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Evaluation of Sepsis Teaching for Medical and Dental Students at a British University

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**Evaluation of Sepsis Teaching for Medical and Dental Students at a British
University**

Accepted Article

Abstract

Aim: The aim of this study was to evaluate sepsis on undergraduate programmes in medicine (BMBS), dentistry (BDS) and dental therapy (BScDTH) at a university in England.

Methods: The study was carried at the Faculty of Health, University of Plymouth. Questionnaires consisting of a series of closed and open-ended items were designed for students and faculty by a group of academics. Following a pilot, participants were invited to complete the questionnaires online. Data collection and analyses were completed over a period of three months.

Results: A total of 71 students responded, including 43 were on the BDS programme, 21 on BMBS, and 7 on BScDTH. The vast majority were aged between 18-24 years old ($n=61$), with 9 reporting being between 25-44 years old. Of the 14 staff who responded, 13 were aged between 35 and 54 years old, with one respondent reporting being aged 25-34. The participants reported their perceptions regarding the teaching and clinical exposure of students to sepsis patients; availability of resources for students and patients to raise sepsis awareness. Students across all programmes reported limited clinical exposure to management of sepsis and lack of confidence in recognising early signs of sepsis in patients. The agreement profile between programmes only differed significantly for recognition of sepsis risk item ($\chi^2(6, n=71) = 26.187, p < 0.001$), with BDS students disagreeing with the item to a larger extent than BMBS and BScDTH students. Students and staff reported similar perceptions regarding information available to students and patients. Responses to open-ended items provided several suggestions for improvements in the teaching of students and raising public awareness on sepsis.

Conclusion: This study identified several areas related to sepsis teaching which require improvements across all programmes. The key issues highlighted by the students included limited clinical exposure to sepsis patients and lack of confidence in recognising early signs of sepsis.

Introduction

Sepsis is a as life-threatening condition caused by a dysregulated host response to infection and may lead to organ dysfunction¹. A recent global study estimated there were approximately 48.9 million cases of sepsis recorded in 2017 and the UK Sepsis Trust has estimated it has claimed approximately 48,000 lives a year with a 20.3% mortality rate in the United Kingdom. ^{2, 3} The figure may be potentially higher during the COVID-19 pandemic.

Many of sepsis-related deaths have been attributed to a late diagnosis as a result of not recognising the signs and symptoms of sepsis. Physiological deterioration with multi-organ failure can be unpredictable and sudden. The National Institute of Health and Clinical Excellence (NICE) has identified groups of the population who are more vulnerable, including children less than 1 years of age or those more than 75 years old, immunocompromised patients and pregnancy, to name a few.⁴ A national campaign in the UK is focused on ensuring prompt diagnosis of sepsis by health professionals to improve patient outcomes including a reduced risk of mortality. A Sepsis Action Plan published by the National Health Service (NHS) England targets health and care organisations to “improve the prevention, early diagnosis and prompt treatment of sepsis”.⁵ Furthermore, toolkits published by the UK Sepsis Trust have been endorsed by NICE.⁶ Similar recommendation are provided by other organisations such as the Royal College of General Practitioners UK and the Care Quality Commission. ^{7,8}

Early evaluation of the risk of sepsis can be carried out by recognising the Red or Amber Flags of sepsis (Table 1).

The most common sources of sepsis are bacterial infections involving the pulmonary, urinary, abdominal systems or skin infections.⁹ Less commonly, sepsis may develop as a complication of odontogenic, mucosal or salivary gland infections and may prove to be fatal.¹⁰⁻¹³

Although the importance of early recognition and referral of suspected sepsis has been emphasised widely, it is not clear whether sepsis-related content is covered adequately in undergraduate curricula in medicine and dentistry. At present, there are limited studies regarding teaching of medical and dental students to recognise sepsis and there is evidence that healthcare students as well as qualified professionals in primary care setting may lack knowledge and confidence to recognise and manage sepsis.^{14, 15} The aim of this study was to evaluate sepsis on undergraduate programmes in medicine, dentistry and dental therapy at a university in England.

Methods

Research Ethics: Ethics approval was granted by the institution's Health Research Ethics and Integrity Committee (Reference number 18/19-1135).

Survey inventory development and piloting: Two separate questionnaires for the survey were developed by a team of four experienced medical and dental academics. One questionnaire was aimed at undergraduate medical and dental students; the other questionnaire was aimed at academic staff. Both questionnaires were piloted with a group of 8 undergraduate students and 4 academic staff by email. The participants were asked to provide their feedback on the questionnaire including language, readability, scoring categories and structure of the scale items. The participants were given the option to *rephrase* any item they felt was worded ambiguously or was not comprehensible in its current form. Finally, the participants were asked to rate each item into one of the three categories: essential; desirable; or irrelevant.

Minor corrections were made following the pilot study. Both forms of the questionnaire included demographic items, a series of five-point Likert agreement scales anchored Strongly Agree and Strongly Disagree related to the participant's perceptions of their knowledge of and exposure to sepsis teaching and management, and free-text items allowing further discussion of their experiences and perceptions of sepsis teaching, and suggestions for raising sepsis awareness.

Setting: Faculty of Health (Medicine, Dentistry and Biomedical Sciences), University of Plymouth, England.

Participants: Participants included Year 3,4 and 5 Bachelor of Dental Surgery (BDS) , Bachelor of Medicine / Bachelor of Surgery (BMBS) as well as Years 2 and 3 Bachelor of Dental Therapy and Hygiene (BScDTH) undergraduate students. Academic staff supervising students on these programmes were also invited to participate.

Survey administration: The survey questionnaires were administered using Online Surveys (previously Bristol Online Survey). Participants were invited by email through the Faculty administration officer who also acted as the gatekeeper. The participants were provided and information sheet to explain the aims and scope of the study along with a web-link to access the questionnaire. Prior to accessing the online questionnaire, the participants were required to indicate their understanding of the study and provide their consent for their participation.

Data collection: Data collection was completed over a period six weeks. One reminder was sent by email after the 2 weeks. All survey responses were collected over encrypted connections and stored in accordance with General Data Protection Regulations (GDPR) guidelines.

Data analysis: Quantitative data was subject to initial descriptive analysis, followed by inferential tests to determine statistical significance of relevant differences in perceptions of knowledge and awareness across the questionnaire items, between programmes, and between students and staff. Data from free-text items regarding suggestions for improvements in teaching were analysed separately.

Results

Of the 71 students who responded, 43 were on the BDS programme, 21 on BMBS, and 7 on BScDTH. The vast majority were aged between 18-24 years old ($n=61$), with 9 reporting being between 25-44 years old.

Of the 14 staff who responded, 13 were aged between 35 and 54 years old, with one respondent reporting being aged 25-34. The majority reported their job role as clinical dental teachers ($n=7$), with 3 clinical medical teachers and 4 non-clinical medical teachers. Most reported having qualified 16-30 years ago ($n=11$), the remaining three having qualified 1-15 years ago.

The distributions of agreement response from students for each item, and by programme of study, are shown in

. Due to small numbers of students selecting some categories, the Likert-scale has been collapsed into Agree (comprising Strongly Agree and Slightly Agree responses) and Disagree (comprising Strongly Disagree and Slightly Disagree responses). The distributions of agreement responses from staff, for each item, with the same category collapsing, are shown in **Error! Reference source not found..**

The agreement profile between programmes only differed significantly for the item "I am able to recognise signs and symptoms which may put patients at risk of developing sepsis" ($\chi(6, n=71) = 26.187, p < 0.001$), with BDS students disagreeing with the statement to a larger extent than BMBS and BScDTH students.

Items common to the student and staff questionnaires are listed in Table 2, along with the student and staff agreement responses, and the p-values from chi-squared tests of whether the responses reflect similar (p-values of equal to or greater than 0.05) or different (p-values of less than 0.005) levels of agreement with the items between

students and staff. Responses to these items show that students and staff have similar perceptions information available to students and patients, but that students, though not staff, feel they do not have adequate exposure to the management of sepsis in child or adult emergency clinics.

Responses to open-ended items provided several suggestions for improvements in the teaching of students and raising public awareness on sepsis. These are summarised below:

Student responses

- Bespoke problem-based learning sessions on patient cases with signs of sepsis
- Involvement of students in developing information leaflets, online resources and public campaigns for raising awareness regarding sepsis
- Dedicated sepsis day for student-led presentations and posters

Staff responses

- Consolidate teaching with additional learning activities such as plenaries, interactive workshops and case-based discussions
- Development of educational resources for patients including leaflets, posters, etc.
- Public awareness campaigns locally and nationally
- Community engagement activities, especially in schools .

Discussion

Studies on sepsis teaching in undergraduate healthcare curricula are limited. However, few published studies have highlighted weakness in sepsis teaching for medical and nursing students and the findings of survey corroborate with previous reports in the literature^{15, 16}. Similar findings have also been echoed in a recent study involving dental professionals, which identified a strong correlation between knowledge and confidence in the management of sepsis, with those reporting greater knowledge also reporting greater confidence.¹⁴ Students reported limited clinical exposure to sepsis patients and lack of confidence in recognising early signs of sepsis, a view which was not shared by the staff. Although our institution provides a variety of learning opportunities for students on all programmes, limited exposure to septic patients with typical symptoms could influence students' perception on actual content of the programme. Nevertheless, students and staff reported similar perceptions regarding information available to students and patients.

A variety of strategies have been used to enhance knowledge and recognition of sepsis amongst healthcare students. These include use of simulated patients, and interdisciplinary learning activities.¹⁷⁻¹⁹ and interactive e-learning programmes on sepsis.²⁰ In addition, experiences of increasing use of technology for blended learning in healthcare education during the COVID-19 pandemic may allow educators to consider other tools such as podcasts, vodcasts, webcasts, webinars, discussion forums, and mobile learning applications. The participants in this study also provided some useful suggestions to improve sepsis teaching for medical and dental students and raising public awareness. In particular, active involvement of students in the development of educational resources and participation in public campaigns may serve to enhance student motivation and also provide opportunities to improve their communication with patients through public engagement. . The corona virus disease (COVID-19) pandemic has impacted on all spheres of human life and medical education is no exception. Healthcare education institutions have had to make significant changes to the delivery of teaching and a blended learning approach has been adopted widely with a significant portion of teaching delivered online.²¹ On a positive note, the resilience and commitment demonstrated by healthcare educators during these unprecedented times in living memory underscores the ability to deal with challenges and changing circumstances.

Sepsis remains a key public health concern and undoubtedly healthcare educators can make improvement in sepsis teaching going forward.

Participants in this study unanimously endorsed the need for more learning activities to consolidate students' understanding and recognition of sepsis. However, it is important to adopt a balanced approach as over-enthusiastic hype about sepsis may create public hysteria about the so-called hidden killer and undermine their confidence in healthcare providers. A cautious strategy is advisable in policy, public messaging, and frontline care, to minimise inappropriate antibiotic use with concurrent risks of resistance and other side effects.²² Moreover, emphasis on the early treatment of sepsis may detract clinicians from the recognition, diagnosis, and treatment of other acute illnesses and may inadvertently lead to overdiagnosis of sepsis.²³

This study has several limitations. Firstly, the response rate was low as the data collection started just prior to the first lockdown during the COVID-19 pandemic and the uncertain environment impacted adversely on the participation rate. Moreover, the ongoing impact of pandemic on educational environment meant that the feasibility of achieving a better response rate by extending the study duration remained low. Secondly, the sample included participants from a single institution, and it may not be possible to generalise the findings. Future multi-institution studies involving a larger sample may provide better insights into the strengths and weaknesses in teaching sepsis to medical and dental students and inform the institutions to improve their teaching strategies.

Conclusion

This study identified several weaknesses in sepsis teaching in undergraduate medical and dental curricula, which require improvements across all programmes. The key issues highlighted by the students included limited clinical exposure to sepsis patients and lack of confidence in recognising early signs of sepsis. The participants unanimously recognised the importance of sepsis teaching to undergraduate students and also endorsed the need to raise public awareness. Several useful and practical recommendations were provided by the participants to achieve these objectives.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Author contributions

K Ali led the study and drafted the manuscript.

N Venkatasami drafted the ethics application and contributed to the review of literature.

D Zahra carried out data analysis.

Z Brookes contributed to data collection for dental and dental therapy students and staff.

J Kisielewska contributed to data collection for medical students and staff.

Funding Information

Not applicable

Conflict of Interest

None of the authors / co-authors have any conflict of interest to declare.

Ethics Information

The study complies with the ethics guidelines and ethics approval was granted by the institution's Health Research Ethics and Integrity Committee (Reference number 18/19-1135).

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Table 1. Signs of Sepsis: Red and Amber Flags

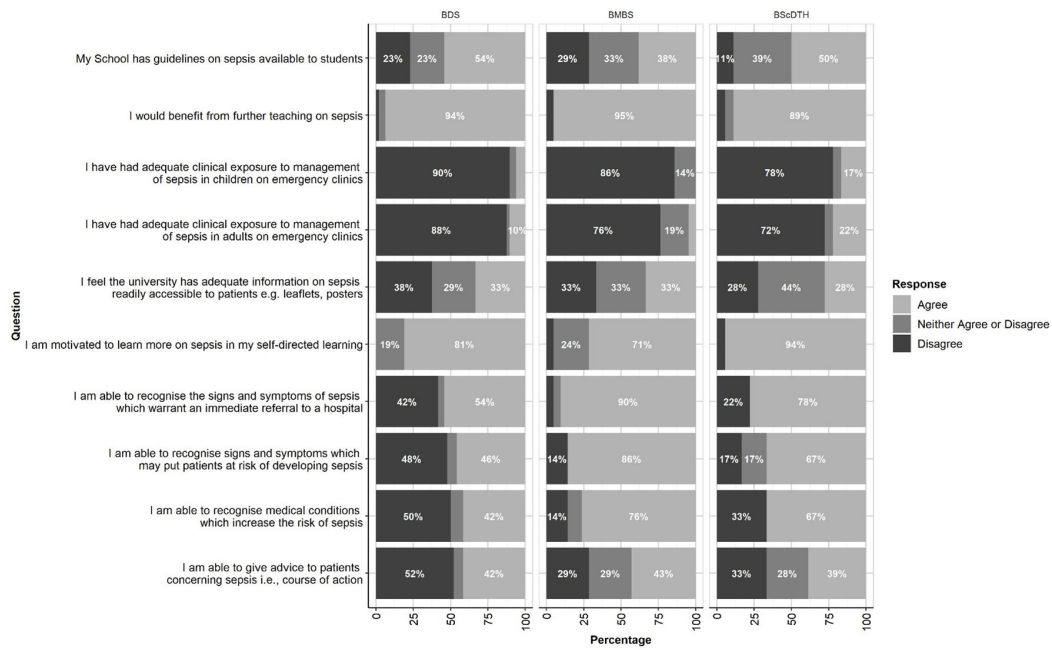
Red Flags	Amber Flags
New deterioration in GCS/AVPU	Relatives worried about mental state/behaviour
Systolic BP \leq 90mmHg (or \geq 40mmHg below normal)	Acute deterioration in functional ability
Respiratory Rate \geq 25 per minute	Immunosuppressed (without recent chemotherapy)
Requires oxygen to keep SpO ₂ 92% (88% in COPD)	Trauma, surgery or procedure in the last 6 weeks
Non-blanching rash or mottled/ ashen/ cyanotic	Respiratory rate 21-24 or dyspnoeic
Not passed urine in the last 18 hours	Systolic BP 91-100mmHg
Recent chemotherapy (within the last 6 weeks)	Heart rate 91-130 or new dysrhythmia
	Not passed urine in the last 12-18 hours
	Tympanic temperature \leq 36°C
	Clinical signs of wound, device, or skin infection

*Adapted from “GDP Sepsis Decision Support Tool for Primary Dental Care”⁵.

** (GCS, Glasgow Coma Scale; BP, blood pressure; COPD, chronic obstructive pulmonary disease).

Table 2. Percentage of Student and Staff agreement responses to common items (p-values from Chi-squared tests of association between student/staff group and agreement with the item).

Item	Response	Student (%)	Staff (%)	<i>p</i>
My School has guidelines on sepsis available to Students	Agree	49	64	0.552
	Neither	28	21	
	Disagree	23	14	
I have had adequate clinical exposure to management of sepsis in adults on emergency clinics / Students have an adequate exposure to the management of sepsis in adults on emergency clinics /	Agree	11	29	<0.001
	Neither	7	36	
	Disagree	82	36	
I have had adequate clinical exposure to management of sepsis in children on emergency clinics/ Students have an adequate exposure to the management of sepsis in children on emergency clinics	Agree	7	14	0.019
	Neither	7	29	
	Disagree	86	57	
I feel the university has adequate information on sepsis readily accessible to patients e.g. leaflets, posters	Agree	32	14	0.406



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Question

Students should incorporate further learning on sepsis themselves during self-directed learning

Students may benefit from further teaching on emergency care in their curriculum

Students have an adequate exposure to the management of sepsis in adults on emergency clinics

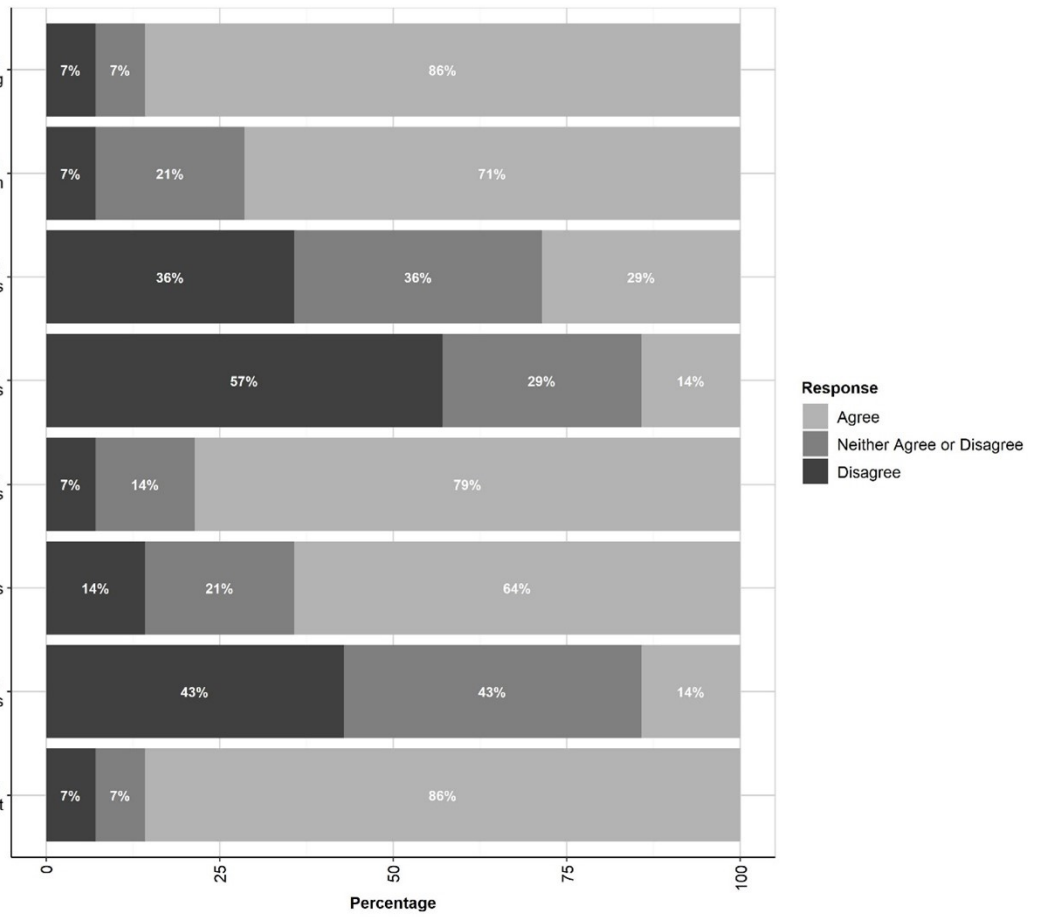
Students have an adequate exposure to the management of sepsis in children on emergency clinics

New graduates are able to recognise signs and symptoms of sepsis

My School has guidelines on sepsis available to Students

I feel the university has adequate information on sepsis readily accessible to patients e.g. leaflets, posters

An increased awareness of sepsis within the medical community is important



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