ABSTRACT

Background

Sepsis is a leading cause of death and disability in adults and children. Evidence suggests that early recognition and management can significantly improve patient outcomes, therefore education of healthcare workers around sepsis is critical. Little is known about the preparation of final year nursing students regarding recognition and response to sepsis.

Objectives

To explore Australian final year nursing student's exposure to and knowledge of sepsis, and their awareness of the importance of early recognition, escalation and management of patients with sepsis.

Methods

An online 17-question survey was developed, validated and then used to evaluate final year nursing students' awareness and knowledge about sepsis.

Design

Multi-site, cross-sectional, study.

Settings

Data were prospectively collected from final year nursing students from five university (graduate entry and undergraduate) programs from four Universities in Queensland, Australia.

Results

Response rate of 22% (237/1075 eligible students responded). Final year nursing students possessed limited knowledge about sepsis (mean scores= 3.8/9; SD = 1.6), and very limited knowledge of paediatric sepsis (median 1[interquartile range 0-1]). Many participants (54%; 128/237) had heard of sepsis prior to commencing their nursing studies, however only 22% (53/237) reported formal dedicated educational units on sepsis. Sepsis education was delivered primarily through didactic lectures (32%; 77/237) and often as part of courses encompassing acute care (38%; 91/237). Only 6% (14/237) of participants recalled exposure to education dedicated to paediatric sepsis.

Conclusions

The knowledge of final year nursing students in relation to recognising, escalating and managing sepsis was limited. There is an urgent need to design education which adequately and safely prepares nurses for the challenges they face when caring for patients with sepsis, particularly paediatric sepsis. Accrediting bodies should consider mandating inclusion of sepsis education as part of all nursing programmes.

INTRODUCTION

Sepsis is defined as a dysregulated host response to infection leading to organ dysfunction (Singer et al., 2016) and is a leading cause of death and disability in adults and children. Recent global data estimates 48.9 million cases with 11 million deaths internationally in 2017 (Fleischmann-Struzek et al., 2018; Rudd et al., 2020). Of these cases, approximately 55,000 cases occur in Australia with 8,700 deaths resulting in costs close to 1.5 billion AUD each year in Australia (Rudd et al., 2020). Sepsis has high mortality rate and results in significant short- and long-term morbidity (Chong et al., 2015). The mortality rate in septic shock (with acute organ dysfunction) can be up to 46% (Kaukonen et al., 2014; Schlapbach et al., 2015).

Sepsis is a time-sensitive illness, so early recognition and response at initial points of care can support prompt escalation of treatment, minimising patient deterioration (Schmatz et al., 2020; Weiss et al., 2020) and death (Jalili et al., 2013; Johnston et al., 2017; Seymour et al., 2017). Early recognition may include application of screening tools such as systemic inflammatory response syndrome criteria (SIRS) (Finkelsztein et al., 2017) or the quick sepsis-related organ failure assessment (qSOFA) (Singer et al., 2016) to prompt further assessment of patients at risk of deterioration. Nurses, particularly emergency nurses, are typically the first contact point patients have with health systems and thus they have a key role in early recognition of sepsis. Nurses are responsible for patient assessment, so their ability to recognise, escalate and prompt management for patients at risk of sepsis is of paramount importance (Harley et al., 2019; Storozuk et al., 2019).

Timely treatment of sepsis relies on early recognition of the signs and symptoms of the disease, and most work around sepsis recognition stresses the importance of early review by health care professionals (Yealy et al., 2015). Despite the fact that sepsis is responsible for more deaths each year in Australia than road traffic accidents approximately 60% of Australians have not heard of sepsis and only 14% could name a symptom in a recent survey by The George Institute (Finfer et al., 2017). While public awareness campaigns have been launched in some states, the level of training and knowledge of healthcare staff, particularly nurses, around sepsis has received little attention so far.

Our recent work suggested that emergency department (ED) nurses' self-identify deficits in their capacity to recognise and respond to patients with sepsis (Delaney et al., 2015; Harley et al., 2019). Internationally, it has been recognised that nurse's knowledge around sepsis is often limited (Goulart et al., 2019; Storozuk et al., 2019). Insights surrounding nurse's existing knowledge and management of sepsis can be used to inform local and state-wide ED policies, to support more effective care processes (Harley et al., 2019). Indeed, the importance of ensuring that the healthcare workers to whom patients with sepsis first present, notably general practice doctors, ambulance officers and emergency department triage staff are trained to recognise and respond in a time critical manner cannot be underestimated (Finfer et al., 2017; Schlapbach et al., 2019; Swannell, 2019). The same is true of knowledge and insights about recognition, response and management of patients with sepsis gained while studying nursing (Levett-Jones et al., 2020).

Children with sepsis can be particularly difficult to assess, diagnosis is problematic, and they are at increased risk of rapid deterioration and long-term term sequalae (Fleischmann-Struzek et al., 2018). Sepsis is a leading cause of preventable death in children with global estimates reporting 25.2 million cases in 2017 affecting the paediatric and adolescent population – representing a large proportion of global sepsis burden (Rudd et al., 2020). Again, nurses play a crucial role in the early detection of sepsis and this requires vigilant assessment skills by nurses who understand that paediatric patients require an individualised approach, given differences in pathophysiological processes compared to adults (Schlapbach et al., 2015; Weiss et al., 2020).

Despite variation in the programmatic delivery of tertiary nursing in Australia, the importance of nursing student education to improve delivery of care to patients and promoting patient safety and outcomes is widely recognised (Levett-Jones et al., 2020; Reade et al., 2010). Despite this recognition, there are no studies available assessing level of training, knowledge, and skills of nursing school graduates on sepsis, nor is there literature exploring what is taught in undergraduate nursing programs about sepsis. The recently released Australian Nursing and Midwifery Accreditation Council (ANMAC) standards state that the guiding principle of any nursing education program is patient safety (ANMAC, 2019). A clear understanding of the depth, breadth and efficacy of nursing education around sepsis is an essential element of ensuring the preparedness of graduates for practice. Without such knowledge, it will be difficult to ensure authentic, contemporary and appropriate learning resources are provided to nursing students.

We aimed to assess final year nursing students' knowledge of sepsis in four Australian Universities using a knowledge assessment survey and explore associations between the student's exposure to education about sepsis and their knowledge of sepsis.

METHODS

This prospective multi-site, cross-sectional study used a survey, developed initially for medical students (RD, LS, BV, manuscript in submission), was then modified for final year nursing students. Ethical approval was provided by each participating University (HREC 29019002310; HREC NRS2019/843; HREC 2019/549; HREC #2019002310). Consent was obtained by the participant agreeing to complete the survey.

Participants

Australian nursing students undertake tertiary educational programmes, accredited by the Australian Nursing and Midwifery council, under the auspices of the Australian Health Professionals Regulation Agency (AHPRA). It is AHPRA who will, on successful completion of the programmes, provide nursing registration (ANMAC, 2019). Programmes can be undergraduate (typically 3 years of full time study) or graduate entry (typically 2 years full time study). Participants eligible for this study

were final year nursing students across five university programs in four of nine Universities in Queensland, Australia. Students at one site did not attend the same university education programme. Rather, two programs, the undergraduate and the graduate entry programmes, ran in parallel, All programmes were accredited by the independent accrediting authority of nursing and midwifery education, the Australian Nursing Midwifery Council (ANMAC) for registration as a nurse (ANMAC, 2019). Universities were de-identified and referred to as sites A, B, C and D.

Survey tool

The online survey was delivered via a SurveyMonkey link. The survey incorporates questions across the domains of sepsis identification, basic pathophysiology and prevalence. Correct (knowledge) answers were based on current literature (Gotts and Matthay, 2016; Schlapbach, 2019; Singer et al., 2016; Storozuk et al., 2019) and was conceived and designed prior to the Global Burden of Disease (GBD) study was published, therefore some questions were based on published data prior to the GBD data (Rudd et al., 2020). The survey was designed to evaluate nursing students' awareness and knowledge about sepsis, and to determine if and at what time students were exposed with the study of sepsis in their university curriculum. The original survey, designed for medical students by content experts (BV, LJS), was adapted for nursing students, revised and reviewed for face and content validity. The questions refined and approved by five clinical experts (Polit and Beck, 2008), including the Queensland state-wide sepsis clinical nurse consultant (AH) and four senior nursing academics (DM, AU, AJ, KRS) (Bannigan and Watson, 2009). The survey piloted first amongst five respondents to ensure user friendliness, ease of electronic interface and effective response collection. Once the pilot phase was successfully completed, the survey was distributed to the broader target participant group. The pilot data are not included in the results.

There were 17 questions in this survey, and testing demonstrated completion within less than 10 minutes. It included deidentified demographic information.

Survey distribution

All final year students of participating institutions were emailed a link to the survey, and associated participant information. Participation was entirely voluntary and no respondent identifiers were recorded. The survey link emailed to potential participants included a short information component, with information at their level of comprehension, about the purpose, methods, demands, risks, inconveniences, discomforts and possible outcomes of the research. Informed consent was implied if respondents clicked on the survey link and completed the survey. The link was emailed by members of the research team who were not directly involved in the teaching programmes at any of these tertiary facilities. Thus, the risk of coercion or power imbalance was minimal. The link remained active for four weeks from October to November 2019, with rolling start dates for participating institutions when ethics approval was gained. Two reminders were sent to the student

cohort via their student logged email address. A link to the survey with associated participant information was also posted on the University student interface sites (Blackboard or equivalent). No other communication with participants was sought.

Analysis

Survey data was transferred from excel (SurveyMonkey results) into the Statistical Package for Stata (version 13; StataCorp, College Station, TX). Participant demographic and responses are reported descriptively using percentages for categorical data and mean and standard deviation (SD) or median and interquartile range (IQR) for continuous variables depending on normality of distribution. Comparison tests were conducted where the sample size was adequate and underlying assumptions were met for two-sample t test or Kruskal-Wallis test depending on the distribution (Polit and Beck, 2008).

Survey performance was described via standard item analysis, and was processed using Microsoft Excel (Haladyna, 2004). The difficulty level of an item was defined as the proportion of respondents who answer the question correctly with the possible values ranging from 0.0 to 1.0 (Considine and Thomas, 2005; Haladyna, 2004). Items were considered too easy if they are answered correctly by more than 90% of the respondents (value > 0.9) and too difficult if they were answered correctly by less than 10% of the respondents (value <0.1) (Haladyna, 2004). Item discrimination was analysed by examining how each item was related to overall test performance. Haladyna (2004) recommends the use of item to total correlations to examine item discrimination by analysing the relationship between each item and the total test score. Values of 0.35 and higher are defined as 'good' values, values from 0.25 to 0.35 as 'satisfying / good', values from 0.15 to 0.25 as 'mediocre / satisfying', and values less than 0.15 as 'bad / mediocre' (Considine and Thomas, 2005). The quality of a response alternative was defined by calculating the proportion of respondents who choose an alternative value (Considine and Thomas, 2005; Haladyna, 2004). Values range from 0.0 to 1.0; where 0.0 is not attractive and a value of 1.0 might be too attractive (Haladyna, 2004).

RESULTS

Participant characteristics and sepsis education

While 294/1075 participants commenced the survey, there were 237/1075 complete responses, reflecting a combined response rate of 22% of graduating nurses from the four participating universities. As presented in Table 1, most participants were completing their first degree (79%; n=187). Just over half of students who responded had heard of sepsis prior to commencing their nursing studies (54%; n=128), and 99% (234/237) had heard of sepsis by this final stage of their degree (see Table 1). Relatively few students reported attendance of formal dedicated educational units on sepsis (22%; n=53). The sepsis education received was often through didactic lectures, including mention in lectures acute care (32%; n=77), although other educational modalities were

commonly used. Moreover, participants were able to select as many options as applicable for this question. Only 6% (n=14) of students reported exposure to education on paediatric sepsis.

<Insert Table 1>

Nursing student's general knowledge around sepsis

Across the general components, total knowledge scores were normally distributed, ranging from 0 to 8 (from a possible 9), with a mean score of 3.7/9 (SD: 1.6). When paediatric specific questions were excluded, most participants were able to correctly answer the question surrounding sepsis symptom identification (Q2 n=204; 86.1% correct) and nearly half responded correctly in relation to the importance of early treatment (Q6 n=106; 44.7% correct; see Table 2). Overall, participants frequently reported being unsure, particularly around epidemiological data (Q4 n=130; 54.8%).

Exploratory item evaluation demonstrated the test performed well across assessments of item difficulty, item discrimination and distractor evaluation. Responses varied only marginally between University sites. There were no significant difference in total knowledge scores between students with prior degree (n = 50, mean score = 3.9 [SD 0.18]) and those who did not (n = 187, mean score = 3.7 [SD 0.12]; t = -1.2, p=0.22). There was however, a small but significant difference between total knowledge scores from students who received formal educational unit/s on sepsis (n = 144, mean 4.0 [SD 0.12]) and those who did not (n = 93, mean 3.3 [SD 0.17]; t = -3.86, p<0.01).

<Insert Table 2>

Nursing student's knowledge around paediatric sepsis

Knowledge of paediatric sepsis was low, with less than a third of students correctly identifying answers to each of the questions, and frequently reporting they were unsure of correct answers across all domains (see Table 3). Exploratory item evaluation demonstrated the test performed well across assessments of item difficulty, item discrimination and distractor evaluation.

<Insert Table 3>

DISCUSSION

In this study we explored final year Australian nursing student's knowledge and awareness of sepsis and identified that this group of students had significant gaps in knowledge. Knowledge was minimal on paediatric sepsis. To our knowledge this is the first study to explore final year nursing

student's knowledge about this important clinical topic and contributes to our understanding of Australian nursing curricula.

Sepsis is a global problem in which timely recognition and treatment are strongly related to better outcomes. The WHO stipulates the need to improve, at institutional and country level, efforts around sepsis prevention, recognition, management (Schlapbach et al., 2019), and yet this appears to be managed superficially, if at all in some undergraduate nursing programmes in Australia. A recent study by Levett-Jones et al. (2020) identified that nurses have a key role in enhancing the quality and safety of care through recognition, management and reporting of issues that have, or could have, a negative impact on patient outcomes. This is particularly true in the area of sepsis (Delaney et al., 2015; Goulart et al., 2019; Johnston et al., 2017) where nurses' that are exposed to patients at triage, prior to Medical Officer assessment, are ultimately key to early recognition and escalation of care. Their role encompasses the complete patient journey, placing emphasis on clinical gestalt to ensure timely management by the multidisciplinary team. Thus, nurse's education and knowledge around sepsis are essential (Delaney et al., 2015; Schwartz, 2019; Storozuk et al., 2019).

In our study we identified that although 50% of the final year students in our sample had heard of sepsis previous to their degree, only 22% reported specific teaching on sepsis and only 44% of participants were able to identify the importance of early sepsis interventions. Our findings indicate a significant gap in the teaching of sepsis, including recognition and response to sepsis undermining the potential use of physiological parameters that inform screening tools, guidelines and pathways. As expected, where students had been exposed to some teaching around sepsis, it marginally enhanced their (retained) knowledge about key elements of sepsis. Thus, undergraduate teaching, where it occurs, can impact knowledge retention and thus, promotes patient safety (ACSQHC, 2017).

The recently released ANMAC standards identify that the guiding principle of any nursing education program must be patient safety (ANMAC, 2019). As the largest profession in the health workforce and the profession responsible for direct patient contact, nurses play a critical role in reducing adverse events and promoting patient safety (Levett-Jones et al., 2020; Usher et al., 2017). Better training may make early career/graduate students feel more confident about speaking up and advocating for patients with sepsis (Levett-Jones et al., 2020; Reade et al., 2010; Usher et al., 2017) and help ensure that in future, nurses working in EDs and hospital wide, do not also report a lack knowledge and understanding about sepsis (Harley et al., 2019; Storozuk et al., 2019).

We also identified that only 6% of participants reported receiving any education about paediatric sepsis. We argue that this finding is concerning because early recognition and escalation of paediatric deterioration, time to treatment, is perhaps even more vital if major adverse outcomes are to be avoided (O'Leary et al., 2015). Many facilities treat both adult and paediatric populations, thus is it important for nurses to have paediatric training. In paediatrics, as in other areas of acute care, nurses

have been identified as playing a key role in the early recognition and subsequent management of paediatric deterioration (O'Leary et al., 2015). It maybe that, as in the education system in the UK, nurses working in paediatric areas should have specialist paediatric training – or at least comprehensive orientation training that includes upskilling around paediatric sepsis.

In Australia, nurse curricula have adapted and responded to many competing priorities including clinical, technological and political (ACSQHC, 2017; ANMAC, 2019). The result of this adaptability and responsiveness is that important clinical topics may be omitted from the theoretical and clinical components of the curricula. Indeed, many factors might drive the apparent deficits in sepsis content in some Australian nursing programmes. There is a deficiency in literature available that provides an insight into the knowledge of the nurse academics who are responsible for the development and delivery of content about sepsis. It may be that current undergraduate nursing programs struggle to find a space for paediatric content in a curriculum that is already content-heavy, or the bioscience underpinning the recognition and management paediatric sepsis is not understood (McCarthy and Wyatt, 2014; Todorovic et al., 2016), or sepsis has not been recognised as a discrete entity and has been blended with infections.

The recent review of Australian nurse education (Schwartz, 2019) anticipates that registered nurses will be required to take increasing responsibility for complex care in the future and recommends that the curriculum explore innovative ways to extend education. Of note, the review does not specifically address sepsis or paediatrics as an educational or clinical priority. Paediatric units or courses are not compulsory in Australian undergraduate nursing programmes and only a very small percentage of undergraduate students experience a paediatric work-integrated learning clinical placement (Mahoney et al., 2013). However, once registered, nurses in Australia are qualified to care for paediatric patients without additional tertiary requirements. At this stage however, it remains unclear why there is not more consistent emphasis on paediatric content across nursing curricula; this is clearly an area for future investigation.

Importantly, our data demonstrates that there was a significant difference in knowledge scores when students experienced/were exposed to formal or integrated education on sepsis. With only 6% of respondents reporting education specifically on paediatric sepsis, the high levels of uncertainly about pathogens and signs of paediatric sepsis are perhaps indicative of importance of education in developing knowledge and awareness of sepsis. This key role of education has been identified by other researchers (Delaney et al., 2015; Storozuk et al., 2019), illustrating the importance of formal educational units on sepsis. Data presented herein suggest that key professional bodies both in Australia and internationally need to clearly identify the minimum standards required by undergraduate nurses to safely care for patients with sepsis and these standards should be transparent in every nursing curriculum. Moreover, these standards need to be actively managed as, while the roles and clinical scope of nurses can certainly vary widely internationally, cross-cultural and

geographical differences in students' skills and knowledge, have been identified previously despite the development of 'universal' recommendations (Kwiecień-Jaguś et al., 2020). Such curriculum content could include the incorporation of a structured and comprehensive approach to sepsis assessment and decision-making that enables student nurses to promote early recognition and response to sepsis. This is particularly important for paediatrics.

LIMITATIONS

This study was conducted using a newly modified survey, insufficiently powered to be subjected to a full factor analysis and specific subgroup analyses. These may be undertaken once a larger population has been sampled. It included a sample of nursing students that is relatively small and only a small proportion (<25%) of the total graduating cohorts. Thus, there may have been some opt-in bias in the questions and responses, limiting generalisability to the wider graduating cohort. This was offset in part by the range of tertiary institutions and programmes included; while only 4 universities were included they represent a range of metropolitan and regional, newer and more established tertiary facilities, attracting students via a range of entry processes and across a range of tertiary entrance scores.

The questions were designed with a primarily nursing focus so, for example, while decreased blood sugar levels may raise concern as they can be seen in patients with sepsis; in particular neonates and young children, they are not commonly a parameter that is taught to trigger concerns around sepsis during early screening by nurses. Moreover, the limited sample preluded examination of possible relationships between elements – such as reported education around specific elements and associated knowledge elements. Future research could explore such relationships. Additionally, the actual curricula provided to the respondents were not critiqued. Instead, the survey focussed on student recall and self reporting, which can carry a degree of bias. Thus, the description reported may not be completely indicative of the current Australian nursing curriculum surrounding sepsis. In order to keep the survey short the number of questions on sepsis was kept brief so we cannot exclude that students may have performed better in other knowledge areas.

CONCLUSIONS

Nurses entering the workforce must be properly prepared to recognise, escalate care of and manage patients, including children, with acute life-threatening conditions, as part of a multi-disciplinary team. Our study indicates that many final year nurses in Australia are under-prepared in relation to sepsis despite the fact that sepsis is a leading cause of preventable morbidity and mortality in Australian health care facilities. In Australia there is currently no standardised approach outlining the number of teaching hours (theoretical or clinical) dedicated to sepsis content. This warrants a reassessment of the curricula and consideration of mandatory inclusion of sepsis. It also highlights the importance of future research around barriers to the inclusion of key topic areas within nursing

curricula and the requirement for evidence-based change. The valid and discriminatory survey tool developed within this study is a tool to explore the impacts of such curricula change around inclusion of sepsis. Moving forward, development of targeted sepsis education, to ensure knowledge retention, is necessary across all health disciplines.

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