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Awareness and Perceived Barriers Toward Early Sepsis Screening and Bundle Compliance Among Critical Care Nurses in Saudi Arabia: A Cross-Sectional Study

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Abstract

Background: Sepsis remains a significant cause of preventable morbidity and mortality among critically ill patients. Critical care nurses play a major role as frontline providers in recognizing and managing sepsis.

Methods: A descriptive cross-sectional study was conducted among 109 critical care nurses in Eastern Saudi Arabia using an online self-administered questionnaire. Data were analysed using descriptive and inferential statistics, including t-tests and one-way ANOVA.

Results: The mean sepsis knowledge score was 9.54 ± 2.7, with 53.2% of nurses demonstrating fair knowledge and 26.6% demonstrating good knowledge. The mean confidence score was 19.5 ± 3.4, indicating generally high confidence in sepsis identification and management. Knowledge was positively correlated with confidence ($r = 0.232$, $p = 0.015$). Nurses who received sepsis training reported significantly higher confidence levels than those without training ($p = 0.047$). Similarly, the availability of sepsis screening tools was associated with significantly higher confidence ($p = 0.029$). The most frequently reported barriers were high workload (50.8%), staffing shortages (44.1%), limited knowledge of updated guidelines (32.2%), and delayed laboratory results (28.0%).

Conclusions: Critical care nurses demonstrated moderate sepsis knowledge and relatively high confidence in sepsis identification and management. Perceived organisational barriers highlight opportunities for training and improved screening support.

Background

Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection and is clinically identified by an acute increase in the Sequential Organ Failure Assessment (SOFA) score in patients with suspected infection, highlighting its strong association with high mortality and the need for early recognition and timely intervention [1]. Sepsis remains one of the leading causes of intensive care unit (ICU) admission worldwide and is associated with substantial short- and long-term morbidity and mortality [2,3]. Recent evidence consistently demonstrates that delays in sepsis recognition and incomplete or delayed implementation of sepsis care bundles are strongly associated with adverse patient outcomes, including increased mortality and prolonged ICU and hospital length of stay [1,4,5]. Although international guidelines are available, early detection of sepsis remains challenging in critically ill patients because early clinical signs are often nonspecific and may overlap with other causes of physiological deterioration in the ICU, contributing to delayed or miss diagnosis [6,7].

Critical care nurses play a pivotal role in the early identification of sepsis due to their continuous patient monitoring, close watching critically ill patients, and responsibility for detecting early physiological deterioration. They are often the first healthcare professionals to recognize subtle clinical changes such as altered vital signs and signs of organ dysfunction, enabling timely escalation of care [1,8]. Their role in implementing early sepsis screening tools and initiating protocol-based interventions is essential for improving patient outcomes and reducing sepsis-related morbidity and mortality [1,9]. Therefore, strengthening ICU nurses' competence in early recognition and rapid response is a key priority in critical care practice and patient safety initiatives [1,8].

Significance of the study

This study is particularly significant because it addresses a critical gap in understanding the determinants of early sepsis recognition among ICU nurses in the local context. By examining nurses' awareness, confidence in identifying and managing sepsis, and the barriers that hinder compliance with sepsis bundles, the findings can support targeted education, competency-based training, and improved workflow design. Furthermore, identifying institutional and system-level barriers can guide hospital leaders in strengthening policies, enhancing screening tools, and allocating resources more effectively. Ultimately, the results of this study have the potential to improve sepsis outcomes by promoting timely intervention, reducing preventable complications, and enhancing adherence to international standards of care. The findings may also contribute to broader quality improvement initiatives and inform nursing practice guidelines, making this research valuable for clinicians, educators, and healthcare administrators seeking to optimize critical care delivery.

Theoretical framework

This study is guided by the Knowledge–Attitude–Practice (KAP) framework proposed by Cabana et al. (1999) , which explains healthcare professionals' adherence to clinical practice guidelines. According to this framework, guideline compliance is influenced by clinicians' knowledge of the guideline, their attitudes toward its use, and perceived external barriers that may hinder implementation [9]. In the context of sepsis care, knowledge and awareness of early sepsis recognition and sepsis bundles are prerequisites for appropriate clinical decision-making. Attitudes, including nurses' confidence and perceived barriers, influence their willingness and ability to apply sepsis screening tools and bundle elements. Ultimately, these factors determine clinical practice, reflected in nurses' compliance with early sepsis screening and sepsis bundle implementation. Consistent with this framework, the present study examines the relationships between ICU nurses' awareness (knowledge and confidence), perceived barriers, and sepsis bundle compliance to provide a comprehensive understanding of factors influencing sepsis care in ICU settings.

Operational definitions

4.1. Awareness in healthcare refers to an individual's cognitive understanding and recognition of a clinical condition, including knowledge of its definition, risk factors, early signs, and appropriate responses, as well as the individual's perceived ability to act appropriately in practice [8].

4.2. Perceived barriers refer to an individual's subjective beliefs or perceptions of factors that hinder or prevent the performance of a specific behaviour, including personal, organizational, and system-related obstacles [6,8].

Study aim

To assess critical care nurses' (CCNs) awareness and Perceived Barriers Toward Early Sepsis Screening and bundle compliance

Research objectives

1. Assess critical care nurses' awareness of sepsis and confidence in identifying and managing septic patients

2. Identify perceived barriers reported by critical care nurses that hinder early sepsis screening and compliance with sepsis care bundles
3. Examine the relationship between critical care nurses' awareness and their confidence in identifying and managing patients with sepsis
4. Evaluate the relationship between critical care nurses' awareness of and confidence in early sepsis screening and bundle compliance, and their sociodemographic characteristics?

Research questions

1. What is the level of awareness among critical care nurses regarding early sepsis screening and sepsis bundle components?
2. What are the perceived barriers reported by critical care nurses that hinder early sepsis screening and compliance with sepsis care bundles?
3. Is there a relationship between critical care nurses' awareness and their confidence in identifying and managing patients with sepsis?
4. Do demographic and professional characteristics influence critical care nurses' awareness, confidence toward early sepsis screening, and bundle compliance?
5. Do demographic and professional characteristics influence ICU nurses' perceived barriers toward early sepsis screening and bundle compliance?

Methods

A descriptive cross-sectional study was conducted in this study

Setting

An online questionnaire was sent to the critical care department, which includes the medical ICU, surgical ICU, coronary care unit, and emergency department in King Fahad University Hospital (KFUH) in Khobar, Eastern Region, Saudi Arabia. In addition, social media platforms such as WhatsApp were used to distribute the questionnaire from March 2026 to May 2026

Sampling and Sampling methods:

An a priori power analysis was conducted using G*Power software (version 3.1.9.2) [10]. Based on a medium effect size ($d = 0.50$), a significance level of $\alpha = 0.05$, and statistical power of 0.95. The analysis indicated a minimum required sample size of 158 participants. To account for potential non-response, the target sample size was increased by 10%, resulting in an intended sample of approximately 176 nurses.

A non-probability convenience sampling approach was used. Registered nurses working in critical care settings were invited to participate through professional nursing networks and social media platforms. Data were collected using an online questionnaire.

A total of 176 nurses accessed the survey, of whom 109 completed the survey and met the eligibility criteria. Consequently, responses from 109 participants were included in the final analysis, corresponding to a completion rate of 61.93%.

Inclusion criteria:

- Registered or licensed nurses assigned to adult ICU shifts during the study period.
- Have ≥ 3 months of ICU work experience.
- Signed informed consent to participate in the study.

Exclusion Criteria:

- Nurses on extended or long-term leave during data collection.
- Nurses not providing direct bedside patient care (e.g., full-time nurse educators,

administrators).
- Intern nursing students.

Data Collection tools:

Data were collected using a structured self-administered online questionnaire adopted from Chua et al. (2022) [8] (the nurses' sepsis awareness, knowledge, and confidence questionnaire). The questionnaire consisted of 31 items and four sections [8,11].

Sociodemographic and Professional Characteristics

The first section included 10 items assessing participants' sociodemographic and professional characteristics, including age, nationality, educational level, job grade, years of experience, work area, previous sepsis training, and the availability of sepsis screening tools and protocols.

Sepsis Awareness and Knowledge

The second section assessed nurses' level of awareness and knowledge regarding sepsis using 15 multiple-choice knowledge-based questions, including direct questions and clinical case scenarios related to sepsis recognition, screening, and management [8].

The score of each question was assigned as follows:

Correct answer = score one

Incorrect answer = score zero

The cut point for "Good" is > 75% of the total score, "fair" is between 50% and less than 75% of the total score, and "poor" is less than 50 % of the total score. The higher scores reflected greater sepsis knowledge and awareness.

Confidence in Identifying and Managing Sepsis

The third section consisted of five statements and five Likert-scale items to evaluate nurses' confidence in identifying sepsis symptoms, performing clinical assessments, escalating concerns appropriately, monitoring patients with sepsis, and initiating early management. Responses ranged from strongly disagree score 1 to strongly agree score 5 and did not include any negative statement. The scale average score ranged from 5 to 25. The higher scores indicated greater confidence [8].

Perceived Barriers and Facilitators

Section four consisted of four questions adapted from Kissel et al. (2025) [11]. and was designed to explore nurses' perceived barriers and facilitators related to sepsis recognition and management in the workplace. Specifically, the questions examined: (1) factors influencing the identification of patients with sepsis or suspected sepsis, (2) facilitators that support the timely recognition of patients with sepsis or suspected sepsis, (3) barriers affecting the delivery of priority sepsis treatment interventions, and (4) facilitators that promote the effective implementation of priority sepsis treatment interventions within the workplace

Validity and Reliability

The original Nurses' Sepsis Awareness, Knowledge and Confidence Questionnaire was developed by Chua et al. (2022) [8]; the content face validity was assessed by a panel of seven experts comprising advanced practice nurses, a nursing academic, and an intensive care specialist. The item-level content validity index ranged from 0.86 to 1.00, while the scale-level content validity index was 1.00. The confidence scale demonstrated good

internal consistency, with a Cronbach's alpha coefficient of 0.87. Permission to use both instruments was obtained from the original authors.

The second survey instrument used in this study was adapted from a previously published questionnaire developed by Kissel et al. (2025) [11]; The original instrument was developed based on the Theoretical Domains Framework (TDF) and underwent face and content validity assessment by a multidisciplinary panel of experts, including intensive care nurses, physicians, researchers with expertise in implementation science, and nurse educators. In addition, end-user testing was conducted among critical care nurses to ensure clarity and relevance of the questionnaire items.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval for the study was obtained from the Institutional Review Board (IRB-PGS-2026-04-0102) at Imam Abdulrahman bin Faisal University (IAU). Participants were informed about the study's purpose, their right to withdraw at any time, the voluntary nature of participation, and the confidentiality of their responses. The consent form was obtained electronically before participants accessed the survey and provided detailed information on the risks and benefits of participation, confirming that involvement was entirely voluntary and that there was no potential harm.

Data Analysis

Statistical Package for the Social Sciences (SPSS v23) was used for data analysis. For the descriptive analysis of the data, frequency distribution tables, means, and standard deviations were computed. Normality of the data was assessed using the Shapiro-Wilk test before starting the inferential analysis. Insignificant results from the Shapiro-Wilk test indicated that the data were normally distributed; the parametric tests were used for inferential analysis. A one-way ANOVA was used to assess significant variation in average scores across categorical variables with more than two categories (e.g., age, job grade, experience). Two-sample Student's t-test was used to test any significant variation in the average scores in relation to the variables with two categories (like nationality, sepsis training, etc.). All p-values less than 0.05 were considered statistically significant.

Results

Participant Characteristics

Table 1 shows the sociodemographic characteristics and job-related data of the critical care nurses. It was found that 40 (36.7%) of participants were aged 26–30 years, 58 (54.2%) were non-Saudi, and more than half were staff nurses, 67 (61.5%). Approximately three-quarters held a bachelor's degree 81 (74.3%), and 99 (82.6%) worked in intensive care units. The same table revealed that more than half of participants didn't receive previous sepsis training 60 (55.0%), while 70 (64.2%) reported the availability of a sepsis screening tool and 79 (72.5%) reported the presence of a sepsis protocol within their workplace.

TABLE 1: Sociodemographic characteristics and job-related data of the critical care nurses (n=109)

Sociodemographic characteristics	Frequency (n=109)	Percentage %
Age		
21-25	9	8.3
26-30	40	36.7
31-35	26	23.9
36-40	21	19.3
41 and above	13	11.9
Nationality		
Saudi	49	45.8
Non-saudi	58	54.2
Job grade		

Staff nurse	67	61.5
Senior staff nurse	37	33.9
Nursing officer	5	4.6
Experience (years)		
Less than a year	4	3.7
1-2	12	11.0
3-5	34	31.2
6-10	30	27.5
11 and more	29	26.6
Qualification		
Diploma	18	16.5
Advance diploma	3	2.8
Bachelor's	81	74.3
Master	8	7.3
Department		
Intensive care	99	90.8
Emergency	10	9.2
Sepsis training		
Yes	49	45.0
No	60	55.0
Sepsis screening tool		
Yes	70	64.2
No	17	15.6
Unknown	22	20.2
Sepsis protocol		
Yes	79	72.5
No	19	17.4
Unknown	11	10.1

Level of knowledge among critical care nurses

The level of knowledge was computed through the percentage of correct answers by the participants, and it was found that 53.2%(n=58) had a fair level of knowledge, whereas 26.6%(n=29) had a good level of knowledge (Figure 1).

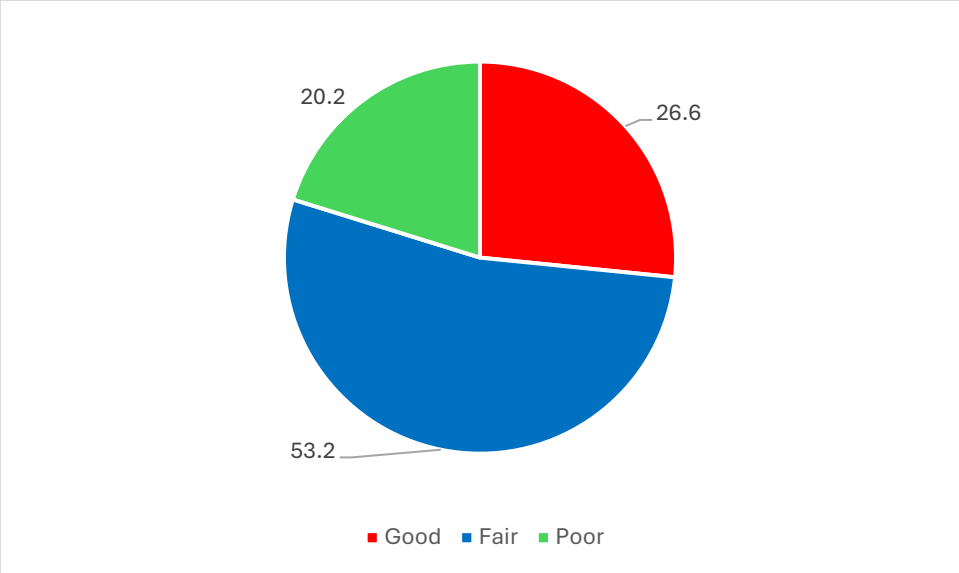


Figure 1: Level of knowledge among critical care nurses

Table 2: Describe the association between level of knowledge and sociodemographic characteristics. It was found that a significantly high proportion of critical care nurses, 20 (33.3%), who received sepsis training during the last year had a good level of knowledge about sepsis management compared to those who didn't receive sepsis training, 9 (18.4%) (P=0.028). In addition, those who were not aware of having sepsis screening tools were at a significantly high percentage with a poor level of knowledge (P=0.032).

TABLE 2: Association between level of knowledge and sociodemographic characteristics

Age	**Knowledge N(%)**		
	Good	**Fair**	**Poor**
21-25	4(44.4)	3(33.3)	2(22.2)
26-30	7(17.5)	20(50.0)	13(32.5)
31-35	8(30.8)	14(53.8)	4(15.4)
36-40	5(23.8)	15(71.4)	1(4.8)
41 and above	5(38.5)	6(46.2)	2(15.4)
P-value		**0.182**	
Nationality			
Saudi	14(28.6)	28(57.1)	7(14.3)
Non-Saudi	13(22.4)	30(51.7)	15(25.9)
P-value		**0.321**	
Job grade			
Staff nurse	14(20.9)	36(53.7)	17(25.4)
Senior staff nurse	12(32.4)	20(54.1)	5(13.5)
Nursing officer	3(60.0)	2(40.0)	0
P-value		**0.179**	
Experience (years)			
Less than a year	1(25.0)	1(25.0)	2(50.0)
1-2	4(33.3)	4(33.3)	4(33.3)
3-5	9(26.5)	16(47.1)	9(26.5)
6-10	5(16.7)	20(66.7)	5(16.7)
11 and more	10(34.5)	17(58.6)	2(6.9)
P-value		**0.197**	
Department			
Intensive care	26(26.3)	52(52.5)	21(21.2)
Emergency	3(30.0)	6(60.0)	1(10.0)
P-value		**0.702**	
Sepsis training			
Yes	20(33.3)	33(55.0)	7(11.7)
No	9(18.4)	25(51.0)	15(30.6)
P-value		**0.028***	
Sepsis screening tool			
Yes	20(28.6)	37(52.9)	13(18.6)
No	5(29.4)	12(70.6)	0
Unknown	4(18.2)	9(40.9)	9(40.9)
P-value		**0.032***	
Sepsis protocol			
Yes	23(29.1)	40(50.6)	16(20.3)
No	4(21.1)	12(63.2)	3(15.8)
Unknown	2(18.2)	6(54.5)	3(27.3)
P-value		**0.807**	

* Statistically significant at the 0.05 level of significance, one-way ANOVA, t- test used

Nurses' Confidence in Sepsis Identification and Management

Table 3 shows critical care nurses' confidence in identifying and managing sepsis. The majority of participants responded positively, with the highest level of agreement for the question "I know how and what to monitor in patients with sepsis," where 93 (85.3%) of participants either agreed or strongly agreed with the statement. Similarly, the lowest agreement was for the question "I am competent in performing clinical assessment of patients with suspected sepsis," with 84 (77%) agreeing with the statement. Moreover, the total confidence score was computed by summing up the scores of all five questions. The total possible score varied between 5 and 25, and a higher score means a higher confidence level. Therefore, the average score for confidence questions was 19.5(±3.4).

TABLE 3: Critical care nurses' confidence in identifying and managing sepsis

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Mean(SD)
I am confident in identifying symptoms of sepsis	4(3.7)	0	19(17.4)	65(59.6)	21(19.3)	3.9(0.83)
I am competent in performing clinical assessment of patients with suspected sepsis	3(2.8)	1(0.9)	21(19.3)	70(64.2)	14(12.8)	3.8(0.76)
I know when to escalate to the doctor when i identify patients with sepsis	3(2.8)	1(0.9)	16(14.7)	71(65.1)	18(16.5)	3.9(0.78)
I know how and what to monitor in patients with sepsis	3(2.8)	1(0.9)	12(11.0)	69(63.3)	24(22.0)	4.0(0.79)
I know the initial management of patients with sepsis	5(4.6)	1(0.9)	16(62.0)	67(62.0)	19(17.6)	3.9(0.88)

Relationship between knowledge, confidence, and their sociodemographic characteristics.

Table 4. Analyses the relationship between critical care nurses' knowledge, confidence, and their sociodemographic characteristics. It was found that the availability of a sepsis screening tool was significantly associated with greater confidence in the initial management of patients with sepsis ($p = 0.039$). Nurses who reported access to a screening tool demonstrated higher confidence scores than those who reported no tool or were unsure of its availability. The same table revealed that no significant relationship was observed between screening tool availability and other confidence-related items.

TABLE 4: Relationship between knowledge, confidence, and their sociodemographic characteristics.

Age	Knowledge	Confidence
21-25	9.4(3.0)	19.6(3.1)
26-30	8.9(3.0)	18.4(4.2)
31-35	9.6(2.5)	20.3(2.6)
36-40	10.4(2.1)	19.8(2.7)
41 and above	9.9(2.3)	20.6(2.1)
P-value	**0.346**	**0.278**
Nationality		
Saudi	9.9(2.3)	19.6(3.7)
Non-Saudi	9.1(2.8)	19.4(3.2)
P-value	**0.09**	**0.59**
Job grade		
Staff nurse	9.2(2.7)	19.2(2.6)
Senior staff nurse	9.9(2.5)	19.9(4.5)
Nursing officer	11.2(2.6)	20.6(1.9)

P-value	**0.175**	**0.062**
Experience (years)		
Less than a year	8.5(4.6)	18.0(2.7)
1-2	9.2(2.4)	19.5(2.5)
3-5	9.4(3.3)	19.4(2.3)
6-10	9.5(2.1)	18.9(4.9)
11 and more	10.1(2.3)	20.4(2.6)
P-value	**0.658**	**0.212**
Department		
Intensive care	9.4(2.7)	19.2(3.3)
Emergency	10.5(2.3)	21.6(3.0)
P-value	**0.028***	**0.283**
Sepsis training		
Yes	9.0(2.6)	20.2(3.2)
No	10.0(2.7)	18.9(3.4)
P-value	**0.078**	**0.047***
Sepsis screening tool		
Yes	9.8(2.6)	20.0(3.1)
No	10.0(1.7)	18.5(4.5)
Unknown	8.4(3.3)	18.6(2.7)
P-value	**0.081**	**0.029***
Sepsis protocol		
Yes	9.7(2.8)	19.6(3.5)
No	9.5(2.0)	19.4(3.1)
Unknown	8.6(2.8)	18.8(3.2)
P-value	**0.491**	**0.266**

*Statistically significant at 0.05 level of significance; one-way ANOVA, t- test used

Perceived Barriers and Facilitators to Sepsis Screening and Bundle Compliance

Table 5. summarizes critical care nurses' perceived barriers and facilitators related to sepsis screening and compliance with sepsis bundles, along with their associations with sociodemographic characteristics. The most reported barrier to early sepsis screening was high workload (50.8%), followed by staffing shortages (44.1%) and limited knowledge of updated guidelines (32.2%). Continuous education was identified as the primary facilitator for improving sepsis recognition and bundle implementation (64.4%), with clear clinical protocols (55.9%) and standardized screening tools (50.0%) also noted as important. Nearly half of the participants (49.2%) considered standardized protocols the best strategy to enhance sepsis management. Analysis revealed significant associations between perceived barriers and sociodemographic factors. A higher proportion of Saudi nurses reported high workload and limited knowledge compared to non-Saudis ($p = 0.027$ and $p = 0.001$, respectively). Nurses with over six years of experience noted protocol availability issues ($p = 0.022$), while those without recent sepsis training cited workload as a barrier ($p = 0.012$). Lastly, supportive leadership was more frequently reported by nurses aged 36–40 ($p = 0.028$).

TABLE 5: Critical care nurses' perceived barriers and facilitators along with their associations with sociodemographic characteristics

Demographic data	**Organization supports**		**Sepsis barriers**		**Sepsis identification Facilitator's**		**Facilitators in the sepsis bundle implementation**	
Age	Providing continuous education	Clear protocol	High workload	Limited knowledge	Ongoing education	Standardized screening tools	Standardized protocols	Supportive leadership
21-25	6(66.7)	3(33.3)	5(55.6)	4(44.4)	5(55.6)	6(66.7)	3(33.3)	3(33.3)

26-30	24(60.0)	20(50.0)	24(60.0)	12(30.0)	16(40.0)	13(32.5)	20(50.0)	8(20.0)
31-35	18(69.2)	18(69.2)	8(30.8)	10(38.5)	13(50.0)	9(34.6)	13(50.0)	5(19.2)
36-40	16(76.2)	15(71.4)	14(66.7)	8(38.1)	13(61.9)	11(52.4)	16(76.2)	12(57.1)
41 and above	12(92.3)	10(76.9)	9(69.2)	4(30.8)	10(76.9)	9(69.2)	6(46.2)	4(30.8)
P-value	**0.249**	**0.093**	**0.066**	**0.891**	**0.168**	**0.063**	**0.170**	**0.028***
Nationality								
Saudi	38(77.6)	34(69.4)	32(65.3)	26(53.1)	20(59.2)	19(38.8)	28(57.1)	16(32.7)
Non-saudi	36(62.1)	32(55.2)	26(44.8)	12(20.7)	26(44.8)	28(48.3)	30(51.7)	15(25.9)
P-value	**0.096**	**0.164**	**0.027***	**0.001***	**0.175**	**0.337**	**0.697**	**0.523**
Experience (years)								
Less than a year	1(25.0)	1(25.0)	2(50.0)	2(50.0)	2(50.0)	2(50.0)	3(75.0)	2(50.0)
1-2	9(75.0)	5(41.7)	7(58.3)	3(25.0)	6(50.0)	7(58.3)	5(41.7)	3(25.0)
3-5	22(64.7)	16(47.1)	18(52.9)	13(38.2)	15(44.1)	12(35.3)	16(74.1)	8(23.5)
6-10	20(66.7)	22(73.3)	15(50.0)	9(30.0)	12(40.0)	10(33.3)	16(53.3)	7(23.3)
11 and more	24(82.8)	22(75.9)	18(62.1)	11(37.9)	22(75.9)	17(58.6)	18(62.1)	12(41.4)
P-value	**0.146**	**0.022***	**0.903**	**0.823**	**0.056**	**0.199**	**0.586**	**0.401**
Sepsis training								
Yes	32(65.3)	30(61.2)	20(40.8)	17(34.7)	28(57.1)	20(40.8)	24(49.0)	18(36.7)
No	44(73.3)	36(60.0)	40(66.7)	21(35.0)	29(48.3)	28(46.7)	34(56.7)	14(23.3)
P-value	**0.406**	**1.00**	**0.012***	**1.00**	**0.441**	**0.566**	**0.446**	**0.143**
Sepsis screening tool								
Yes	49(70.0)	41(58.6)	38(54.3)	23(32.9)	42(60.0)	37(52.9)	38(54.3)	22(31.4)
No	12(70.6)	11(64.7)	6(35.3)	5(29.4)	6(35.3)	4(23.5)	9(52.9)	4(23.5)
Unknown	15(68.5)	14(63.4)	16(72.7)	10(45.5)	9(40.9)	7(31.8)	11(50.0)	6(27.3)
P-value	**0.983**	**0.850**	**0.065**	**0.488**	**0.092**	**0.04***	**0.940**	**0.791**
Sepsis protocol								
Yes	54(68.4)	47(59.5)	45(57.0)	22(27.8)	43(54.4)	41(51.9)	43(54.4)	25(31.6)
No	12(63.2)	12(63.2)	8(42.1)	9(47.4)	10(52.6)	5(26.3)	11(57.9)	4(21.1)
Unknown	10(90.9)	7(63.6)	7(63.6)	7(63.6)	4(36.4)	2(18.2)	4(36.4)	3(27.3)
P-value	**0.247**	**0.935**	**0.421**	**0.030***	**0.531**	**0.025***	**0.480**	**0.652**

***** Statistically significant at 0.05 level of significance, one-way ANOVA, t- test used

Discussion

This cross-sectional study investigated critical care nurses (CCNs) across various hospitals in the Eastern Province to evaluate their awareness of sepsis, their confidence in recognizing and treating patients with sepsis, and the perceived obstacles to early sepsis screening and compliance with sepsis bundles.

The present study found that critical care nurses demonstrated moderate levels of sepsis awareness (mean knowledge score = 9.54 ± 2.7), with more than half of participants (53.2%) demonstrating fair knowledge and only 26.6% demonstrating good knowledge. This finding is comparable to that reported by Chua et al. [9] in Singapore, where nurses demonstrated moderate sepsis knowledge (mean score = 10.56 ± 2.01 out of 15). Likewise, Alsulami et al. [12]in Saudi Arabia found that although nurses maintained satisfactory knowledge regarding sepsis recognition and management, important knowledge gaps remained in several aspects of sepsis care. These findings reveals while awareness of sepsis among critical care nurses is generally acceptable, opportunities remain to strengthen knowledge related to early recognition and evidence-based management of sepsis.

In the present study, no significant associations were observed between age, nationality, years of experience, or awareness of sepsis protocols and levels of knowledge and confidence. These findings suggest that sepsis knowledge was relatively similar across most demographic and professional groups within the study sample. In contrast, the study found a significant association between clinical department and sepsis awareness ($p = 0.028$), with emergency department nurses demonstrating higher knowledge scores than intensive care unit nurses. This may be due to the frequent involvement of emergency nurses in the initial assessment and triage of patients with suspected infection, which increases their exposure to early sepsis recognition and management. The finding is partially consistent with the study conducted by Chua et al. [9], which reported differences in sepsis knowledge across clinical practice areas, with higher levels observed among nurses working in acute care settings in relation to sepsis assessment and management.

The findings of this study reveal that critical care nurses who received sepsis-related training demonstrated significantly higher confidence levels than those who had not received training ($p = 0.047$). This finding supports previous evidence highlighting the value of continuing professional education in strengthening nurses' preparedness to recognise and manage sepsis. Similarly, Elsayed et al. [13] reported that targeted educational programmes improved nurses' knowledge and self-reported sepsis management practices. Taken together, these findings reinforce the importance of ongoing sepsis-focused education as a strategy to enhance clinical confidence and support evidence-based practice.

The study results found the availability of sepsis screening tools was significantly associated with higher confidence levels ($p = 0.029$). This aligned with the multi-site study conducted in Singapore by Chua et al. [8], which reported higher confidence levels among nurses who participated in recent sepsis education and training activities. Similarly, Edwards and Jones (2021) in Wales [14], reported that nurses who didn't receive sepsis training demonstrated significantly greater confidence in sepsis screening and management compared with untrained nurses. These findings highlight the important role of ongoing sepsis-focused education in strengthening nurses' confidence and preparedness to recognise and manage patients with sepsis.

The current study finding the perceived barriers, high workload was the most frequently reported barrier (50.8%), followed by staffing shortages (44.1%), limited knowledge of updated guidelines (32.2%), and delayed laboratory results (28.0%). These findings are similar to the study from Jordan reported by Bani Hamad et al. [15], which identified insufficient staffing, lack of time, and limited resources as major barriers to implementing sepsis management guidelines in acute care settings. Also similar to the, Alshammari et al. [16] finding reported that staffing constraints, competing clinical priorities, and workflow-related challenges negatively influenced nurses' adherence to sepsis guidelines. The persistence of these barriers suggests that improving sepsis care requires more than educational initiatives alone. Organisational strategies aimed at strengthening workforce capacity, improving workflow efficiency, ensuring timely access to diagnostic resources, and supporting

adherence to updated clinical guidelines are equally important for enhancing sepsis screening and bundle compliance.

The present study identified significant associations between demographic and professional characteristics and perceived barriers and facilitators to early sepsis recognition among critical care nurses. These findings highlight the multifactorial nature of sepsis care delivery, where both individual and organizational factors interact to influence clinical practice.

Concerning critical care nurses' nationality was significantly associated with key perceived barriers, where Saudi nurses reported higher levels of high workload (65.3% vs 44.8%, $p = 0.027$) and limited knowledge (53.1% vs 20.7%, $p = 0.001$) compared to non-Saudi nurses. These findings may reflect variations in clinical exposure, staffing allocation, or differences in orientation and continuing education systems. Similar patterns have been reported by a study conducted by Liu et al. [5], which identified workload burden and knowledge deficits as major determinants of delayed sepsis recognition in critical care environments, particularly in resource-constrained or high-acuity settings.

Regarding the critical care nurses' years of experience were significantly associated with perception of a clear protocol as a barrier ($p = 0.022$), with nurses having more than 6 years of experience reporting greater concerns. This may indicate that experienced nurses are more critically aware of gaps or inconsistencies in institutional protocols, or that protocols may not be uniformly implemented across units. In contrast, Edwards and Jones [14] reported that experienced nurses generally demonstrate higher confidence in applying structured protocols, suggesting that institutional variability in protocol implementation may explain differences across settings.

In relation to sepsis training was significantly associated with perceived high workload ($p = 0.012$), where nurses without recent training reported greater workload-related barriers. This finding is aligned with the study conducted by Kim et al. [17], which demonstrated that structured sepsis training programs improve clinical efficiency and enhance early recognition, thereby reducing perceived workload burden through improved decision-making and workflow organization.

Implications for Clinical Practice

Continuing professional development activities enhance both awareness and confidence. The findings of this study have important implications for nursing practice and healthcare organizations. Regular evidence-based sepsis education programs should be integrated into healthcare organizations should also ensure the availability of standardized sepsis screening tools and clear clinical protocols across critical care settings.

Addressing workload-related challenges and staffing shortages may further improve nurses' ability to perform timely assessments and adhere to sepsis bundle recommendations. Furthermore, emerging technologies such as electronic sepsis alerts and artificial intelligence-supported clinical decision systems may offer additional opportunities to support early sepsis recognition and improve outcomes.

Limitations

This study has several limitations. The cross-sectional design limits the ability to establish causal relationships between sepsis awareness, confidence, and perceived barriers. The use of convenience sampling and online recruitment may have bias, as nurses with a greater interest in sepsis-related topics may have been more likely to participate. Also, participants were recruited from critical care settings across Eastern Saudi Arabia; the findings cannot fully generalise to nurses working in other regions or healthcare systems. Finally, the study assessed perceived confidence and barriers rather than objective clinical performance or actual sepsis bundle compliance in practice.

Recommendations

Based on the findings of this study, several recommendations can be made. First, healthcare institutions should provide competency-based training programmes and regular sepsis education as nurses who had received sepsis-related training reported significantly higher confidence levels in identifying and managing patients with sepsis.

Second, hospitals should increase the availability and utilisation of standardised sepsis screening tools and clinical decision-support systems. The present study demonstrated that access to sepsis screening tools was associated with significantly higher confidence levels among nurses, highlighting the value of structured assessment pathways in supporting timely recognition and intervention.

Third, organisational barriers identified in this study, including high workload and staffing shortages, Adequate staffing levels will improve nurses' ability to perform timely assessments, monitor clinical deterioration, and adhere to sepsis bundle requirements, particularly in critical areas

Organizational strategies aimed at reducing delays in laboratory investigations and improving internal communication may facilitate more timely sepsis diagnosis and treatment initiation. At last, future research should incorporate larger multicentre samples and longitudinal designs to evaluate changes in sepsis awareness and confidence over time and to examine the impact of educational and organisational interventions on actual sepsis bundle compliance and patient outcomes.

Conclusions

The findings suggest that sepsis-focused education, standardised screening tools, and organisational support may help address perceived barriers to early sepsis recognition. Further studies are needed to assess actual bundle compliance and clinical outcomes.

List of abbreviations

CCN: Critical care nurse; ICU: Intensive care unit; KAP: Knowledge–Attitude–Practice; SOFA: Sequential Organ Failure Assessment; SPSS: Statistical Package for the Social Sciences.

Declarations

Consent for publication

Not applicable.

Availability of data and materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to appropriate ethical and institutional approval.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

YA contributed to the study conceptualization, methodology development, data collection, data analysis, manuscript drafting, critical review, editing, and revision of the manuscript. FK participated in study conceptualization, data collection, data analysis, literature review, manuscript drafting, review, editing, and revision. HS was responsible for data collection, literature review, manuscript review, editing, and revision. RA contributed to the discussion section as well as manuscript review and editing. AA and FA assisted with data collection. All authors reviewed, approved, and agreed to the final version of the manuscript.

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