# How Much Nursing Students Know about Sepsis? – A Cross Sectional Study

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## Abstract

**Introduction.** Understanding sepsis is essential for its early detection and prompt treatment. Education on sepsis should begin during training, making it important to evaluate students' knowledge. This research aimed to build on a previous study by exploring the level of sepsis knowledge among undergraduate nursing students and analyzing differences across academic years and study formats.

**Methods.** This cross-sectional study involved 419 nursing students from the University of Applied Health Sciences in Zagreb, Croatia. Participants included students from all three academic years, as well as both full-time and part-time (employed) nursing students. Data collection utilized a modified version of the sepsis knowledge questionnaire created by Eitze et al., while demographic details such as gender, age, employment status, and academic year were also recorded. The data were analyzed using SPSS (IBM, Version 25.0), employing the Chi-square test to assess statistical significance.

**Results.** Statistically significant differences were found in the percentage of third-year students providing correct answers related to sepsis knowledge when compared to first- and second-year students. Additionally, employed students demonstrated a significantly higher number of correct responses regarding the causes and symptoms of sepsis compared to their non-employed peers.

**Conclusions.** The capacity of nursing students to recognize and respond to a patient's deterioration due to sepsis highlights the urgent need for comprehensive sepsis education. Our results indicate the need for greater integration of sepsis-related topics into the core nursing curriculum, particularly emphasizing practical training and simulation exercises to enhance early detection and management of sepsis.

## Introduction

According to the latest definition, sepsis is described as a life-threatening organ dysfunction caused by the body's inadequate response to infection (1). Based on the most recent data, there were 48.9 million sepsis cases globally in 2017, leading to 11 million deaths. The World Health Organization states that prevention, appropriate diagnosis, and treatment are crucial in improving mortality rates (2). Today, sepsis is becoming more common in general wards, making it essential for nursing students to acquire adequate knowledge of sepsis and how to recognize it during their studies. The available literature indicates that coverage of sepsis in undergraduate nursing programs is often ineffective and inadequate (3).

Higher education in Croatia is organized through university and professional study programmes, which are equivalent to colleges or universities in the United States. Professional programmes provide students with the necessary level of knowledge and skills for applied professions, facilitating their direct integration into the workforce. The undergraduate nursing programmes last for three years, and after completion students are awarded the title "Bachelor of Nursing". Subsequently, graduates may choose to pursue a two-year graduate programme. Students have the option to study nursing on a full-time or part-time basis. Education on sepsis is integrated throughout each year of study in various courses (4).

Stefaniet et al. report that 60.8% of their respondents were educated about the early detection of sepsis; however, they noted that knowledge about sepsis itself is scarce, as almost no one knew its definition (5).

Harley and colleagues assessed the knowledge of final-year nursing students at four Australian universities, finding that 86.1% of respondents correctly identified sepsis symptoms, and nearly half (44.7%) emphasized the importance of starting treatment early (6).

Research by Nakiganda and colleagues on knowledge of guidelines for treating and recognizing sepsis revealed that only 30% of nurses had heard of sepsis treatment guidelines, and were unfamiliar with their content (7).

At a medical centre in Chicago, Illinois, sepsis screening is conducted by nurses. During the implementation of the screening, it was observed that the nurses lacked general knowledge of sepsis, revealing deficiencies in the curriculum and nursing education related to this topic. The research led to the development and implementation of educational interventions, including simulation exercises and a sepsis course (8). Valičević and colleagues' research also found that nursing students had poor knowledge of sepsis (9), while Harley emphasized the importance of incorporating sepsis into the curriculum in Australia to enable comprehensive education for nurses, promoting early recognition of sepsis (6).

Evaluating the knowledge levels of undergraduate nursing students is crucial, as it indicates their preparedness for future roles in the healthcare system postgraduation, highlighting its increasing relevance. This study aimed to investigate the extent of sepsis knowledge among undergraduate nursing students and to analyze variations across different academic years and study formats. The importance of this research is rooted in assessing the effectiveness of the educational materials offered to students throughout their academic progression.

This study builds upon the previous research by Valičević et al., titled "Knowledge of Sepsis in Nursing Students – A Cross-Sectional Study" (9).

## Methods

### Participants and Procedure

A cross-sectional study was conducted at the University of Applied Health Sciences in Zagreb from September 2022 to September 2023. The study included 419 nursing students from all three years of the undergraduate program, encompassing both part-time students (who were employed in the healthcare sector) and full-time students. Participation was voluntary, and informed consent was obtained from all the participants. Before administering the surveys, the university's teaching staff briefed the students on the study's objectives and purpose.

## Instrument

For this study, demographic data (including gender, age, employment status, and year of study) and a questionnaire provided by Eitze et al. (10) were used. The questionnaire comprised five demographic questions, two questions related to awareness items preceding the knowledge scale, nine questions on knowledge of sepsis, and seven questions on knowledge of the symptoms of sepsis. The respondents answered the sepsis-related questions with "yes," "no," or "unsure." The questionnaire was administered in Croatian and underwent a double-blind translation process.

## Data Analysis

The data was analyzed using SPSS software (IBM, Version 25.0) (11). For categorical (nominal) variables, the results were presented as frequencies and percentages. The Chi-square test was employed to determine the statistical significance between the variables.

## Ethics

The study adhered to the principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of the University of Applied Health Sciences in Zagreb (Class: 602-03/22-18/540, Reg. No. 251-379-10-22-02, dated 1 September 2022). Participation was completely voluntary, and all participants provided informed consent.

## Results

The sample consisted of 419 undergraduate nursing students across all three academic years, including 369 (88.1%) females and 50 (11.9%) males. A more detailed description of the sample can be found in Graph 1.

Table 1 illustrates the number and percentage of respondents who provided correct, incorrect, or unsure responses to questions about sepsis. First-year students had significantly fewer correct answers regarding the statement, "Sepsis can be caused by lung inflammation", in comparison to second- and third-year students. Additionally, knowledge about the statement "Sepsis can be caused by influenza" improved with advancing years of study, with third-year students demonstrating a significantly higher level of understanding compared to first-year students.

Table 3 results indicate that first-year students showed the lowest level of knowledge about sepsis symptoms on several questions. In their answers to the questions "*Are chills and fever symptoms of sepsis?*" and "*Is a high heart rate a symptom of sepsis?*" there were significantly fewer correct answers among first-year students compared to second-year students. Additionally, their answers to the questions "*Is disorientation a symptom of sepsis?*" and "*Is shortness of breath a symptom of sepsis?*" demon-
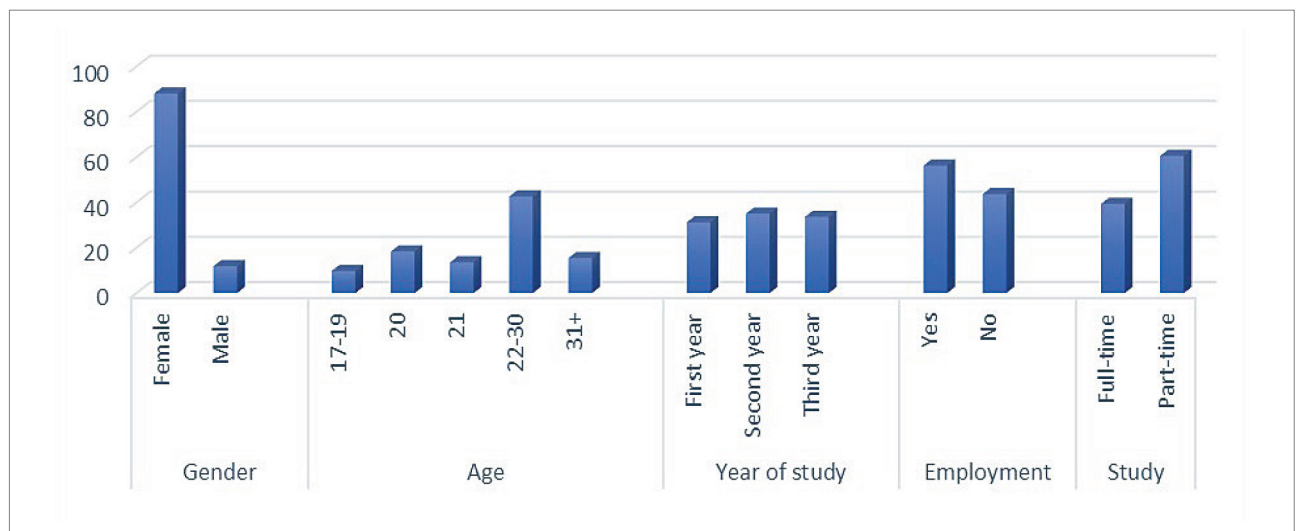


Graph 1. **Respondents' demographic data**

| Table 1. **Distribution of Students' Correct Responses to "Knowledge of Sepsis" by Year of Study** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Year of study** | | | | | |
| | | **First year** | | **Second year** | | **Third year** | *p* |
| | | **N** | **%** | **n** | **%** | **n** | **%** | |
| With sepsis, you must call the emergency services immediately. | Incorrect or unsure | 18 | 13.7 | 21 | 14.3 | 21 | 14.9% | 0.964 |
| | Correct | 113 | 86.3 | 126 | 85.7 | 120 | 85.1% | |
| Sepsis is an intense allergic reaction. | Incorrect or unsure | 26 | 19.8 | 18 | 12.2 | 22 | 15.6 | 0.221 |
| | Correct | 105 | 80.2 | 129 | 87.8 | 119 | 84.4 | |
| Sepsis is an intense immune response of the body. | Incorrect or unsure | 43 | 32.8 | 31 | 21.1 | 32 | 22.7 | 0.055 |
| | Correct | 88 | 67.2 | 116 | 78.9 | 109 | 77.3 | |
| Sepsis is caused by multidrug-resistant superbugs in hospitals. | Incorrect or unsure | 13 | 9.9 | 16 | 10.9 | 11 | 7.8 | 0.662 |
| | Correct | 118 | 90.1 | 131 | 89.1 | 130 | 92.2 | |
| Sepsis can be diagnosed by a red line infiltrating from a wound up to the heart. | Incorrect or unsure | 116 | 88.5 | 118 | 80.3 | 114 | 80.9 | 0.128 |
| | Correct | 15 | 11.5 | 29 | 19.7 | 27 | 19.1 | |
| Mortality after heart attacks is higher than mortality after sepsis. | Incorrect or unsure | 98 | 74.8 | 109 | 74.1 | 103 | 73 | 0.945 |
| | Correct | 33 | 25. | 38 | 25.9 | 38 | 27 | |
| There are more cases of breast cancer than cases of sepsis. | Incorrect or unsure | 92 | 70.2 | 94 | 63.9 | 90 | 63.8 | 0.447 |
| | Correct | 39 | 29.8 | 53 | 36.1 | 51 | 36.2 | |
| Sepsis can be caused by lung inflammation. | Incorrect or unsure | 56 | 42.7 | 34 | 23.1 | 41 | 29.1 | **0.002** |
| | Correct | 75 | 57.3 | 113 | 76.9 | 100 | 70.9 | |
| Sepsis can be caused by influenza. | Incorrect or unsure | 89 | 67.9 | 85 | 57.8 | 70 | 49.6 | **0.009** |
| | Correct | 42 | 32.1 | 62 | 42.2 | 71 | 50.4 | |

strated a significantly lower level of knowledge than both second and third-year students.

Employed students answered questions concerning disorientation, shortness of breath, and low blood pressure as symptoms of sepsis more accurately, as shown in Table 4.

## Discussion

Following the previous research, the teaching staff at the faculty were informed about the results and the need for enhanced education on sepsis by sharing published article. In our study, students' knowledge of sepsis was assessed. There was a difference in sepsis knowledge among students who were not employed and among those who were at the beginning of their education (Table 3). Students who were at the beginning of their education showed a lower level of knowledge than third-year students. This

**Table 2. Distribution of Students' Correct Responses to "Knowledge of Sepsis" Based on Employment Status**

| | | Employment | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | Yes | | No | | p |
| | | n | % | n | % | |
| With sepsis, you must call the emergency services immediately. | Incorrect or unsure | 40 | 16.9 | 20 | 10.9 | 0.081 |
| | Correct | 196 | 83.1 | 163 | 89.1 | |
| Sepsis is an intense allergic reaction. | Incorrect or unsure | 32 | 13.6 | 34 | 18.6 | 0.162 |
| | Correct | 204 | 86.4 | 149 | 81.4 | |
| Sepsis is an intense immune response of the body. | Incorrect or unsure | 57 | 24.2 | 49 | 26.8 | 0.540 |
| | Correct | 179 | 75.8 | 134 | 73.2 | |
| Sepsis is caused by multidrug-resistant superbugs in hospitals. | Incorrect or unsure | 18 | 7.6 | 22 | 12 | 0.129 |
| | Correct | 218 | 92.4 | 161 | 88 | |
| Sepsis can be diagnosed by a red line infiltrating from a wound up to the heart. | Incorrect or unsure | 183 | 77.5 | 165 | 90.2 | **0.001** |
| | Correct | 53 | 22.5 | 18 | 9.8 | |
| Mortality after heart attacks is higher than mortality after sepsis. | Incorrect or unsure | 175 | 74.2 | 135 | 73.8 | 0.930 |
| | Correct | 61 | 25.8 | 48 | 26.2 | |
| There are more cases of breast cancer than cases of sepsis. | Incorrect or unsure | 151 | 64 | 125 | 68.3 | 0.355 |
| | Correct | 85 | 36 | 58 | 31.7 | |
| Sepsis can be caused by lung inflammation. | Incorrect or unsure | 58 | 24.6 | 73 | 39.9 | **0.001** |
| | Correct | 178 | 75.4 | 110 | 60.1 | |
| Sepsis can be caused by influenza. | Incorrect or unsure | 121 | 51.3 | 123 | 67.2 | **0.001** |
| | Correct | 115 | 48.7 | 60 | 32.8 | |

**Table 3. Distribution of Students' Correct Responses to "Knowledge of the Symptoms of Sepsis" by Year of Study**

| | | Year of study | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | First year | | Second year | | Third year | | p |
| | | N | % | n | % | n | % | |
| Are chills and fever symptoms of sepsis? | Incorrect or unsure | 24 | 18.3 | 11 | 7.5 | 14 | 9.9 | **0.014** |
| | Correct | 107 | 81.7 | 136 | 92.5 | 127 | 90.1 | |
| Is disorientation a symptom of sepsis? | Incorrect or unsure | 48 | 36.6 | 30 | 20.4 | 32 | 22.7 | **0.004** |
| | Correct | 83 | 63.4 | 117 | 79.6 | 109 | 77.3 | |
| Is shortness of breath a symptom of sepsis? | Incorrect or unsure | 83 | 63.4 | 65 | 44.2 | 66 | 46.8 | **0.003** |
| | Correct | 48 | 36.6 | 82 | 55.8 | 75 | 53.2 | |
| Is a high heart rate a symptom of sepsis? | Incorrect or unsure | 32 | 24.4 | 13 | 8.8 | 28 | 19.9 | **0.002** |
| | Correct | 99 | 75.6 | 134 | 91.2 | 113 | 80.1 | |
| Is low blood pressure a symptom of sepsis? | Incorrect or unsure | 62 | 47.3 | 56 | 38.1 | 53 | 37.6 | 0.187 |
| | Correct | 69 | 52.7 | 91 | 61.9 | 88 | 62.4 | |
| Is diarrhoea a symptom of sepsis? | Incorrect or unsure | 91 | 69.5 | 95 | 64.6 | 91 | 64.5 | 0.619 |
| | Correct | 40 | 30.5 | 52 | 35.4 | 50 | 35.5 | |
| Are a skin rash and eczema symptoms of sepsis? | Incorrect or unsure | 83 | 63.4 | 83 | 56.5 | 92 | 65.2 | 0.272 |
| | Correct | 48 | 36.6 | 64 | 43.5 | 49 | 34.8 | |

**Table 4. Distribution of Students' Correct Responses to "Knowledge of the Symptoms of Sepsis" Based on Employment Status**

| | | Employment | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | Yes | | No | | p |
| | | n | % | n | % | |
| Are chills and fever symptoms of sepsis? | Incorrect or unsure | 22 | 9.3 | 27 | 14.8 | 0.086 |
| | Correct | 214 | 90.7 | 156 | 85.2 | |
| Is disorientation a symptom of sepsis? | Incorrect or unsure | 44 | 18.6 | 66 | 36.1 | **<0.001** |
| | Correct | 192 | 81.4 | 117 | 63.9 | |
| Is shortness of breath a symptom of sepsis? | Incorrect or unsure | 106 | 44.9 | 108 | 59 | **0.004** |
| | Correct | 130 | 55.1 | 75 | 41 | |
| Is a high heart rate a symptom of sepsis? | Incorrect or unsure | 35 | 14.8 | 38 | 20.8 | 0.112 |
| | Correct | 201 | 85.2 | 145 | 79.2 | |
| Is low blood pressure a symptom of sepsis? | Incorrect or unsure | 82 | 34.7 | 89 | 48.6 | **0.004** |
| | Correct | 154 | 65.3 | 94 | 51.4 | |
| Is diarrhoea a symptom of sepsis? | Incorrect or unsure | 153 | 64.8 | 124 | 67.8 | 0.530 |
| | Correct | 83 | 35.2 | 59 | 32.2 | |
| Are a skin rash and eczema symptoms of sepsis? | Incorrect or unsure | 148 | 62.7 | 110 | 60.1 | 0.587 |
| | Correct | 88 | 37.3 | 73 | 39.9 | |

highlights the significance of education during the academic journey.

Our findings are in line with earlier research of Valicevic et al., although it is challenging to make direct comparisons due to variations in the sepsis knowledge questionnaires utilized and differences in the ward settings across different studies (9).

Similar results were obtained in the Harley (6) study on Australian students, where there was also less knowledge in first-year students than final-year students. For example, 36.6% of first-year respondents answered the question "*Is shortness of breath a symptom of sepsis*?" correctly, while 53.2% of third-year students provided a correct answer.

In the Tilton study (12), the majority of the respondents (60%) were familiar with the definition of sepsis: "a host's uncontrolled systemic inflammatory response to an infection". In our study, when asked "Is sepsis an intense immune response of the body?", more than 80% of respondents in each year answered the question correctly.

According to research findings by Chua (13), nursing job grade (*p*>0.001), education level (*p*<0.001) and clinical work area (*p*<0.001) were identified as sig-

nificant predictors of nurses' knowledge of sepsis. As in our study, employed students demonstrated better knowledge than unemployed ones.

Significant improvement in the level of knowledge of sepsis is visible on several items compared to the previous research wave of Valicevic et al.: "*With sepsis, you must call the emergency services immediately*", "*Sepsis is caused by multidrug-resistant superbugs in hospitals*", "*There are more cases of breast cancer than cases of sepsis*" and "*Sepsis can be caused by lung inflammation*". However, there were fewer correct associations with the statement "*Sepsis can be diagnosed by a red line infiltrating from a wound up to the heart*" than in 2020 (9).

Knowledge of sepsis symptoms was significantly better than 2020 in most of the evaluated items: "*Are chills and fever symptoms of sepsis?*", "*Is disorientation a symptom of sepsis?*", "*Is shortness of breath a symptom of sepsis?*", "*Is a high heart rate a symptom of sepsis?*", "*Is low blood pressure a symptom of sepsis?*". There were fewer correct answers to the question of whether diarrhoea is a symptom of sepsis than there were in 2020.

The importance of early recognition and treatment of patients with sepsis cannot be overstated. There-

fore, it is crucial to raise awareness and understanding of sepsis in healthcare workers and students. To achieve this, students need to be educated and trained to recognize sepsis promptly, focusing on early diagnosis and treatment (14).

Nurses play a crucial role in patient assessment and care. Therefore, the importance of education during nursing studies must be emphasized to enable students to develop appropriate skills and knowledge. While refining and improving knowledge and skills is ideally done in a clinical setting at the patient's bedside, this is often challenging to implement in practice. More educational institutions are conducting simulations (15). Learning through simulation and play is frequently positively evaluated and accepted by students during their training, as they find it facilitates knowledge acquisition and ensures practice in a safe environment. Learning through play or simulation is considered a more effective approach than traditional lecture-based or e-learning methods (16). Technological advances are enabling knowledge and skills development through online platforms. The increasing use of three-dimensional computer simulations presents real-life situations in a computerized environment, providing users with the impression of being in a specific situation (15). This type of simulation ensures a safe learning environment without risks for patients, and it is flexible, allowing different approaches for each patient. Research conducted by Adhikari and colleagues (15) focusing on a sepsis-related simulation indicated an increase in self-confidence and a reduction in anxiety in both nurses and students when identifying clinical deterioration due to sepsis (15).

We would like to emphasize the importance of education-related interventions to conduct proper assessments of septic patients. Nursing students should better understand sepsis guidelines and use tools for early detection. Furthermore, educational institutions should implement teaching strategies that facilitate students' acquisition of knowledge, attitudes, and skills (15,17). This research once again highlights the need for education of nurses about sepsis.

## Study limitations

Geographical Limitation: This study was carried out at a single institution, the University of Applied Health Sciences in Zagreb, which may restrict the generalizability of the findings to nursing students across Croatia. Including multiple institutions could provide a broader understanding of sepsis knowledge.

Gender imbalance: As is common in nursing programs, the majority of the sample consisted of female students (88.1%). While this reflects the gender distribution in the nursing profession, it limits the study's ability to explore potential gender differences in sepsis knowledge.

## Conclusion

Sepsis is a leading cause of mortality and long-term complications in patients. Early recognition of its symptoms, combined with appropriate therapeutic interventions, is crucial for improving patient outcomes. The ability of nursing students to swiftly detect and respond to patient deterioration due to sepsis is vital, highlighting the need for thorough sepsis education. Our study evaluated the sepsis knowledge among undergraduate nursing students, identifying an overall gap in their ability to recognize, understand, and manage sepsis. The results also showed an improvement in sepsis knowledge in later academic years, along with a significant difference between full-time and part-time (employed) students. Considering the scarcity of global research on this topic, there is a pressing need for further studies and educational initiatives that prepare nursing students to provide effective and timely care for sepsis patients. The authors advocate for greater inclusion of sepsis-related material in nursing curricula, covering both theoretical knowledge and hands-on clinical and simulation training.

## Acknowledgments

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# KOLIKO STUDENTI SESTRINSTVA ZNAJU O SEPSI? – PRESJEČNO ISTRAŽIVANJE

## Sažetak

**Uvod**. Razumijevanje sepse ključno je za njezino rano otkrivanje i brzo liječenje. Edukacija o sepsi trebala bi započeti tijekom obrazovanja, stoga je važno vrednovati znanje studenata. Ovo istraživanje imalo je za cilj unaprjeđenje prethodne studije istražujući razinu znanja o sepsi među studentima prijediplomskog studija sestrinstva i analizirajući razlike između studijskih godina i vrsta studija.

**Metode**. Ovo presječno istraživanje uključilo je 419 studenata sestrinstva sa Zdravstvenog veleučilišta u Zagrebu u Hrvatskoj. Sudionici su bili studenti svih triju studijskih godina, kao i redovni i izvanredni (zaposleni) studenti sestrinstva. Za prikupljanje podataka primijenjena je modificirana verzija upitnika znanja o sepsi koju su izradili Eitze i sur., dok su također zabilježeni demografski podaci kao što su spol, dob, status zaposlenja i studijska godina. Podaci su analizirani primjenom SPSS-a (IBM, verzija 25.0) te primjenom hi-kvadrat testa za procjenu statističke značajnosti.

**Rezultati**. Utvrđene su statistički značajne razlike u postotku studenata treće godine koji su dali točne odgovore o znanju o sepsi u odnosu na studente prve i druge godine. Dodatno, zaposleni studenti pokazali su znatno veći broj točnih odgovora o uzrocima i simptomima sepse u odnosu na svoje vršnjake koji nisu zaposleni.

**Zaključci**. Sposobnost studenata sestrinstva da prepoznaju i odgovore na pogoršanje pacijenta uslijed sepse naglašava hitnu potrebu za sveobuhvatnim obrazovanjem o sepsi. Naši rezultati ukazuju na potrebu za većom integracijom tema povezanih sa sepsom u temeljni kurikulum sestrinstva, posebno naglašavajući praktičnu obuku i simulacijske vježbe za poboljšanje ranog otkrivanja i liječenja sepse.

**Ključne riječi:** sepsa, znanje, studenti sestrinstva