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Critical care nurses' knowledge and experience of sepsis assessment and management: A cross-sectional correlational study

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ABSTRACT

Background & Aim: Sepsis is a major global health issue, often leading to delayed recognition due to its varied symptoms. ICU nurses play a crucial role in early detection, but knowledge gaps in sepsis assessment and management persist. This study aimed to examine critical care nurses' knowledge and experience of caring for patients with sepsis.
Methods & Materials: A cross-sectional correlational study was conducted on a convenience sample of 320 ICU nurses from various hospitals in Jordan. A Validated tool assessed nurses' knowledge and experience of sepsis management.
Results: Nurses demonstrated moderate knowledge, with an overall score of 9.76 ± 1.43. Hypotension (51.6%) was the most recognized symptom, and 94.7% understood sepsis involves an infection with an inflammatory response. However, knowledge gaps remained, with only 31.9% knowing antibiotics should be given within 2 hours and 73.4% recognizing they should be administered before blood cultures. Regarding SIRS criteria, only a small percentage correctly identified key signs, such as temperature <36°C (26.3%) and heart rate >80 bpm (23.8%). Sepsis risk factors like IV drug use (34.4%) and chronic steroid use (21.9%) were recognized, but fewer identified the elderly (10.6%) as high-risk. Hypotension (50.9%) was the most challenging aspect of care. Nurses emphasized the need for better education (50.6%) and improved treatment protocols (46.9%).
Conclusion: This study highlights critical gaps in ICU nurses' knowledge and experience in assessing and managing sepsis. The findings identified region-specific barriers and the urgent need for tailored training programs in resource-limited critical care settings.

Introduction

Sepsis is a critical health concern and one of the leading causes of mortality and morbidity worldwide, particularly in intensive care units (ICUs). It is estimated that sepsis affects approximately 49 million people globally each year, resulting in nearly 11 million deaths, which accounts for about 20% of all deaths worldwide (1). The management of sepsis presents significant challenges, as the condition can rapidly escalate from an initial infection to severe sepsis or septic shock, necessitating prompt and effective intervention to improve patient outcomes (2).

The global burden of sepsis is substantial, with mortality rates in ICU settings often ranging between 30% and 50%, reflecting a widespread trend in both high-income and low- and middle-income countries (3,4). Early recognition of sepsis is essential for the timely initiation of life-saving interventions, yet it is frequently delayed due to the nonspecific and variable clinical manifestations of the condition (5). The role of ICU nurses is pivotal in this context, as they are often the first to detect changes in a patient's condition that may indicate the onset of sepsis (6).

However, previous studies have highlighted gaps in critical care nurses' knowledge regarding the assessment and management of sepsis. For example, a study by Storozuk et al. (7) found that only 8% of emergency nurses in Canada answered sepsis-related questions correctly, indicating a significant knowledge deficit. Similarly,

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research conducted in Australia by Harley et al. (8) revealed that just 44% of nursing students were aware of the need for early recognition of sepsis. These findings suggest that knowledge deficiencies are not isolated to any particular region but are a global issue requiring urgent attention.

Moreover, a systematic review by Rababa et al. (9) pointed out that while ICU nurses play a crucial role in the early recognition and management of sepsis, only about 40% of them focus adequately on the early administration of antibiotics and intravenous fluids. This gap in practice and clinical experience highlights the need for ongoing education and training to ensure that ICU nurses are equipped with the necessary knowledge and skills to manage sepsis effectively (10,11).

While previous research has explored sepsis care globally, Persistent knowledge gaps have investigated critical care nurses' knowledge and experience in sepsis assessment and management within the Middle Eastern context, which remains underexplored. Therefore, this study aims to assess ICU Jordanian nurses' current knowledge and experience regarding sepsis assessment and management. The findings will contribute to the ongoing efforts to enhance global sepsis care, aiming to identify context-specific barriers or develop targeted training programs tailored to ICU settings in resource-limited areas and reduce the high mortality and morbidity associated with this condition.

Methods

Design, sample, and setting

This cross-sectional correlational study was conducted on a convenience sample of 320 nurses working in ICUs at governmental, private, or university hospitals in Jordan. In this study, a descriptive analysis was used to examine frequencies, and the sample size was determined based on data requirements rather than a power analysis. To ensure reliable and precise estimates of the population parameters, a sample size of 320 participants was chosen. This sample size was based on a margin of error of ±5% and a confidence level of 95%. The sample size was calculated using the formula for estimating proportions: n= (Z^2*p* (1-p))/E^2

Using this formula, a sample size of approximately 320 participants was determined, ensuring sufficient power for accurate frequency estimates and the ability to capture variability in the population. Given the descriptive nature of the study and the use of frequency distributions, this sample size provides the necessary precision for the observed characteristics.(12). The eligible participants were nurses working in the ICU with a minimum experience of one year.

Measurements

Nurses' knowledge of sepsis: The researchers used the Emergency Nurses' Knowledge of Sepsis Questionnaire to evaluate critical care nurses' knowledge regarding sepsis (7). This tool consists of three main sections. In the first section, we collected demographic information and asked about the perceived level of sepsis knowledge. The second section consisted of seven multiple-response questions, which included fill-in-the-blank, check-all-that-apply, and multiple-choice questions. These questions focused on the most common signs of severe sepsis, the SIRS criteria, and the characteristics of patient groups at high risk for sepsis. The third section involved 14 true-or-false questions covering four domains: (a) definitions, (b) treatment of sepsis, (c) general knowledge of sepsis, and (d) SIRS variables associated with sepsis. Response options included "true," "false," and "I do not know" (7). The tool was used in its original English version, as English is the formal language of education in Jordan's nursing schools. Consequently, the participants were fully capable of understanding and responding to the tool in English, and there was no need for translation. A pilot study was conducted prior to the main study, involving 15 ICU nurses. The results indicated that all items in the questionnaire were clear, and no adaptations, refinements, or adjustments were necessary. To ensure reliability and validity, the tool underwent a review process for face and content validity by two sepsis experts. The experts confirmed that the items were

comprehensive, relevant, and clearly aligned with the study objectives, resulting in a validity score of 0.90, indicating excellent validity. Additionally, the reliability was confirmed, yielding a Cronbach's alpha score of 0.85, indicating high internal consistency.

Ethical considerations

Ethical approval was obtained by contacting the Institutional Review Board (IRB) of the Jordan University of Science and Technology, King Abdullah University Hospital, and the Ministry of Health (IRB # 603-2023). Written informed consent was obtained from all participants before their inclusion in the study. The written informed consent was designed with a system that ensures that the participants are fully aware of the study, its objectives, potential risks, and how to conduct it. We strived to confirm the voluntary participation of each participant through their reading of the instructions and their refusal or acceptance through their signature. Participants were given code numbers rather than names during the sample collection period. The researchers told them their information would only be used for study purposes, and no one else would have access to it. The completed surveys were kept in a locked cabinet in the university supervisor's office for five years. The researchers informed the participants that they had completed autonomy in deciding whether to participate in the research or not. They also informed them that they could withdraw from the research without penalty or withdrawal of benefits.

Data collection

The researchers cooperated with the directors of the selected hospitals and nursing officials. Then, the researchers visited the relevant units, where they met the participating nurses and used clear communication skills to explain the study's purpose, objectives, and benefits. The researchers made sure to publish informed consent forms, and written consents were obtained from the participants. Printed questionnaires were distributed and included personal delivery to each nurse who met the inclusion criteria through the assistance of the nursing administration, which familiarized the researcher with the units. Throughout this stage, the researchers answered questions and clarified any information that was unclear to the participants. Participants were encouraged to return the questionnaires to their units. Continuous follow-up of participants' inquiries was a priority to ensure accurate and correct answers. This follow-up facilitated immediate adjustments and effective resolution of emerging issues, ensuring the data's reliability, accuracy, and ethical integrity. Standardized training for the two research assistants and consistent data collection protocols across all sites. Inter-rater reliability was conducted every 10% of the data collection to ensure consistency and accuracy. The data were collected from January 1 to March 1, 2024.

Data analysis

The data used in this study were analyzed using descriptive statistical methods. SPSS (Statistical Package for the Social Sciences) was used as statistical software to implement the planned analyses. First, the dataset was preprocessed to remove errors and outliers. The researchers then used descriptive statistics to present the demographic and work-related variables of the participants, offering a brief profile of the sample. Critical care nurses' knowledge and experience were also measured using descriptive statistics.

Results

Demographic characteristics of study participants

The study included 320 nurses, with 44.4% males and 55.6% females. The nurses worked in different sectors: 52.5% in governmental hospitals, 24.4% in private hospitals, and 23.1% in university hospitals. Their years of experience in the ICU varied, with 19.7% having fewer than two years, 19.1% having 2 to 5 years, and so on. In terms of education, 90.9% had a bachelor’s degree. The distribution of nurses among different working units was as follows: 29.4% in the Surgical ICU, 20.3% in CCU, 29.4% in the Medical ICU, and 20.9% in the General ICU.

Table 1. Demographic characteristics of study participants

Variable	Category	n	%
Gender	Male	142	44.4
	Female	178	55.6
Age	less than 25	62	19.4
	25-30	80	25.0
	31-35	66	20.6
	36-40	69	21.6
	41-45	27	8.4
	More than 45	16	5.0
Type of hospital	Governmental	168	52.5
	Private	78	24.4
	University	74	23.1
Years in ICU	Less than 2	63	19.7
	2-5	61	19.1
	6-8	58	18.1
	9-11	66	20.6
	12-14	43	13.4
	More than 15	29	9.1
Educational level	Diploma	3	.9
	Bachelor's	291	90.9
	Master	25	7.8
	Doctorate	1	.3
Working unit	Surgical ICU	94	29.4
	CCU	65	20.3
	Medical ICU	94	29.4
	General ICU	67	20.9

Nurse's knowledge of severe sepsis, SIRS criteria, and high-risk persons

Table 2 presents the nurses' knowledge of the most prevalent symptoms of severe sepsis, with hypotension being the most frequently identified symptom (51.6%), followed by fever (14.7%) and tachycardia (5.9%). It also details nurses' understanding of SIRS criteria, with only 26.3% correctly identifying a temperature <36°C as a criterion. Regarding individuals at high risk for sepsis, 34.4% of nurses identified IV drug users as high-risk, while fewer recognized other groups, such as chronic steroid users (21.9%) or the elderly (10.6%). For further details, please refer to Table 2.

Table 2. Nurse's knowledge of severe sepsis, SIRS criteria, and high-risk persons

Category	Key Indicators	n	%
Signs of severe sepsis	Hypotension	165	51.6
	Fever	47	14.7
	Tachycardia	19	5.9
	Confusion	17	5.3
	Others (e.g., oliguria, weakness)	71	22.5
SIRS criteria	Temperature < 36°C	84	26.3
	Respiratory rate > 20/min	83	25.9
	Heart rate > 80/min	76	23.8
	WBC > 12	60	18.8
	WBC with 10% immature bands	17	5.3
Persons at high risk for sepsis	IV drug users	110	34.4
	Chronic steroid users	70	21.9
	COPD	63	19.7
	Elderly	34	10.6
	Others (e.g., asplenia)	43	13.5

Knowledge of SIRS criteria and sepsis

The descriptive analysis of nurses' knowledge associated with sepsis SIRS criteria is shown in Table 3. Only 35.0% picked the correct SIRS inflammatory variables answer, while 65.0% did not. Hemodynamic variables were properly recognized by 80.9% and were inaccurate by 19.1%. Organ dysfunction factors were answered correctly 27.8% of the time and incorrectly 72.2%. Impaired tissue perfusion factors were answered correctly 80.6% of the time and incorrectly 19.4%. The mean sepsis SIRS criterion knowledge score was 2.2438, with a standard deviation of 0.87992.

Table 3 shows nurses' sepsis skills. Sepsis is a known or suspected infection with an inflammatory response, according to 94.7% of participants. Additionally, 92.2% accurately identified sepsis with a systolic BP below 90 mmHg. Most participants (83.1%) recognized sepsis kills as many as strokes and AMIs. Only 80.6% of severe sepsis patients chose antibiotics over intravenous fluids. Regarding WBC count, 79.4% said 4 x 10E9/L indicates sepsis. Severe sepsis was properly diagnosed as an infection with organ failure by 82.5%. 67.2% accurately detected serum lactate over 4 mmol/L. 76.3% predicted severe sepsis mortality accurately. However, just 73.4% knew that antibiotics should be given before blood cultures. Additionally, 31.9% correctly said antibiotics should be administered within 2 hours after diagnosis. Many (59.7%) thought sepsis diagnosis required good blood cultures. About 40.0% knew hyperbilirubin did not indicate sepsis, and 54.7% knew hyperglycemia was a diagnostic criterion in non-diabetics. Septic shock was diagnosed by 79.4% as severe sepsis with low BP despite fluid resuscitation. Sepsis knowledge averaged 9.7563 with a standard deviation of 1.43073.

Table 3. Knowledge of SIRS criteria and sepsis

Category	Subcategory/Question	Correct (%)	Incorrect (%)	Mean Score
SIRS criteria knowledge	Inflammatory variables	35.0	65.0	
	Hemodynamic variables	80.9	19.1	
	Organ Dysfunction variables	27.8	72.2	
	Impaired tissue perfusion variables	80.6	19.4	
Mean score for SIRS knowledge				**2.24/4 (SD = 0.88)**
General sepsis knowledge	Definition of sepsis	94.7	5.3	
	Diagnostic criteria for cystolic BP < 90 mmHg	92.2	7.8	
	Sepsis mortality compared to strokes and MIs	83.1	16.9	
	Priority of antibiotics over IV fluids in severe sepsis	80.6	19.4	
	WBC count in diagnostic criteria	79.4	20.6	
	Severe sepsis and organ failure	82.5	17.5	
	Serum lactate > 4 mmol/L as indicator	67.2	32.8	
	Sepsis mortality (3–5 out of 10 patients)	76.3	23.8	
	Antibiotic timing before blood cultures	73.4	26.6	
	Antibiotics within 2 hours of diagnosis	31.9	68.1	
	Blood cultures and sepsis diagnosis	40.3	59.7	
	Hyperbilirubin in diagnostic criteria	40.0	60.0	
	Hyperglycemia without diabetes as a diagnostic criterion	54.7	45.3	
	Definition of septic shock	79.4	20.6	
Mean score for general sepsis knowledge				**9.76/13 (SD= 1.43)**

Experience of caring for patients with sepsis

Figure 1 outlines nurses' experiences caring for septic patients. The biggest challenge was hypotension (50.9%), followed by fever (8.4%), medication management (6.9%), multidisciplinary team coordination (11.9%), and swift sepsis identification (7.8%). To support nurses, education and training (50.6%), treatment adjustment (8.1%), early diagnosis (5.9%), teamwork (11.9%), criteria and protocols (8.1%), and equipment (7.5%) were mentioned. Improvement suggestions included treatment adjustment (46.9%), education and training (10.0%), multidisciplinary team coordination (13.1%), and prompt diagnosis (6.6%).

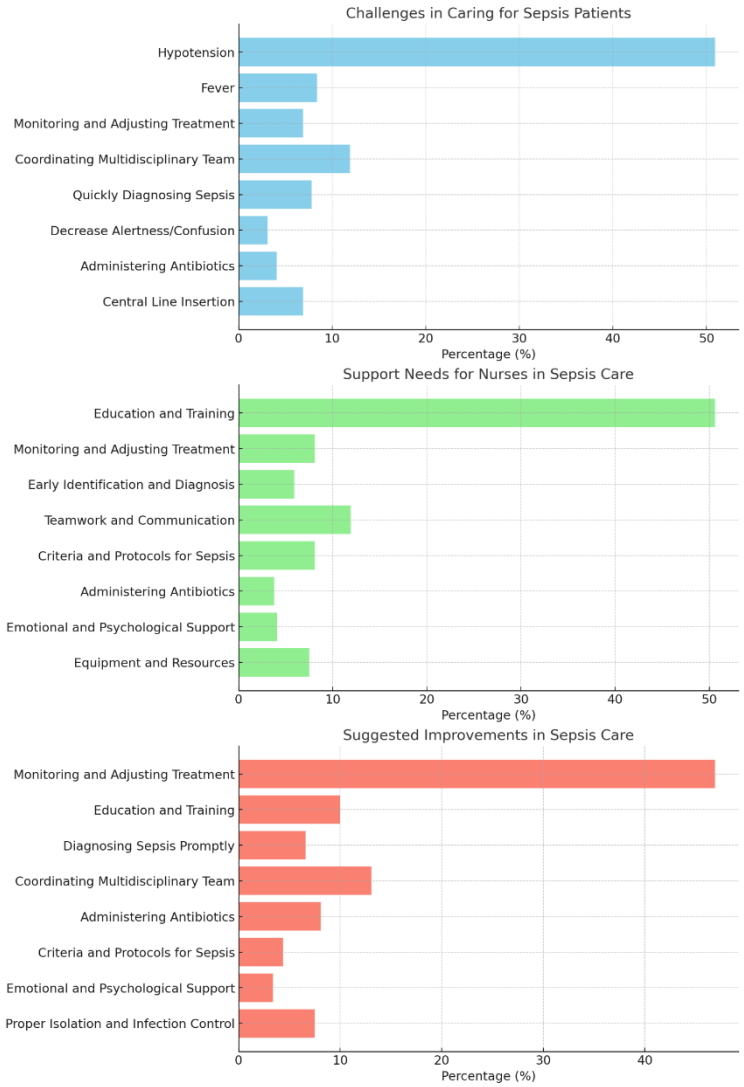

Figure 1. Experience of caring for patients with sepsis

Discussion

The current study critically evaluated critical care nurses' knowledge and experience in sepsis assessment and management, revealing significant gaps that mirror findings from multiple healthcare systems globally. However, the study also underscores the importance of understanding how regional differences in training, healthcare infrastructure, and sepsis protocols may influence these findings, making the discussion particularly relevant to healthcare professionals worldwide.

The study examined nurses' knowledge of sepsis symptoms and found that 51.6% correctly identified hypotension as a common symptom of severe sepsis. However, the recognition of other critical symptoms, such as fever (14.7%), tachycardia (5.9%), and confusion (5.3%), was significantly lower.

These findings align with those of Storozuk et al. (7) in Canada, Coiner and Wingo (13) in the United States, and Chua et al. (15) in Singapore, all of whom found significant gaps in the recognition of the full range of sepsis symptoms. This is a global challenge that spans diverse healthcare settings, where the lack of comprehensive training on sepsis symptoms remains a barrier to timely diagnosis and intervention. However, a divergence is observed in studies like Rahman et al. (16), which found a higher rate of correct identification of tachycardia and fever in their cohort. This suggests that some regions or healthcare systems have implemented more targeted educational efforts, which may have a stronger impact on early sepsis detection. The differing rates of symptom recognition underscore the variability in sepsis education and care practices across countries, pointing to the need for international collaboration in improving sepsis training.

The variability in knowledge regarding SIRS criteria is also concerning. Only 26.3% of participants in this study correctly identified a temperature less than 36°C as a SIRS criterion, and 25.9% recognized a respiratory rate greater than 20 breaths per minute. These findings align with the results of Rahman et al. (16) and Jeffery et al. (17), who also observed low recognition of the SIRS criteria, which is crucial for early sepsis diagnosis. Across various global studies (18), incomplete knowledge of SIRS criteria has been shown to delay sepsis identification and treatment, emphasizing the urgent need for a standardized approach to educating healthcare professionals on these key diagnostic criteria.

Regarding the knowledge of high-risk populations for sepsis, the study found that only 34.4% of participants correctly identified intravenous drug users as a high-risk group, while 21.9% recognized chronic steroid users, and 19.7% identified individuals with chronic obstructive pulmonary disease (COPD). These findings are consistent with a study by Coiner and Wingo (2021), which reported that many nurses failed to recognize patients with chronic illnesses and those with a history of drug use as being at high risk for sepsis. Similarly, the study by Storozuk et al. (7) found that knowledge about high-risk populations was variable, with significant gaps in identifying patients with immunosuppressive conditions or those with a history of substance abuse as being particularly vulnerable to sepsis. In contrast, studies in regions with higher prevalence rates of chronic diseases, such as Öztürk et al. (19), showed that a larger proportion of nurses could identify these at-risk populations. This suggests that local epidemiological patterns, such as the higher prevalence of certain diseases in specific regions, may inform the education and awareness of healthcare workers. Therefore, integrating local health data into sepsis education could help increase the recognition of high-risk groups across different healthcare settings. Moreover, the study by LeBlanc et al.(20) highlighted that many nurses were unaware of the increased sepsis risk among elderly patients and those with underlying health conditions, further supporting the need for enhanced education and training.

The results of the study concerning nurses' knowledge of SIRS criteria associated with sepsis also highlight significant deficiencies. Only 35.0% of participants correctly identified the relevant SIRS inflammatory variables, while 80.9% correctly recognized the hemodynamic variables. However, recognition of organ dysfunction and impaired tissue perfusion variables was much lower, with only 27.8% and 80.6% of nurses answering correctly, respectively. These findings are consistent with those reported by Thompson et al. (21), where only a minority of nurses could accurately identify all SIRS criteria, particularly those related to organ dysfunction. Similarly, a study by Nucera et al. (22) found that nurses often failed to recognize SIRS criteria associated with organ dysfunction, which is critical for the early diagnosis of severe sepsis.

The overall sepsis knowledge score in this study, with a mean of 9.7563 and a standard deviation of 1.43073, reflects a moderate level of knowledge among the nurses. This score is comparable to the findings of Storozuk et al. (7), who reported similar knowledge levels among ICU nurses in

Canada, indicating that while nurses have a basic understanding of sepsis, significant gaps remain. The study by Coiner and Wingo (13), also found moderate knowledge levels among nurses, with substantial variability in their ability to accurately diagnose and manage sepsis. Additionally, a study by de Souza et al. (14) Brazil reported similar knowledge scores, with many nurses lacking comprehensive knowledge of sepsis management protocols. Chua et al. 's work further supports these findings. (15), who reported that while nurses' basic understanding of sepsis is often sufficient, there is a critical need for continuous education and training to address the gaps in knowledge that persist across different healthcare systems.

The study also explored the experiences of nurses in caring for patients with sepsis, highlighting that hypotension was identified as the most challenging aspect of care by 50.9% of participants. This finding is consistent with a study by Rahman et al. (16), which reported that hypotension is one of the most common and challenging symptoms faced by nurses in the management of sepsis, often requiring immediate intervention to prevent progression to septic shock. Similarly, the study by Jeffery et al. (17) found that hypotension was frequently cited as a primary concern among nurses caring for septic patients, particularly in the context of managing fluid resuscitation and vasopressor therapy. The research by Drahnak et al. (18) also supports this finding, indicating that hypotension is a critical and challenging symptom to manage in septic patients, often leading to poor outcomes if not addressed promptly. Furthermore, the study by Thompson et al. (21) found that hypotension was a significant challenge for nurses, particularly in recognizing and responding to the early signs of septic shock.

In addition to hypotension, the study highlighted other challenges such as fever (8.4%), medication management (6.9%), multidisciplinary team coordination (11.9%), and swift sepsis identification (7.8%). These issues were also reported by Chua et al. (15) and LeBlanc et al. (20), which further demonstrate that sepsis management is a complex, multi-faceted issue that requires effective communication, timely interventions, and collaborative care. Variations in challenges, as noted by Öztürk Birge et al. (19) and Coiner and Wingo (13), suggest that healthcare environments with higher patient loads or different clinical priorities may face unique hurdles in sepsis management. These findings reinforce the need for region-specific strategies to address the multifaceted challenges of sepsis care globally.

Future recommendations

Based on the findings, several recommendations can be made for improving sepsis care. Healthcare institutions should implement mandatory sepsis education programs for all critical care nurses, with a focus on early recognition of sepsis and SIRS criteria. Periodic knowledge assessments and refresher courses should be introduced to ensure that nurses maintain up-to-date knowledge. The adoption of standardized sepsis management protocols is essential to reduce variability in practice and ensure that all nurses follow evidence-based guidelines. Furthermore, training nurses in effective communication and teamwork is crucial for improving coordination among multidisciplinary teams, thus facilitating timely interventions. Finally, stronger advocacy for policies that prioritize sepsis education and the development of clear management protocols will help establish sepsis as a critical area of focus in nursing practice and education.

Implications and future research

The implications of these findings are significant for both nursing practice and education. The results highlight the need for targeted educational interventions to address the specific gaps in knowledge, particularly in recognizing sepsis symptoms, identifying SIRS criteria, and understanding high-risk populations. Healthcare institutions may also need to update their sepsis management protocols to reflect current best practices and ensure that nurses have the necessary tools to effectively assess and manage sepsis. Moreover, the study emphasizes the

importance of collaboration between nurses and multidisciplinary teams to improve communication and coordination in sepsis care, ultimately improving patient outcomes.

Future research should focus on longitudinal studies to track changes in nurses' knowledge over time, particularly in response to educational interventions. Additionally, interventional studies could evaluate the effectiveness of specific training programs in improving sepsis management. Future studies should also explore the barriers nurses face in acquiring adequate knowledge on sepsis and assess how these barriers can be addressed. International comparative studies could provide valuable insights into the global challenges and best practices in sepsis care, further informing the development of effective training and protocols.

Limitations

The study has several limitations that should be considered when interpreting its findings. One of the primary limitations is the relatively small sample size, which may restrict the generalizability of the results to a broader population of critical care nurses. Additionally, the use of self-reported data introduces the possibility of biases, such as social desirability or recall bias, which may lead to an overestimation of nurses' knowledge and experiences regarding sepsis assessment and management. Furthermore, the study's cross-sectional design only provides a snapshot of the participants' knowledge at one point in time, limiting the ability to assess changes over time or the impact of educational interventions. Finally, the study did not explore in depth the factors that influence nurses' knowledge, such as available training programs or work environment, which could offer valuable insights into the root causes of the knowledge gaps identified.

Conclusion

This study reveals critical gaps in the knowledge and experience of critical care nurses regarding sepsis assessment and management. These gaps are consistent with findings from numerous studies conducted globally, suggesting that this is a widespread issue that requires urgent attention. The moderate overall knowledge score and the specific challenges identified in managing sepsis symptoms, such as hypotension, underscore the need for ongoing education and targeted training programs. By addressing these gaps, healthcare systems can improve the early recognition and management of sepsis, ultimately leading to better patient outcomes. This study contributes to the growing body of evidence that highlights the importance of continuous professional development for nurses, particularly in critical care settings where the timely and accurate management of sepsis is crucial.

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Conflict of interest

All authors declared no conflict of interest.

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