labs: Hgb 13 g/dL; Hct 39%; Plts. 137,000/ μ L; Na⁺ 130 mEq/L; K⁺ 4.1 mEq/L; Cl⁻ 95 mEq/L; Creat. 1.2 mg/dL; BUN 18 mg/dL WBC 7.4/ μ L; Neutrophils 64%; Lymphocytes 28%; Monocytes 4%; Eosinophils 3%; Basophils 1%.”

Patient in Room 3

“77-year-old patient with a past medical history of congestive heart failure, type 2 diabetes mellitus, hypertension, hypercholesterolemia, and depression was admitted from the emergency department with swelling in both their legs and cellulitis. They are being treated with empiric antibiotics and are on 2 L of oxygen, which is the oxygen therapy they receive at home. They underwent occupational therapy yesterday and stated they could not walk more than 10 steps without feeling light headed. The patient is being followed by psych for depressive episode that occurred yesterday during therapy and is currently stable. Their urine output over the last 6 hours is 500 mL of clear dark yellow urine. Their family member is visiting this morning. Their medications include antibiotics, Lasix, a beta blocker, and subcutaneous insulin injections on a sliding scale. They have a saline lock in their right forearm. The patient's vital signs are: BP 150/104; HR 84; RR 22; T 97.9; SpO₂ 95% on 2L O₂ via NC. Labs: Hgb 15 g/dL; Hct 45%; Plts. 237,000/ μ L; Na⁺ 130 mEq/L; K⁺ 3.2 mEq/L; Cl⁻ 95 mEq/L; Creat. 0.7 mg/dL; BUN 10

mg/dL; WBC 14/ μ L; Neutrophils 76%; Lymphocytes 11%; Monocytes 10%; Eosinophils 2%; Basophils 1%.”

Patient in Room 4

“25-year-old patient with a past medical history of sickle cell anemia, 5 cerebral vascular accidents, and 2 pulmonary embolisms presented to the emergency with pain in their left leg following a sickle cell crisis that was triggered by a cold front. A doppler revealed a deep vein thrombus in the left leg. They are complaining of itching following the last administration of pain medication. Their medications include morphine sulfate and Benadryl. They have an IV with normal saline running at 225 mL/hr. Their vital signs are: BP 130/88; HR 56; RR 16; T 98.2; SpO₂ 98% on room air. Labs: Hgb 10.5 g/dL; Hct 31%; Plts. 134,000/ μ L; Na⁺ 151 mEq/L; K⁺ 5.7 mEq/L; Cl⁻ 108 mEq/L; Creat. 0.8 mg/dL; BUN 17 mg/dL; WBC 10/ μ L.

1. Which patient are you most concerned about developing sepsis or showing signs and symptoms of sepsis in the above scenario?

Room 1

Room 2

Room 3

Room 4

None

Regarding the patient you are most concerned about with regards to sepsis...

2. Which lab value(s) is/are most concerning to you? Select all that apply.

Hemoglobin, hematocrit, and platelets

Electrolytes

Creatinine clearance and BUN

White blood cell count

None

3. Which vital signs/assessment findings are most concerning to you? Select all that apply.

Blood pressure

Heart Rate

Respiration rate and pulse oxygenation

Temperature

Mental status

None

4. Which assessment findings contribute to your concern about your patient developing sepsis? Select all that apply.

Hemoglobin, hematocrit, and platelets

Electrolytes

Creatinine clearance and BUN

White blood cell count

Blood pressure

Heart Rate

Respiration rate and peripheral oxygen saturation (pulse ox)

Temperature

Mental status

None

Midway through the shift

The patient in **Room 1** complains of pain in their groin underneath the dressing. They are becoming agitated about being immobile following the procedure and having to use a bedpan. Their urine output is 800 mL of clear yellow urine. Their vital signs are: BP 134/87; HR 76; RR 17; T 98.4; SpO₂ 99% on room air.

The patient in **Room 2** is resting in their bed after their family member left. They report that they don't need anything but ask if you can elevate the head of their bed a little more. They have 200 mL of clear dark urine in their toilet hat. During morning rounds, the provider switched them to 4 L of oxygen. Their vital signs are: BP 104/69; HR 93; RR 25; T 99.4; SpO₂ 91% on 4 L O₂.

The patient in **Room 3** is complaining of shortness of breath after walking to the restroom and reports that they have pain in their legs that they attribute to the compression bandages applied for their edema. Their feet are warm to slightly cool bilaterally with no palpable pedal pulses. Their toilet hat shows another 150 mL of clear dark yellow urine. Their vital signs are: BP 149/102; HR 76; RR 23; T 97.6; SpO₂ 95% on 2L O₂ via NC.

The patient in **Room 4** has pain medication due in 15 minutes. They rate their pain at a 4, but they are anxious that the pain will get worse very soon. Their mucous membranes appear moist and pink, and their skin is dry and warm. Their urine output is 900 mL of clear light-

yellow urine so far this shift. Their vital signs are: BP 135/93; HR 61; RR 17; T 98.4; SpO₂ 94% on room air.

Previous patient information for your reference as needed:

Beginning of the shift

Patient in Room 1

“57-year-old patient with a past medical history of type 2 diabetes mellitus, hypercholesterolemia, hypertension and peripheral neuropathy was admitted to the emergency department last night with chest pain. The patient underwent an angioplasty with a stent for a coronary artery blockage. The patient experienced excessive bleeding at the catheter insertion site (groin) that was controlled in the operating room. The patient is currently in bed watching TV while waiting for their breakfast tray. The patient’s current medications include a statin, subcutaneous insulin injections on a sliding scale, a beta-blocker, and gabapentin. Normal saline solution is infusing intravenously (IV) at 125 mL/hr. The patient’s vital signs are: Blood pressure (BP) 137/92 mm Hg; heart rate (HR) 74 beats per minute; respiratory rate (RR) 18 breaths per minute; temperature (T) 98.6°F; oxygen saturation (SpO₂) 99% at room air.

Laboratories (labs): hemoglobin (Hgb) 14.2 g/dL; hematocrit (Hct) 42%; platelets (Plts.) 215,000/μL; serum sodium (Na⁺) 141mEq/L; serum potassium (K⁺) 3.8 mEq/L; serum chloride (Cl⁻) 97 mEq/L; serum creatinine (Creat.) 1.1 mg/dL; urea nitrogen in blood (BUN) 18 mg/dL; white blood cells (WBC) 8.2/μL.”

Patient in Room 2

“49-year-old patient with a past medical history of polycystic kidney disease and underwent a kidney transplant 6 years ago presented to the emergency department with shortness of breath, chest discomfort, and fatigue. A chest x-ray revealed left lower lobe pneumonia. They were started on empiric antibiotics and 2 L of oxygen. They are enjoying a visit with a family member. Their medications include antibiotics, anti-rejection medication, and a daily vitamin. They have an IV with normal saline running at 125 mL/hr. The patient’s vital signs are: BP 110/74, HR 82, RR 24, T 99.2, SpO₂ 94% on 2L O₂ via nasal cannula (NC).

Labs: Hgb 13 g/dL; Hct 39%; Plts. 137,000/μL; Na⁺ 130 mEq/L; K⁺ 4.1 mEq/L; Cl⁻ 95 mEq/L; Creat. 1.2 mg/dL; BUN 18 mg/dL WBC 7.4/μL; Neutrophils 64%; Lymphocytes 28%; Monocytes 4%; Eosinophils 3%; Basophils 1%.”

Patient in Room 3

“77-year-old patient with a past medical history of congestive heart failure, type 2 diabetes mellitus, hypertension, hypercholesterolemia, and depression was admitted from the emergency department with swelling in both their legs and cellulitis. They are being treated with empiric antibiotics and are on 2 L of oxygen, which is the oxygen therapy they receive at home. They underwent occupational therapy yesterday and stated they could not walk more than 10 steps without feeling light headed. The patient is being followed by psych for depressive episode that occurred yesterday during therapy and is currently stable. Their urine output over the last 6 hours is 500 mL of clear dark yellow urine. Their family member is visiting this morning. Their medications include antibiotics, Lasix, a beta blocker, and subcutaneous insulin injections on a sliding scale. They have a saline lock in their right forearm. The patient’s vital signs are: BP 150/104; HR 84; RR 22; T 97.9; SpO2 95% on 2L O2 via NC.

Labs: Hgb 15 g/dL; Hct 45%; Plts. 237,000/ μ L; Na+ 130 mEq/L; K+ 3.2 mEq/L; Cl- 95 mEq/L; Creat. 0.7 mg/dL; BUN 10 mg/dL; WBC 14/ μ L; Neutrophils 76%; Lymphocytes 11%; Monocytes 10%; Eosinophils 2%; Basophils 1%.”

Patient in Room 4

“25-year-old patient with a past medical history of sickle cell anemia, 5 cerebral vascular accidents, and 2 pulmonary embolisms presented to the emergency with pain in their left leg following a sickle cell crisis that was triggered by a cold front. A doppler revealed a deep vein thrombus in the left leg. They are complaining of itching following the last administration of pain medication. Their medications include morphine sulfate and Benadryl. They have an IV with normal saline running at 225 mL/hr. Their vital signs are: BP 130/88; HR 56; RR 16; T 98.2; SpO2 98% on room air.

Labs: Hgb 10.5 g/dL; Hct 31%; Plts. 134,000/ μ L; Na+ 151 mEq/L; K+ 5.7 mEq/L; Cl- 108 mEq/L; Creat. 0.8 mg/dL; BUN 17 mg/dL; WBC 10/ μ L.

1. Which patient are you most concerned about developing sepsis or showing signs and symptoms of sepsis in the above scenario?

Room 1

Room 2

Room 3

Room 4

None

Regarding the patient you are most concerned about with regards to sepsis...

2. Which vital signs/assessment findings are most concerning to you? Select all that apply.

Blood pressure

Heart Rate

Respiration rate and peripheral oxygen saturation (pulse ox)

Temperature

Mental status

None

At the end of the shift, the nurse gives a handoff report to the next nurse:

The patient in **Room 1** is no longer complaining of pain but is still agitated about using a bedpan and is difficult to communicate with because of their hostility. They complained of some pain in their groin early in the shift but has not complained of pain since and the site appears to be soft, nondistended and appropriate color. Their vital signs are: BP 135/89; HR 73; RR 17; T 98.4; SpO₂ 99% on room air.

The patient in **Room 2** has been in bed all day, but the outgoing shift nurse notes that they are very sweet, and their family usually comes to visit her in the morning. During a nap

earlier, they reported having a “bad dream” and felt like something was crawling on their arm, causing them to remove their IV. You inserted another one in the other arm. They are 4 L of oxygen. Their vital signs are: BP 100/69; HR 93; RR 27; T 99.1; SpO₂ 89% on 4 L O₂.

The patient in **Room 3** has continued to have shortness of breath when they get out of bed to use the restroom or for occupational therapy. They have a history of depression but have not seemed to have any major depressive episodes since the shift before yours. Their urine output has been good, and they have a saline lock in their right forearm that you just flushed to ensure patency. They are on 2 L of oxygen and continue to receive antibiotics for their cellulitis. The leg does not appear to have any changes in color over the last 12 hours, and their edema is 1+ bilaterally. Their vital signs are: BP 153/106; HR 73; RR 22; T 97.7; SpO₂ 94% on 2L O₂ via NC.

The patient in **Room 4** is complaining of pain in their left leg and rated it at a 7. They continue to have anxiety about their pain and use their call light frequently to talk with you about their concerns. They are very nice, but they take up a lot of your time with their frequent calls. Their vital signs are: BP 138/94; HR 64; RR 16; T 98.1; SpO₂ 95% on room air.

Previous patient information for your reference as needed:

Beginning of the shift

Patient in Room 1

“57-year-old patient with a past medical history of type 2 diabetes mellitus, hypercholesterolemia, hypertension and peripheral neuropathy was admitted to the emergency department last night with chest pain. The patient underwent an angioplasty with a stent for a coronary artery blockage. The patient experienced excessive bleeding at the catheter insertion site (groin) that was controlled in the operating room. The patient is currently in bed watching TV while waiting for their breakfast tray. The patient’s current medications include a statin, subcutaneous insulin injections on a sliding scale, a beta-blocker, and gabapentin. Normal saline solution is infusing intravenously (IV)

at 125 mL/hr. The patient's vital signs are: Blood pressure (BP) 137/92 mm Hg; heart rate (HR) 74 beats per minute; respiratory rate (RR) 18 breaths per minute; temperature (T) 98.6°F; oxygen saturation (SpO₂) 99% at room air.

Laboratories (labs): hemoglobin (Hgb) 14.2 g/dL; hematocrit (Hct) 42%; platelets (Plts.) 215,000/μL; serum sodium (Na⁺) 141mEq/L; serum potassium (K⁺) 3.8 mEq/L; serum chloride (Cl⁻) 97 mEq/L; serum creatinine (Creat.) 1.1 mg/dL; urea nitrogen in blood (BUN) 18 mg/dL; white blood cells (WBC) 8.2/μL.”

Patient in Room 2

“49-year-old patient with a past medical history of polycystic kidney disease and underwent a kidney transplant 6 years ago presented to the emergency department with shortness of breath, chest discomfort, and fatigue. A chest x-ray revealed left lower lobe pneumonia. They were started on empiric antibiotics and 2 L of oxygen. They are enjoying a visit with a family member. Their medications include antibiotics, anti-rejection medication, and a daily vitamin. They have an IV with normal saline running at 125 mL/hr. The patient's vital signs are: BP 110/74, HR 82, RR 24, T 99.2, SpO₂ 94% on 2L O₂ via nasal cannula (NC).

Labs: Hgb 13 g/dL; Hct 39%; Plts. 137,000/μL; Na⁺ 130 mEq/L; K⁺ 4.1 mEq/L; Cl⁻ 95 mEq/L; Creat. 1.2 mg/dL; BUN 18 mg/dL WBC 7.4/μL; Neutrophils 64%; Lymphocytes 28%; Monocytes 4%; Eosinophils 3%; Basophils 1%.”

Patient in Room 3

“77-year-old patient with a past medical history of congestive heart failure, type 2 diabetes mellitus, hypertension, hypercholesterolemia, and depression was admitted from the emergency department with swelling in both their legs and cellulitis. They are being treated with empiric antibiotics and are on 2 L of oxygen, which is the oxygen therapy they receive at home. They underwent occupational therapy yesterday and stated they could not walk more than 10 steps without feeling light headed. The patient is being followed by psych for depressive episode that occurred yesterday during therapy and is currently stable. Their urine output over the last 6 hours is 500 mL of clear dark yellow urine. Their family member is visiting this morning. Their medications include antibiotics, Lasix, a beta blocker, and subcutaneous insulin injections on a sliding scale. They have a saline lock in their right forearm. The patient's vital signs are: BP 150/104; HR 84; RR 22; T 97.9; SpO₂ 95% on 2L O₂ via NC.

Labs: Hgb 15 g/dL; Hct 45%; Plts. 237,000/ μ L; Na⁺ 130 mEq/L; K⁺ 3.2 mEq/L; Cl⁻ 95 mEq/L; Creat. 0.7 mg/dL; BUN 10 mg/dL; WBC 14/ μ L; Neutrophils 76%; Lymphocytes 11%; Monocytes 10%; Eosinophils 2%; Basophils 1%.”

Patient in Room 4

“25-year-old patient with a past medical history of sickle cell anemia, 5 cerebral vascular accidents, and 2 pulmonary embolisms presented to the emergency with pain in their left leg following a sickle cell crisis that was triggered by a cold front. A doppler revealed a deep vein thrombus in the left leg. They are complaining of itching following the last administration of pain medication. Their medications include morphine sulfate and Benadryl. They have an IV with normal saline running at 225 mL/hr. Their vital signs are: BP 130/88; HR 56; RR 16; T 98.2; SpO₂ 98% on room air.

Labs: Hgb 10.5 g/dL; Hct 31%; Plts. 134,000/ μ L; Na⁺ 151 mEq/L; K⁺ 5.7 mEq/L; Cl⁻ 108 mEq/L; Creat. 0.8 mg/dL; BUN 17 mg/dL; WBC 10/ μ L.

Midway through the shift

The patient in Room 1 complains of pain in their groin underneath the dressing. They are becoming agitated about being immobile following the procedure and having to use a bedpan. Their urine output is 800 mL of clear yellow urine. Their vital signs are: BP 134/87; HR 76; RR 17; T 98.4; SpO₂ 99% on room air.

The patient in Room 2 is resting in their bed after their family member left. They report that they don't need anything but ask if you can elevate the head of their bed a little more. They have 200 mL of clear dark urine in their toilet hat. During morning rounds, the provider switched them to 4 L of oxygen. Their vital signs are: BP 104/69; HR 93; RR 25; T 99.4; SpO₂ 91% on 4 L O₂.

The patient in Room 3 is complaining of shortness of breath after walking to the restroom and reports that they have pain in their legs that they attribute to the compression bandages applied for their edema. Their feet are warm to

slightly cool bilaterally with no palpable pedal pulses. Their toilet hat shows another 150 mL of clear dark yellow urine. Their vital signs are: BP 149/102; HR 76; RR 23; T 97.6; SpO2 95% on 2L O2 via NC.

The patient in Room 4 has pain medication due in 15 minutes. They rate their pain at a 4, but they are anxious that the pain will get worse very soon. Their mucous membranes appear moist and pink, and their skin is dry and warm. Their urine output is 900 mL of clear light-yellow urine so far this shift. Their vital signs are: BP 135/93; HR 61; RR 17; T 98.4; SpO2 94% on room air.

1. Which patient are you most concerned about developing sepsis or showing signs and symptoms of sepsis in the above scenario?

Room 1

Room 2

Room 3

Room 4

None

Regarding the patient you are most concerned about with regards to sepsis...

2. Which vital signs/assessment findings are most concerning to you? Select all that apply.

Blood pressure

Heart Rate

Respiration rate and peripheral oxygen saturation (pulse ox)

Temperature

Mental status

None

Follow-up Section

Thank you for your participation in this study. Your performance in this survey is anonymous to the investigators and will have no impact on your performance in the class you were recruited from.

APPENDIX E: DATA ANALYSIS RESULTS

Table 1			
Section	Question	Response Options	% (n)
Demographics	Gender	Male	22.5% (n=9)
		Female	77.5% (n=31)
		Other	
	What is your age?	18-20	0.0% (n=0)
		21-23	27.5% (n=11)
		24-26	30.0% (n=12)
		27+	42.5% (n=17)
	Years of previous college experience as a student, including bachelors, masters, and doctorate degrees.	1-4	42.5% (n=17)
		5-6	45.0% (n=18)
7-8		7.5% (n=3)	
More than 8		5.0% (n=2)	
How many semesters have you completed of nursing school, not including the one you're currently enrolled in?	3	75.0% (n=30)	
	4	22.5% (n=9)	
	5	2.5% (n=1)	
	6	0.0% (n=0)	
	More than 6	0.0% (n=0)	
What course(s) are you currently enrolled in?	Nursing Care of the Adult II	0.0% (n=0)	
	Critical Care	97.5% (n=39)	
	Both Nursing Care of the Adult II and Critical Care	2.5% (n=1)	
	Neither	0.0% (n=0)	
Which clinical(s) have you participated in?	Nursing Care of the Adult II	37.5% (n=15)	
	Practicum	2.5% (n=1)	
	Both Nursing Care of the Adult II and Practicum	60.0% (n=24)	
What is the highest acuity setting you have cared for patients in during clinicals?	ICU	55.0% (n=22)	
	PCU	37.5% (n=15)	
	Medical/Surgical unit	7.5% (n=3)	
	Other (Please specify) – free text		
		Other: NICU* Labor and delivery*	

	During your clinicals, have you ever completed a sepsis screening while charting?	Yes No	55.0% (n=22) 45.0% (n=18)
	During your clinicals, have you ever cared for a patient whose sepsis screening score was positive, indicating they might have sepsis?	Yes No	37.5% (n=15) 62.5% (n=25)
	During your clinicals, have you ever cared for a patient with sepsis?	Yes No	45.0% (n=18) 55.0% (n=22)
Comfort			
	How comfortable are you with identifying a patient at risk for developing sepsis?	Very comfortable Somewhat comfortable Neither comfortable nor uncomfortable Somewhat uncomfortable Very uncomfortable	5.0% (n=2) 50.0% (n=20) 22.5% (n=9) 22.5% (n=9) 0.0% (n=0)
	How comfortable are you identifying a patient who might be septic?	Very comfortable Somewhat comfortable Neither comfortable nor uncomfortable Somewhat uncomfortable Very uncomfortable	5.0% (n=2) 35.0% (n=14) 32.5% (n=13) 27.5% (n=11) 0.0% (n=0)
	How comfortable are you identifying signs and symptoms associated with sepsis?	Very comfortable Somewhat comfortable Neither comfortable nor uncomfortable Somewhat uncomfortable Very uncomfortable	7.5% (n=3) 55.0% (n=22) 22.5% (n=9) 15.0% (n=6) 0.0% (n=0)
	How comfortable are you caring for a patient with sepsis?	Very comfortable Somewhat comfortable Neither comfortable nor uncomfortable Somewhat uncomfortable Very uncomfortable	5.0% (n=2) 32.5% (n=13) 35% (n=14) 20.0% (n=8) 0.0% (n=0)

			7.5% (n=3)
Beliefs			
	I believe that nurses play an integral role in detecting sepsis.	Strongly Agree Agree Neither agree nor disagree Disagree Strongly Disagree	87.5% (n=35) 12.5% (n=5) 0.0% (n=00) 0.0% (n=0) 0.0% (n=0)
	I believe that my actions as a nurse can improve outcomes for patients.	Strongly Agree Agree Neither agree nor disagree Disagree Strongly Disagree	95.0% (n=38) 5.0% (n=2) 0.0% (n=0) 0.0% (n=0) 0.0% (n=0)
	I believe early identification of sepsis can improve patient outcomes.	Strongly Agree Agree Neither agree nor disagree Disagree Strongly Disagree	100.0% (n=40) 0.0% (n=0) 0.0% (n=0) 0.0% (n=0) 0.0% (n=0)
	I would like to learn more about sepsis and identification of sepsis.	Strongly Agree Agree Neither agree nor disagree Disagree Strongly Disagree	90.0% (n=36) 7.5% (n=3) 2.5% (n=1) 0.0% (n=0) 0.0% (n=0)
General Knowledge Assessment			
	Which are the best indicators to screen patients at the bedside for possible sepsis? Select all that apply.	Creatinine clearance Respiration rate Altered mental status Systolic blood pressure less than or equal to 100 mmHg Low urine output	n=13 n=34 n=37 n=34 n=26
	Correct combination of answers for select all that apply question:	Respiration rate, Altered mental status, and Systolic blood pressure less than or equal to 100 mmHg	27.5% (n= 11)

	Sepsis is... (select one)	<p>defined by a host's uncontrolled systemic inflammatory response to an infection</p> <p>defined by an allergic reaction to an infectious agent that causes</p> <p>a systemic response defined by life-threatening organ dysfunction caused by a dysregulated host response to infection</p>	<p>40.0% (n=16)</p> <p>0.0% (n=0)</p> <p>60.0% (n=24)</p>
	I would screen my patient for sepsis if they were experiencing mild organ dysfunction (e.g., elevated liver enzymes).	<p>Yes</p> <p>No</p>	<p>87.5% (n=35)</p> <p>12.5% (n=5)</p>
	I would evaluate my patient further for sepsis if they presented with an infection and have an altered mental status.	<p>Yes</p> <p>No</p>	<p>100.0% (n=40)</p> <p>0.0% (n=0)</p>
	I would evaluate my patient further for sepsis if they had a systolic blood pressure of 100 mmHg or less.	<p>Yes</p> <p>No</p>	<p>92.5% (n=37)</p> <p>7.5% (n=3)</p>
	I would evaluate my patient further for sepsis if they had a respiration rate of 22 or more.	<p>Yes</p> <p>No</p>	<p>82.5% (n=33)</p> <p>17.5% (n=7)</p>
	I would evaluate my patient further for sepsis if they had a Glasgow Coma Scale of 6.	<p>Yes</p> <p>No</p>	<p>90.0% (n=36)</p> <p>10.0% (n=4)</p>
	Sepsis is the primary cause of death from infection.	<p>True</p> <p>False</p>	<p>90.0% (n=36)</p> <p>10.0% (n=4)</p>
	Sepsis is influenced by gender, race, and age.	<p>True</p> <p>False</p>	<p>40.0% (n=16)</p> <p>60.0% (n=24)</p>
	Sepsis is influenced by the type of pathogen that infects a host.	<p>True</p> <p>False</p>	<p>70.0% (n=28)</p> <p>30.0% (n=12)</p>

	Sepsis should be considered in any patient that presents with an infection.	True False	87.5% (n=35) 12.5% (n=5)
	Sepsis can occur in any patient on any floor in the hospital.	True False	100.0% (n=40) 0.0% (n=0)
	Sepsis can only be screened for by a physician.	True False	2.5% (n=1) 97.5% (n=39)
	Patients in the hospital with organ dysfunction presenting with abnormal labs have a higher risk for death than patients who present with ST-segment elevation myocardial infarctions.	True False	77.5% (n=31) 22.5% (n=9)
	Inflammation is the hallmark of sepsis.	True False	65.0% (n=26) 35.0% (n=14)
	Sepsis can progress into septic shock.	True False	100.0% (n=40) 0.0% (n=0)
	Inflammation with a known cause (e.g., a recent surgery) can still be classified as sepsis.	True False	52.5% (n=21) 47.5% (n=19)
	Autoimmune disorders (e.g., lupus) are a type of sepsis.	True False	7.5% (n=3) 92.5% (n=37)
	While heartrate might indicate physiologic changes in the patient first, blood pressure is more reliable for determining concern for sepsis and the need for further screening.	True False	80.0% (n=32) 20.0% (n=8)
	Sepsis is better classified as a (select one)	Disease Syndrome	7.5% (n=3) 92.5% (n=37)
	General knowledge questions (20 total):	11 correct 12 correct 13 correct 14 correct 15 correct 16 correct 17 correct 18 correct 19 correct	2.5% (n=1) 5.0% (n=2) 7.5% (n=3) 12.5% (n=5) 20.0% (n=8) 17.5% (n=7) 17.5% (n=7) 12.5% (n=5) 5.0% (n=2)

General Knowledge Application			
Beginning of Shift Handoff			
	Which patient are you most concerned about developing sepsis <u>or</u> showing signs and symptoms of sepsis in the above scenario?	Room 1 Room 2 Room 3 Room 4 None	5.0% (n=2) 40.0% (n=16) 50.0% (n=20) 5.0% (n=2) 0.0% (n=0)
Regarding the patient you are most concerned about <u>with regards to sepsis...</u>			
	Which lab value(s) is/are most concerning to you? Select all that apply.	Hemoglobin, hematocrit, and platelets Electrolytes Creatinine clearance and BUN White blood cell count None	n=8 n=8 n=13 n= 30 n=2
	Which vital signs/assessment findings are most concerning to you? Select all that apply.	Blood pressure Heart Rate Respiration rate and pulse oxygenation Temperature Mental status None	n= 23 n=9 n=33 n=28 n=22 n=0
	Which assessment findings contribute to your concern about your patient developing sepsis? Select all that apply.	Hemoglobin, hematocrit, and platelets Electrolytes Creatinine clearance and BUN White blood cell count Blood pressure Heart Rate	n=8 n=14 n=13 n=30 n=20 n=14

		Respiration rate and peripheral oxygen saturation (pulse ox) Temperature Mental status None	n=33 n=31 n=23 n=0
Midway through the shift			
	Which patient are you most concerned about developing sepsis or showing signs and symptoms of sepsis in the above scenario?	Room 1 Room 2 Room 3 Room 4 None	0.0% (n=0) 80.0% (n=32) 15.0% (n=6) 5.0% (n=2) 0.0% (n=0)
Regarding the patient you are most concerned about with regards to sepsis...			
	Which vital signs/assessment findings are most concerning to you? Select all that apply.	Blood pressure Heart Rate Respiration rate and pulse oxygenation Temperature Mental status None	n= 32 n=24 n=36 n=37 n=8 n=0
End of the shift			
	Which patient are you most concerned about developing sepsis or showing signs and symptoms of sepsis in the above scenario?	Room 1 Room 2 Room 3 Room 4 None	0.0% (n=0) 87.5% (n=35) 10.0% (n=4) 2.5% (n=1)
Regarding the patient you are most concerned about with regards to sepsis...			
	Which vital signs/assessment findings are most concerning to you? Select all that apply.	Blood pressure Heart Rate Respiration rate and pulse oxygenation	n= 34 n=26 n=36

		Temperature	n=33
		Mental status	n=26
		None	n=0
*These responses fit into one of the categories provided above and were manually added so they would be counted with the appropriate aggregate total			

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