

Assessment of Level of Knowledge of Sepsis Among Nursing Students

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ABSTRACT

Background: Sepsis is a life-threatening organ dysfunction resulting from a dysregulated host response to infection. Early recognition is important in nursing practice, yet knowledge among undergraduate nursing students remains incompletely characterized in Pakistan. **Objective:** To assess sepsis knowledge among nursing students during the early stages of a Bachelor of Science in Nursing programme. **Methods:** A descriptive cross-sectional study included 160 full-time female second- and fourth-semester BSN students at the College of Nursing, University of Child Health Sciences, Lahore. Participants were selected using simple random sampling from a sampling frame of 273 students. Data were collected using the Determinants of Sepsis Knowledge questionnaire and analysed descriptively using frequencies and percentages. **Results:** Overall, 89.4% had heard of sepsis. Correct responses varied substantially across knowledge items: 68.1% recognized the need for immediate emergency response, whereas only 21.9% correctly rejected sepsis as an intense allergic reaction and 17.5% correctly rejected the assertion that it is specifically caused by multidrug-resistant hospital organisms. Chills and fever were recognized by 85.0%, shortness of breath by 66.3%, and tachycardia by 64.4%, compared with 48.1% for disorientation and 45.0% for hypotension. Aggregate item-level accuracy was 40.6% for general sepsis knowledge and 51.9% for symptom recognition. **Conclusion:** Students demonstrated high awareness but heterogeneous item-level knowledge, with important deficiencies in conceptual understanding, causation, epidemiology, and recognition of selected manifestations. **Keywords:** Sepsis; Knowledge; Nursing Students; Undergraduate Nursing Education; Symptom Recognition; Pakistan.

INTRODUCTION

Sepsis is a major clinical and public-health problem characterized by life-threatening organ dysfunction resulting from a dysregulated host response to infection (1). Infection may be caused by bacterial, viral, fungal, or other pathogenic microorganisms, and the host normally responds through coordinated innate and adaptive immune mechanisms. In sepsis, however, the response to infection becomes dysregulated and may produce widespread inflammatory, immune, endothelial, circulatory, and metabolic disturbances that compromise tissue perfusion and organ function. The Sepsis-3 consensus distinguishes sepsis from uncomplicated infection and defines septic shock as a more severe subset characterized by profound circulatory and metabolic abnormalities. Clinically, septic shock is identified by a requirement for vasopressors to maintain a mean arterial pressure of at least 65 mmHg together with a serum lactate concentration greater than 2 mmol/L despite adequate volume resuscitation (1).

The global burden of sepsis remains substantial. An analysis conducted for the Global Burden of Disease Study estimated approximately 48.9 million incident cases of sepsis and 11.0 million sepsis-related deaths worldwide in 2017, accounting for almost one-fifth of all global deaths (2). The burden is

disproportionately concentrated in regions with fewer healthcare resources and demonstrates the importance of early recognition, timely escalation, infection prevention, and appropriate management. Sepsis can affect individuals of any age, although vulnerability is particularly increased among neonates, older adults, people with impaired immunity, patients with severe underlying illnesses, and individuals exposed to invasive procedures or serious infections (3-4).

The clinical presentation of sepsis is heterogeneous and cannot be reduced to a single defining symptom. Patients may demonstrate fever or hypothermia, tachycardia, tachypnoea or shortness of breath, hypotension, altered mental status, chills, reduced tissue perfusion, and other manifestations associated with infection and organ dysfunction. The rapid progression of the condition makes early recognition particularly important. The Sepsis-3 consensus introduced the quick Sequential Organ Failure Assessment (qSOFA) criteria—altered mentation, systolic blood pressure of 100 mmHg or less, and respiratory rate of at least 22 breaths/minute—as bedside indicators associated with an increased risk of poor outcomes among adults with suspected infection outside the intensive care unit (1). These criteria should be understood in the context of clinical assessment rather than as a stand-alone diagnostic definition of sepsis (5-6).

Nurses have a central role in identifying clinical deterioration because they maintain frequent and sustained contact with hospitalized patients, monitor vital signs, assess changes in consciousness and respiratory or circulatory status, and communicate deterioration to the wider clinical team. Consequently, adequate knowledge of the definition, causes, warning manifestations, severity, and urgency of sepsis is an important component of nursing competence. Evidence from practising nurses indicates that knowledge is not consistently optimal. In a multi-site cross-sectional study of 709 registered nurses, Chua et al. found only moderate overall knowledge of sepsis and reported that knowledge was associated with educational level, job grade, and clinical work area (3). The findings reinforce the importance of structured sepsis education and repeated clinical exposure in strengthening recognition and response (5).

The development of appropriate sepsis knowledge should therefore begin during undergraduate nursing education rather than after entry into professional practice. Nursing students are expected to integrate theoretical knowledge with clinical assessment skills as they progress through training; however, studies have demonstrated important deficiencies in their understanding of sepsis. Valičević et al. assessed 618 undergraduate nursing students in Croatia using the Determinants of Sepsis Knowledge questionnaire and found that students in later academic years and employed students generally demonstrated better knowledge than students in earlier years and those without employment experience (4). These findings suggest that both progression through the curriculum and exposure to clinical practice may contribute to the development of sepsis-related knowledge (6-9).

Similar concerns have been identified in other educational settings. Roye-Green et al. evaluated 292 medical and nursing students in Jamaica and found substantial gaps in knowledge of sepsis recognition and management, although performance improved among students who had received formal sepsis education or had progressed to later stages of training. Almost all respondents considered additional sepsis training necessary, emphasizing that knowledge deficits remain relevant even within formal healthcare education programmes (5). Collectively, these studies indicate that awareness of the term sepsis does not necessarily correspond to accurate understanding of its pathophysiology, causes, epidemiological burden, clinical manifestations, or required urgency of response.

Measurement of such knowledge also requires distinction between simple awareness and more detailed conceptual understanding. Eitze et al. developed the Determinants of Sepsis Knowledge questionnaire to evaluate familiarity with sepsis together with knowledge of its causes, symptoms, epidemiological importance, and prevention-related concepts (6). Subsequent application of this approach among undergraduate nursing students demonstrated its usefulness in identifying specific misconceptions that may not be apparent from a simple question asking whether a student has previously heard of sepsis (4).

Item-level assessment is particularly useful in an educational context because it identifies the specific concepts for which additional teaching may be required.

Evidence concerning sepsis knowledge among nursing students has predominantly originated from countries outside Pakistan. Differences in undergraduate curricula, clinical exposure, educational resources, simulation opportunities, and healthcare environments limit the direct transferability of findings from international student populations. Within Pakistan, evidence describing sepsis knowledge among students during the early stages of undergraduate nursing education remains limited. Establishing the pattern of correct responses, misconceptions, and uncertainty at this stage may provide useful baseline information for nursing educators and may help identify areas in which sepsis-related theoretical and simulation-based education can be strengthened.

The present study therefore aimed to assess knowledge of sepsis among second- and fourth-semester Bachelor of Science in Nursing students at the College of Nursing, University of Child Health Sciences, Lahore. Specifically, the study evaluated students' awareness of sepsis and their item-level knowledge concerning its conceptual basis, causes, epidemiological importance, urgency, and clinical symptoms. The research question was: What is the level and pattern of knowledge of sepsis among nursing students during the early stages of the BSN programme?

MATERIALS AND METHODS

A descriptive quantitative cross-sectional study was conducted to assess knowledge of sepsis among undergraduate nursing students at a single point in their academic training. The study was carried out at the College of Nursing, University of Child Health Sciences, Lahore, Pakistan, during the overall research period from July 2025 to June 2026. The College provides undergraduate nursing education through classroom instruction and clinical training and includes lecture facilities, laboratory and simulation facilities, library resources, and computer-based learning facilities.

The target population consisted of full-time Bachelor of Science in Nursing students enrolled in the second and fourth semesters at the College of Nursing. These academic groups represented students in the early stages of the undergraduate nursing programme and constituted the population from which participants were selected. All students in the eligible cohorts were female. Students were eligible if they were enrolled as full-time second- or fourth-semester BSN students during the study period. Students who were on leave during the period of data collection were excluded.

The sampling frame consisted of 273 eligible second- and fourth-semester students from the relevant morning and evening batches. A simple random sampling technique was used. Each eligible student was assigned a unique identification number from 1 to 273, after which participants were selected using a lottery method. Only students selected through this procedure were approached for participation. A target sample of 160 participants was determined using OpenEpi on the basis of a finite target population of 273 students, a 95% confidence level, and a 5% margin of error. A total of 160 students subsequently participated in the study and constituted the analytical sample.

Data were collected using a structured, self-administered questionnaire derived from the Determinants of Sepsis Knowledge instrument originally developed by Eitze et al. to assess awareness and detailed knowledge of sepsis (6). The instrument has subsequently been used to evaluate sepsis knowledge among undergraduate nursing students (4). The questionnaire used in the present study contained four components. The first collected demographic information, including age, gender, semester of study, and study status. The second contained two awareness-related items preceding the knowledge assessment. The third comprised nine items assessing knowledge of sepsis, including its urgency, conceptual basis, causes, diagnostic misconceptions, and epidemiological comparisons. The fourth comprised seven items assessing recognition of symptoms associated with sepsis. Responses to knowledge and symptom items

were recorded using categorical response options that allowed participants to indicate an affirmative response, a negative response, or uncertainty, according to the individual item.

For analytical purposes, sepsis knowledge was operationalized as the pattern of correct, incorrect, and unsure responses to the individual questionnaire items. Correct responses were identified according to the scoring key of the questionnaire. The study therefore assessed item-level knowledge across conceptual, etiological, epidemiological, urgency-related, and symptom-recognition domains rather than assigning participants to an unsupported overall category such as “good,” “moderate,” or “poor” knowledge. The two preliminary awareness items were analysed separately from the principal knowledge and symptom-recognition items (10-12).

Following institutional ethical and administrative approval, the selected students were approached during periods that did not interfere with scheduled teaching activities. The researchers explained the purpose of the study, the voluntary nature of participation, and the measures used to protect anonymity and confidentiality. Written informed consent was obtained before participation. Printed questionnaires were then distributed to consenting students and completed individually. Data were collected directly from the selected participants during available lecture-break or free-class periods. Participation was voluntary, and students retained the right to withdraw from the study without penalty. Information collected through the questionnaires was used solely for research purposes.

Several procedures were used to promote methodological consistency. Probability-based selection from a defined sampling frame was used to reduce avoidable selection bias within the eligible student population. All participants completed the same structured questionnaire under a standardized self-administered format, and the same eligibility criteria and recruitment procedure were applied to both semester groups. Use of an established sepsis-knowledge instrument also facilitated comparison of the item-level findings with previous nursing-student research using the same conceptual framework (4,6).

Data were analysed using IBM SPSS Statistics version 27.0. The analysis was primarily descriptive because the stated objective was to characterize the existing pattern of sepsis knowledge within the sampled nursing-student population. Categorical variables, including demographic characteristics, awareness responses, sepsis-knowledge responses, and symptom-recognition responses, were summarized using frequencies and percentages. Percentages were calculated using the relevant valid denominator for each item. Item-specific missing responses were retained as missing rather than being treated as correct or incorrect responses. No causal interpretation was made because of the cross-sectional design.

The study was undertaken after approval from the relevant institutional review process and administrative permission from the College of Nursing. Participants received verbal and written information about the study before providing written informed consent. Participation was voluntary, confidentiality of participant information was maintained, and the collected information was used only for the purposes of the research. Participants were informed that they could withdraw from the study at any stage without adverse consequences.

RESULTS

A total of 160 undergraduate nursing students were included in the analysis. Results are presented according to participant characteristics, awareness of sepsis, knowledge of sepsis, and recognition of sepsis-related symptoms. Categorical variables are reported as frequencies and percentages. Percentages were calculated using the corresponding valid denominator.

The participants were predominantly young nursing students. Of the 160 participants, 78 (48.8%) were aged 18–20 years, another 78 (48.8%) were aged 21–23 years, and 4 (2.5%) were aged 24–26 years. All participants were female and enrolled as full-time students. Seventy-five students (46.9%) were enrolled in the second semester and 85 (53.1%) were enrolled in the fourth semester.

Table 1. Demographic Characteristics of Participants (N = 160)

Characteristic	Category	n (%)
Age, years	18–20	78 (48.8)
	21–23	78 (48.8)
	24–26	4 (2.5)
Gender	Female	160 (100.0)
Semester	Second semester	75 (46.9)
	Fourth semester	85 (53.1)
Study status	Full-time	160 (100.0)

The age distribution was almost equally divided between the 18–20-year and 21–23-year groups, while only a small proportion of students were aged 24–26 years. Fourth-semester students constituted a slightly larger proportion of the sample than second-semester students.

Most participants had previously heard the term sepsis. Specifically, 143 students (89.4%) reported awareness of the term, whereas 17 (10.6%) had not heard of it. Knowledge concerning the availability of a vaccine specifically for sepsis was considerably less certain. Only 41 students (25.6%) correctly recognized that there is no single vaccine specifically against sepsis, while 56 (35.0%) responded incorrectly and 63 (39.4%) were unsure.

Table 2. Awareness Items Preceding the Sepsis Knowledge Assessment (N = 160)

Awareness item	Response	n (%)
Had previously heard of sepsis	Yes	143 (89.4)
	No	17 (10.6)
Recognition that there is no single vaccine specifically for sepsis	Correct	41 (25.6)
	Incorrect	56 (35.0)
	Unsure	63 (39.4)

These findings demonstrate a marked difference between familiarity with the term sepsis and more specific knowledge about the condition. Although nearly nine in ten students had heard of sepsis, approximately three-quarters either answered the vaccine-related item incorrectly or were unsure.

Knowledge varied substantially across the nine sepsis-related items. The highest proportion of correct responses was observed for the statement describing sepsis as an intense immune response of the body, which was answered correctly by 111 students (69.4%). Recognition of sepsis as requiring an immediate emergency response was also relatively high, with 109 participants (68.1%) answering correctly. Ninety-three students (58.1%) correctly recognized that sepsis may arise in association with lung inflammation, whereas 69 (43.1%) correctly identified influenza as a possible precipitating infection.

Important misconceptions were identified in several conceptual and epidemiological items. Only 35 students (21.9%) correctly rejected the statement that sepsis is an intense allergic reaction, while 105 (65.6%) incorrectly accepted this statement. Similarly, only 28 participants (17.5%) correctly rejected the assertion that sepsis is caused specifically by multidrug-resistant hospital organisms, making this the item with the lowest correct-response proportion. Only 45 students (28.1%) correctly rejected the belief that sepsis can be diagnosed by a red line extending from a wound toward the heart.

Knowledge of the epidemiological burden of sepsis was also limited. Forty-six participants (28.8%) correctly rejected the statement that mortality following heart attack is higher than mortality associated with sepsis, while 48 (30.0%) correctly rejected the statement that breast cancer occurs more frequently than sepsis.

Table 3. Item-Level Knowledge of Sepsis

Sepsis knowledge item	Correct n (%)	Incorrect n (%)	Unsure n (%)
Immediate emergency response is required in sepsis	109 (68.1)	32 (20.0)	19 (11.9)
Sepsis is an intense allergic reaction	35 (21.9)	105 (65.6)	20 (12.5)
Sepsis involves an intense/dysregulated immune response	111 (69.4)	23 (14.4)	24 (15.0)
Sepsis is caused specifically by multidrug-resistant hospital organisms	28 (17.5)	81 (50.6)	51 (31.9)
Sepsis can be diagnosed by a red line extending from a wound toward the heart	45 (28.1)	72 (45.0)	43 (26.9)

Sepsis knowledge item	Correct n (%)	Incorrect n (%)	Unsure n (%)
Mortality after heart attack is higher than mortality after sepsis	46 (28.8)	78 (48.8)	36 (22.5)
Breast cancer cases are more frequent than sepsis cases	48 (30.0)	76 (47.5)	36 (22.5)
Sepsis can occur in association with lung inflammation/infection	93 (58.1)	32 (20.0)	35 (21.9)
Sepsis can occur in association with influenza	69 (43.1)	39 (24.4)	52 (32.5)

Values are based on N = 160 except for the item concerning the immune response, for which 158 responses could be classified as correct, incorrect, or unsure. One additional response was recorded under an anomalous response code and one response was missing.

Across the nine knowledge items, 584 correct responses were recorded among 1,438 classifiable item responses, corresponding to an aggregate item-level accuracy of 40.6%. This aggregate percentage represents the proportion of correctly answered questionnaire items across the sample and should not be interpreted as an individual participant knowledge score or as a validated classification of overall knowledge.

The response pattern demonstrated that students were comparatively more successful in identifying the urgency of sepsis and its relationship with the immune response than in distinguishing sepsis from unrelated conditions, understanding its possible infectious causes, and estimating its epidemiological burden. Uncertainty was particularly evident for whether sepsis could occur following influenza (32.5%) and whether it is specifically caused by multidrug-resistant hospital organisms (31.9%).

Recognition of symptoms also varied considerably. Chills and fever were the most frequently recognized manifestations, correctly identified by 136 students (85.0%). Shortness of breath was correctly identified by 106 participants (66.3%), while 103 (64.4%) correctly recognized an elevated heart rate.

Recognition of clinically important manifestations related to neurological and circulatory deterioration was lower. Disorientation was correctly identified by 77 students (48.1%), and low blood pressure was recognized by 72 (45.0%). Almost one-third of participants (29.4%) were unsure whether low blood pressure was associated with sepsis.

Performance was weakest on items requiring participants to exclude symptoms that were not designated as sepsis manifestations in the questionnaire scoring key. Only 54 students (33.8%) correctly rejected diarrhea as a sepsis symptom, while 62 (38.8%) incorrectly identified it as a symptom. Skin rash and eczema showed the largest misconception: only 33 students (20.6%) correctly rejected them, whereas 100 (62.5%) identified them as symptoms of sepsis.

Table 4. Knowledge of Symptoms of Sepsis (N = 160)

Symptom item	Correct n (%)	Incorrect n (%)	Unsure n (%)
Chills and fever	136 (85.0)	12 (7.5)	12 (7.5)
Disorientation	77 (48.1)	52 (32.5)	31 (19.4)
Shortness of breath	106 (66.3)	33 (20.6)	21 (13.1)
High heart rate	103 (64.4)	27 (16.9)	30 (18.8)
Low blood pressure	72 (45.0)	41 (25.6)	47 (29.4)
Diarrhea	54 (33.8)	62 (38.8)	44 (27.5)
Skin rash and eczema	33 (20.6)	100 (62.5)	27 (16.9)

Across the seven symptom-recognition items, 581 of 1,120 responses were correct, corresponding to an aggregate item-level accuracy of 51.9%. Correct recognition was substantially higher for fever/chills, shortness of breath, and tachycardia than for disorientation and hypotension. The response pattern also showed considerable difficulty distinguishing manifestations included in the questionnaire scoring key from unrelated symptoms, particularly skin rash/eczema and diarrhea.

Overall, the results demonstrated high awareness of the term sepsis but heterogeneous item-level knowledge. Students showed comparatively stronger recognition of emergency response requirements and several common manifestations, while notable deficiencies remained in conceptual differentiation,

etiological understanding, epidemiological knowledge, recognition of hypotension and disorientation, and exclusion of unrelated symptoms.

DISCUSSION

The present study assessed sepsis knowledge among 160 second- and fourth-semester undergraduate nursing students at the College of Nursing, University of Child Health Sciences, Lahore. The principal finding was a clear contrast between familiarity with the term sepsis and accurate understanding of the condition. Although 89.4% of participants had previously heard of sepsis, knowledge across individual conceptual, etiological, epidemiological, and symptom-recognition items was heterogeneous. Aggregate item-level accuracy was 40.6% across the nine general sepsis-knowledge items and 51.9% across the seven symptom-recognition items. These values represent the proportion of correctly answered questionnaire items rather than validated participant-level knowledge scores. Students demonstrated comparatively stronger recognition of the urgency of sepsis, its association with an immune response, fever and chills, shortness of breath, and tachycardia, while important deficiencies were observed in differentiating sepsis from an allergic reaction, understanding its infectious causes, appreciating its epidemiological burden, and recognizing disorientation and hypotension (2, 13).

The distinction between awareness and accurate conceptual knowledge is consistent with previous research using the same or related instruments. Valičević et al. evaluated 618 undergraduate nursing students in Croatia and found that knowledge differed according to academic year and employment status, with students in later years and those who were employed generally demonstrating higher proportions of correct responses (4). Similarly, a subsequent European study involving 626 nursing students from Croatia, Cyprus, and Greece identified differences in sepsis knowledge between educational settings and reported that knowledge remained incomplete across student populations (7). These findings support the interpretation that having encountered the term sepsis does not necessarily indicate mastery of its underlying clinical concepts (14-16).

One of the most notable misconceptions in the present study concerned the nature of sepsis. Although 69.4% correctly recognized its relationship with an intense or dysregulated immune response, only 21.9% correctly rejected the statement that sepsis is an intense allergic reaction. This combination suggests that students may recognize elements of the inflammatory or immune response without clearly distinguishing sepsis from other immune-mediated conditions. Such conceptual discrimination is important because contemporary definitions characterize sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection rather than an allergic disorder (1). Undergraduate teaching should therefore emphasize not only memorization of the definition but also the distinction between infection, host response, organ dysfunction, allergy, and other systemic inflammatory conditions (11).

Knowledge of the causes of sepsis also showed substantial variation. Only 17.5% correctly rejected the proposition that sepsis is specifically caused by multidrug-resistant hospital organisms, whereas 58.1% recognized that it may occur in association with pulmonary infection and 43.1% recognized influenza as a possible precipitating infection. The response pattern suggests that some students may conceptualize sepsis primarily as a hospital-acquired complication involving resistant bacteria rather than as a syndrome that can develop from a range of community- or healthcare-associated infections. The original Determinants of Sepsis Knowledge research similarly demonstrated that awareness of the term did not necessarily correspond to accurate knowledge of sepsis causes and epidemiology (6). From an educational perspective, students should understand that antimicrobial resistance may complicate the management of infection but is not a defining prerequisite for sepsis (11-13).

A further misconception concerned the belief that a red line extending from a wound toward the heart can diagnose sepsis. Only 28.1% correctly rejected this statement, whereas 45.0% accepted it and 26.9% were unsure. This finding indicates difficulty differentiating visible manifestations of localized or

spreading infection from the systemic syndrome of sepsis. The persistence of such misconceptions is important because early recognition requires synthesis of infection-related history with evidence of physiological deterioration and organ dysfunction rather than reliance on a single visible sign. Similar misconceptions have been examined in studies using the Determinants of Sepsis Knowledge instrument, reinforcing the usefulness of directly addressing incorrect lay concepts during formal education (4,6).

The students also demonstrated limited knowledge of the epidemiological importance of sepsis. Only 28.8% correctly rejected the statement that mortality after heart attack is higher than mortality associated with sepsis, and 30.0% correctly rejected the statement that breast cancer occurs more frequently than sepsis. Although these questionnaire items do not measure students' knowledge of exact incidence or mortality estimates, they indicate under-recognition of the relative burden of sepsis. This is noteworthy because global estimates have demonstrated that sepsis contributes substantially to worldwide morbidity and mortality (2). Roye-Green et al. similarly found limited epidemiological knowledge among healthcare students in Jamaica, while respondents overwhelmingly expressed a desire for additional sepsis training (5).

Recognition of the need for urgent escalation was comparatively stronger. More than two-thirds of participants correctly identified that sepsis requires an immediate emergency response. This represents an important element of awareness because delayed recognition and escalation can contribute to deterioration. Nevertheless, recognizing urgency in principle does not establish that a student can identify sepsis accurately in clinical practice. Harley et al. found that final-year Australian nursing students had limited overall knowledge of sepsis despite being considerably further advanced in their education, and only a minority recalled receiving dedicated formal sepsis education (8). Their findings indicate that progression through nursing education alone may not guarantee adequate sepsis competence unless the topic is explicitly incorporated into teaching and clinical preparation. The Australian study was published in *Nurse Education Today*, volume 97, in February 2021.

Symptom recognition in the present study was strongest for chills and fever, which were correctly identified by 85.0% of participants. Shortness of breath and elevated heart rate were correctly recognized by 66.3% and 64.4%, respectively. These findings indicate comparatively greater familiarity with overt physiological manifestations commonly associated with systemic infection. Similar patterns have been observed among nursing students internationally, with fever and other readily observable physiological changes generally being better recognized than manifestations requiring integration of neurological or circulatory deterioration (4,7).

More clinically important gaps emerged for disorientation and hypotension. Only 48.1% recognized disorientation and 45.0% recognized low blood pressure. These manifestations are particularly relevant because altered mentation and low systolic blood pressure form part of the bedside qSOFA criteria used to identify adults with suspected infection who may be at increased risk of poor outcomes (1). Failure to associate changes in mental status or haemodynamic instability with sepsis may therefore limit a student's ability to recognize deterioration when the presentation is not dominated by fever or other obvious signs. These findings reinforce the need for undergraduate education to connect pathophysiology with bedside observations rather than teaching signs and symptoms as isolated facts.

The pattern is also consistent with evidence from practising nurses. Chua et al. reported moderate sepsis knowledge among 709 registered nurses and found that educational level, job grade, and clinical work area were associated with knowledge performance (3). Owaidh Alsulami et al., using a modified version of the Determinants of Sepsis Knowledge questionnaire among 286 nurses in Saudi Arabia, likewise demonstrated variation in understanding of sepsis causes and symptoms across participant characteristics (9). Rababa et al. reported deficiencies in knowledge, practice, and decision-making relating to sepsis among critical-care nurses in Jordan and highlighted the importance of educational interventions directed at recognition and management (10). Together, these findings indicate that

knowledge deficiencies identified during undergraduate education may remain relevant after qualification unless reinforced by structured education and clinical experience.

The greatest symptom-related misconception in the present study concerned skin rash and eczema. Only 20.6% correctly rejected these as symptoms according to the questionnaire scoring key, whereas 62.5% incorrectly selected them. Diarrhea also showed considerable uncertainty, with only 33.8% providing the response designated as correct by the instrument. These findings should be interpreted specifically as performance on the validated questionnaire items rather than as evidence that individual symptoms can never occur in patients who are septic. Clinical presentations depend on the underlying infection, patient characteristics, and associated disease processes. The educational implication is therefore not simply to memorize an exclusive list of symptoms, but to understand the distinction between manifestations that raise concern for systemic deterioration and symptoms that may instead reflect the source or accompanying illness.

The present findings have several implications for undergraduate nursing education. The observed combination of high nominal awareness and inconsistent conceptual accuracy suggests that sepsis education should progress beyond definition-based teaching. Structured learning could emphasize recognition of infection-associated deterioration, differentiation of sepsis from common misconceptions, interpretation of changes in consciousness and blood pressure, and appropriate escalation of care. Evidence from nursing-student studies indicates that knowledge generally improves with academic progression, clinical exposure, and dedicated sepsis education (4,7,8). Simulation-based clinical scenarios may be particularly useful because they require students to integrate vital signs, neurological status, infection history, and deterioration rather than recognize isolated textbook statements.

The timing of such education may also be important. Participants in the present study were second- and fourth-semester students and therefore represented relatively early stages of the BSN programme. Their response patterns provide a baseline description of knowledge before completion of advanced undergraduate clinical education. The study did not directly compare knowledge between the two semester groups; therefore, no conclusion can be drawn from these data regarding improvement between semesters. Future analysis using participant-level data could determine whether academic progression within this population is associated with higher item-level or composite knowledge, provided that scoring is undertaken according to a defensible instrument framework.

This study has several strengths. It addresses an under-investigated educational topic among nursing students in Pakistan and uses an established questionnaire previously applied in sepsis-knowledge research. Probability-based selection from a defined sampling frame also strengthened recruitment within the eligible student population. The item-level approach identified specific misconceptions that would be concealed by reporting awareness alone and provides actionable information regarding topics requiring greater educational emphasis.

Several limitations should also be considered. The study was conducted at a single nursing institution, which limits generalizability to students enrolled in other universities or nursing programmes in Pakistan. All participants were female and full-time students, and the findings therefore cannot be assumed to represent male students, part-time students, or nursing students with substantial prior healthcare employment. The cross-sectional design captures knowledge at one point in training and cannot determine whether knowledge improves longitudinally or whether educational exposure causes differences in performance. The analysis was descriptive, and participant-level comparisons between semesters were not available in the analysed results. In addition, the study assessed questionnaire knowledge rather than observed clinical recognition, escalation behaviour, or management competence; consequently, the findings should not be interpreted as direct evidence of actual bedside performance (4, 7, 13).

Further multicentre research involving nursing institutions from different regions of Pakistan would improve representativeness and permit evaluation of curricular and institutional variation. Longitudinal studies could examine changes in sepsis knowledge as students progress through academic and clinical training. Intervention studies could also evaluate whether structured lectures, simulation-based education, case-based learning, or combined educational approaches improve knowledge retention and clinical recognition. Future work would additionally benefit from validated participant-level scoring and analysis of associations between knowledge and academic stage, prior sepsis education, and clinical exposure.

Overall, the present study demonstrates that early-stage undergraduate nursing students were generally familiar with the term sepsis but displayed substantial variability in item-level knowledge. Recognition of fever, chills, shortness of breath, tachycardia, and the urgency of sepsis was comparatively strong, whereas important deficiencies were identified in conceptual differentiation, causation, epidemiological understanding, recognition of disorientation and hypotension, and exclusion of several non-target symptoms. These findings identify specific educational domains that can be addressed during subsequent undergraduate nursing training.

Among second- and fourth-semester BSN students, awareness of the term sepsis was high, but accurate knowledge varied substantially across conceptual, etiological, epidemiological, and symptom-recognition items. Students demonstrated comparatively stronger recognition of the urgency of sepsis and of fever, chills, shortness of breath, and tachycardia, while important deficiencies were evident in distinguishing sepsis from an allergic reaction, understanding its possible causes and burden, recognizing disorientation and hypotension, and excluding several non-target symptoms. These findings identify specific areas in which structured sepsis education during undergraduate nursing training may strengthen students' knowledge and preparation for later clinical learning.

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