



## A cross-sectional survey of nursing students' patient safety knowledge

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### ABSTRACT

**Background:** Knowledge provides a foundation for safe and effective nursing practice. However, most previous studies have focused on exploring nursing students' self-reported perceptions of, or confidence in, their level of patient safety knowledge, rather than examining their actual levels of knowledge.

**Objective:** The overarching objective of this study was to examine final year nursing students' levels of knowledge about key patient safety concepts.

**Design:** A cross-sectional design was used for this study. Data collection was undertaken during 2018 using a web-based patient safety quiz with 45 multiple choice questions informed by the Patient Safety Competency Framework for Nursing Students. A Modified Angoff approach was used to establish a pass mark or 'cut score' for the quiz.

**Setting and participants:** Nursing students enrolled in the final year of a pre-registration nursing program in Australia or New Zealand were invited to participate in the study.

**Results:** In total, 2011 final year nursing students from 23 educational institutions completed the quiz. Mean quiz scores were 29.35/45 or 65.23% (SD 5.63). Participants achieved highest scores in the domains of person-centred care and therapeutic communication, and lowest scores for infection prevention and control and medication safety.

Based on the pass mark of 67.3% determined by the Modified Angoff procedure, 44.7% of students (n = 899) demonstrated passing performance on the quiz. For eight of the institutions, less than half of their students achieved a passing mark.

**Conclusions:** Given the pivotal role that nurses play in maintaining patient safety, the results from this quiz raise important questions about the preparation of nursing students for safe and effective clinical practice. The institutional results also suggest the need for increased curricula attention to patient safety.

### 1. Introduction

Adverse events in healthcare are a major source of morbidity and mortality. Despite ongoing attempts to address the human and systems factors that lead to unsafe healthcare, it is estimated that

internationally, adverse events are the third leading cause of death in developed countries (Makary and Daniel, 2016). The personal and financial impact of these negative consequences of healthcare is considerable. For example, in Australian public hospitals, it is estimated that 12–16% of expenditure is the direct result of adverse events, with

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the costs of hospital-acquired complications equating to more than \$4 billion each year (Australian Commission for Safety and Quality in Healthcare [ACSQHC], 2019). However, these statistics fail to depict the distress and disability caused to patients and their families when 'things go wrong' in healthcare.

Nursing is the largest profession in the health workforce and nurses spend more time with patients than any other healthcare providers. Nurses therefore have the potential to, not only champion patient safety, but to also have a significant impact on error reduction (DeLucia et al., 2009). However, safe practice requires both clinical skills and a requisite level of clinically relevant knowledge (Miller, 1990). Thus, ensuring that final year nursing students have the skills and knowledge needed for safe and effective practice has become a key priority for universities (Usher et al., 2017).

Although previous studies have sought to explore nursing students' patient safety knowledge, most have focused on confidence in, and self-reported perceptions of, knowledge (Usher et al., 2017). Identifying nursing students' actual knowledge levels in relation to patient safety is imperative and has the potential to make a significant impact on clinical practice and patient outcomes. The cross-sectional study described in this paper therefore sought to examine the levels of patient safety knowledge that nursing students from Australia and New Zealand possessed.

## 2. Background

Patient safety is defined as 'the prevention of errors and adverse effects to patients associated with healthcare' (World Health Organization [WHO], 2017), and adverse events are described as unintentional injury or complications caused by an episode of healthcare (WHO, 2009). Internationally, it is estimated that 10–25% of hospitalised patients experience adverse events each year, the majority of which are avoidable (ACSQH, 2019).

Nurses play 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 (Vaismoradi et al., 2011). It is therefore essential that nursing graduates possess the knowledge and skills required to identify and address factors that could jeopardise patient safety. Education providers are charged with the responsibility for designing curricula that specifically focus on graduates' competence for practice. However, there has been ongoing debate about the extent to which patient safety is appropriately integrated into nursing education programs (Tella et al., 2014), as well as the rigor with which patient safety is taught and assessed (Istomina et al., 2011).

In many countries there has been ongoing discussion about the value of, and need for, standardised examinations for assessing nursing students' patient safety knowledge prior to graduation (Missen et al., 2018). Consequently, end-of-program examinations have become common practice in countries such as the United States and Canada; although in many other contexts universities and accreditation authorities have shifted away from this approach. In Australia, there is no final benchmark national exam prior to registration as a nurse. Instead, graduates who successfully complete a nursing degree submit a self-reported legal declaration to the Nursing and Midwifery Board of Australia specifying that they are competent to practice (AIHW, 2016). Conversely, the Nursing Council of New Zealand requires students to pass a validated examination in order to gain entry to the register (Nursing Council of New Zealand, 2017).

Notwithstanding the recognised controversies, standardised tests can be beneficial for evaluating nursing students' understanding of patient safety, as diagnostic tools for identifying curricular strengths and weaknesses, to guide program improvements, and for benchmarking. Importantly, these types of tests can provide students with formative feedback about their level of patient safety knowledge.

In other efforts to examine healthcare students' understanding of patient safety, a range of surveys have been used, for example, the

Health Professional Education in Patient Safety Survey (Ginsburg et al., 2012), the Healthcare Professional Patient Safety Assessment Curriculum Survey (Mansour, 2015), the Patient Safety Competency Self-evaluation Survey (Lee et al., 2014), the Student Perceptions of Quality and Safety Competencies (Sullivan et al., 2009), and the Safety Attitudes Questionnaire (Sexton et al., 2006). However, these surveys each focus on attitudes, perceptions and self-reported confidence in patient safety knowledge, rather than assessing students' actual knowledge levels.

One of the pervading challenges in designing instruments specifically to assess knowledge of patient safety is the lack of clarity about relevant patient safety constructs. To address this issue, Levett-Jones et al. (2017) used a modified Delphi technique to develop and validate the Patient Safety Competency Framework (PSCF) (see: [http://psframework.wpengine.com/wp-content/uploads/2018/01/PSCF\\_Brochure\\_UTS-version\\_FA2-Screen.pdf](http://psframework.wpengine.com/wp-content/uploads/2018/01/PSCF_Brochure_UTS-version_FA2-Screen.pdf)). The PSCF consists of knowledge and skill statements categorised into nine domains:

1. Person-centred care
2. Therapeutic communication
3. Cultural competence
4. Teamwork and collaborative practice
5. Clinical reasoning
6. Evidence-based practice
7. Preventing, minimising and responding to adverse events
8. Infection prevention and control
9. Medication safety.

The PSCF Framework was used in the development of the Patient Safety for Nursing Students Website (<http://patientsafetyfornursingstudents.org/>) and the PSCF knowledge statements provided the foundation for the Patient Safety Quiz (PSQ) used in this study.

## 3. Study aim

The overarching aim of this study was to examine final year nursing students' levels of knowledge in relation to key patient safety concepts. It was anticipated that providing individual performance reports and formative feedback to each student on completion of the PSQ may motivate them to address areas of deficit and build on areas of strength with regard to patient safety knowledge. For educational institutions, the aim was to provide a report which included aggregated quiz results and valuable information about their students' levels of patient safety knowledge which could be used for curriculum development. Further, the PSQ was conceptualised as a way of benchmarking students' performance across educational institutions.

## 4. Methods

### 4.1. Study design

A cross-sectional survey design was used to elicit data from specific nursing student populations at a single point in time.

### 4.2. Survey design - Patient Safety Quiz

The web-based PSQ was developed to examine final year nursing students' knowledge levels. The quiz comprised 45 multiple-choice questions based on the PSCF. There were five questions for each of the nine patient safety domains and it took approximately 15–20 min to complete. The quiz included clinically relevant questions that required high level cognitive skills such as analysis, synthesis and evaluation, as well as knowledge recall. Marks were awarded for correct quiz responses and, where there were multiple correct options to an individual question, participants were awarded part marks for each correct response.

The PSQ was pilot tested in 2017 with minor amendments subsequently made. An expert panel consisting of 12 academics, an educational linguist and an academic with expertise in the development of assessment items, reviewed the quiz questions for relevance, accuracy, consistency, clarity and ambiguity. This was undertaken to enhance the face, content and construct validity of the PSQ (Rubio et al., 2003).

#### 4.3. Establishing the pass mark for the Patient Safety Quiz

In order to establish a pass mark or 'cut score' for the PSQ, a Modified Angoff approach was used (Ricker, 2006). The purpose of a cut-score is to separate students who meet a pre-determined standard from those who do not, particularly in high-stakes assessment. The Modified Angoff process used an iterative five step approach:

1. Identification of a panel of 'judges' – we invited academic staff members who had a clear understanding of what was expected of final year nursing students in terms of patient safety knowledge.
2. Review of the 45 PSQ questions – individual panel members identified those questions they believed that a 'borderline' student should reasonably be expected to answer correctly, with 'borderline' referring to a student who would just barely meet the expected performance criteria (Ricker, 2006).
3. Development of consensus performance – to enhance interrater reliability, panel members worked in small groups to develop a common understanding of a 'borderline' student and to discuss their responses to any questions where there was a lack of consensus. Following this discussion, panel members could amend their individual responses if deemed appropriate.
4. Identification of borderline response threshold – individual panel members identified the total number of questions (out of 45) that a 'borderline' student would answer correctly.
5. Determining a pass mark – the mean score was calculated by summing the individual borderline response thresholds and dividing the total by the number of panel members. This mean score was used to determine the pass mark for the PSQ.

Twenty-two academic staff members from two Australian universities participated in the Modified Angoff process. On average, they had been registered nurses for 18 years (range 16–41 years) and had been employed as academics for 11 years (range 4–35 years). The pass mark determined by the Modified Angoff process for the PSQ was 30.3/45 or 67.3%.

#### 4.4. Setting and participants

Nursing students enrolled in the final year of a pre-registration nursing program in Australia or New Zealand were eligible to participate in the study.

#### 4.5. Recruitment and ethical considerations

Following ethical approval (HREC ETH18-2352N), Heads of Schools of Nursing from all Australian (n = 39) and New Zealand (n = 18) higher education institutions were emailed by the Chief Investigator and permission sought for their students to participate in the study. Heads of School who were willing for their students to participate, nominated a designated contact person who sought site specific ethical approvals where necessary. The contact person at each participating educational institution also took responsibility for inviting students to participate in the study, either by email or by posting an announcement on their learning management system with a link to the PSQ.

When students accessed the web-based PSQ they were provided with a Participant Information Statement which explained that completion of the quiz was voluntary, and that submission of the quiz would be taken as implied consent. The quiz was anonymous, and

researchers were not provided with any information that could identify individual participants.

Students were informed that those who completed the quiz would automatically receive a certificate of achievement outlining their individual results, including their total score and a score for each of the nine patient safety domains. Educational institutions received a report with deidentified and aggregated results for their cohort of students, including overall mean score, range of scores, and mean scores for each of the domains.

#### 4.6. Data collection

Data collection was undertaken during 2018. In addition to quiz responses, demographic details were collected including participants' educational institution, age, gender, previous experience of working in the healthcare industry, and country of origin.

#### 4.7. Data analysis

Descriptive statistics (frequencies, percentages and measures of central tendency) were used to summarise the demographic data and PSQ responses. Passing performance was determined by the Modified Angoff procedure. Quiz responses were categorised and analysed according to the domains of the PSCF and by participating education institutions.

Post hoc item analysis was undertaken to determine the difficulty index of each quiz item; expressed as the proportion of students who answered a particular item correctly (Essen and Akpan, 2018). Difficulty index p-values range from 0.0 to 1.0 with higher values indicating easier items and lower values indicating items of greater difficulty. These values were then classified according to difficulty index p-value ranges as 0.75–1.0 'easy' 0.26–0.74 'moderate', 0.21–0.25 'fair', and 0.20 and below 'difficult' (Essen and Akpan, 2018).

### 5. Results

In total, 2011 final year nursing students from 23 educational institutions completed the PSQ. This number excluded the 24 responses with missing data. Participants included 1900 students from Australian universities (n = 14) with the remaining 111 representing educational institutions from New Zealand (n = 9). The response rate for each university/institution ranged from 12 to 100% with an average of 44.59%.

#### 5.1. Participant demographic characteristics

The mean age of participants was 29 years (range 20–67 years) and 84% (n = 1696) were female. Approximately half (53%, n = 1056) of the participants had experience working in the healthcare industry. The country of origin for the majority of the participants was Australia (57%, n = 1147) and 4.53% (n = 91) were from New Zealand. The remaining participants were born in 13 other countries (China, India, Japan, Kenya, Malaysia, Nepal, Philippines, South Africa, South Korea, Sri Lanka, United Kingdom, Vietnam or Zimbabwe).

#### 5.2. Patient Safety Quiz results

The raw scores for the PSQ ranged from 5 (11.1%) to 45 (100%) (see Table 1). The mean score was 29.35 (or 65.23%) with a standard deviation of 5.63.

Although students from 23 educational institutions completed the survey, the number of responses by institution varied from 4 to 385, with six institutions having fewer than 10 participants. Table 2 shows the response rates and results for each of the 17 institutions that had 10 or more participants.

Based on the pass mark of 67.3% determined by the Modified

**Table 1**  
Measures of central tendency by scores and percentages for the Patient Safety Quiz.

	Mean	Mode	Median	Max	Min
Score x/45	29.35	32.67	29.67	45.00	5.53
%	65.23	72.59	65.93	100	12.3

Angoff procedure, 44.7% of students (n = 899) demonstrated passing performance on the quiz. For educational institutions, 26.74% to 90% of participating students achieved 67.3% or higher (see Table 2 and Fig. 1). For eight of the institutions, less than half of the participants achieved this mark.

The PSQ included five questions related to each of the nine domains from the Patient Safety Competency Framework. Participants achieved the highest scores in the domains of Person-Centred Care and Therapeutic Communication, and lowest scores for Infection Prevention and Control and Medication Safety. Table 3 provides a breakdown of the scores and percentages for each of the nine domains.

Item analysis of the PSQ indicated that the level of difficulty of questions ranged from 'easy' to 'moderate'. Seventeen questions were rated as 'easy', 9 as 'moderate-easy', 18 as 'moderate' and one as 'fair' (see Table 4). No questions were 'too difficult' and needed to be discarded, as indicated by a p value of < 0.20.

## 6. Discussion

International patient safety guidelines highlight the importance of all healthcare professionals having foundational knowledge relevant to patient safety (European Network for Patient Safety, 2010; WHO, 2017). Hence, universities have a fundamental responsibility to provide appropriate education for developing this knowledge.

The overarching aim of this study was to examine final year nursing students' levels of knowledge about key patient safety concepts in relation to the nine domains of the PSCF. Item analysis of the PSQ indicated that the level of difficulty ranged from 'moderate' to 'easy'. Yet, the overall mean score for participants was below the 67.3% pass mark determined by the expert panel, with less than half demonstrating a level of patient safety knowledge consistent with passing performance. Given the pivotal role that nurses play in maintaining patient safety, these results raise significant concerns about the current preparation of nurses for safe and effective practice. The finding that the majority of institutions had over half of their final year nursing students falling below the established pass mark is also of concern and suggestive of a

need for curriculum renewal and a refocus on patient safety.

Of the nine domains represented in the PSQ, the lowest mean performance was in infection control and medication safety. This result is of particular concern given that medication errors and nosocomial infections are the most burdensome adverse event types (Tella et al., 2015; [ACSQHC], 2019). It could be argued that these domains represent more task focused and technical aspects of patient safety, while the other seven domains represent non-technical skills such as person-centred care and therapeutic communication which may support psychological safety. These findings contrast with those of Usher et al. (2017) who identified that students were most confident in clinical safety skills and least confident in their knowledge about the socio-cultural dimensions of practice. Reconciling these findings suggests that, although students may be confident in their knowledge, their confidence may be misplaced.

### 6.1. Strengths and limitations

This study sheds light on the readiness of final year nursing students for clinical practice and in particular, their knowledge about patient safety. The PSQ was informed by the PSCF which was developed through a Delphi project that included experts from Australia and New Zealand. Thus, the PSQ items have face and content validity for these students. The use of the modified Angoff was a particular strength in our approach, allowing for an appropriate pass mark to be calculated for the PSQ, and enabling sound conclusions to be drawn about students' levels of knowledge. This aspect was further enhanced through a large sample size. As there were nearly 2000 Australian participants in the PSQ and an estimated 8000 nursing students graduate each year (Department of Health, 2013), this sample size represents almost a quarter of graduates. As the New Zealand sample was much smaller, the results cannot be considered representative of that cohort.

There are a number of influences which can impact student participation and that may have contributed to the variation in response rates by educational institutions in this study. Some of these relate to choices in research design such as how the researcher makes the request (modes of communication, source, timing and clarity) and what the researcher requests (type of participation, rationale and perceived importance of the study, incentives, social context and norms, ease of response) (Cyr et al., 2013). In our study there were pragmatic restrictions which resulted in indirect recruitment via gatekeepers on whom we relied to select the most appropriate time and means to communicate the invitation to students.

Student recruitment was also likely impacted by individual

**Table 2**  
Response rates, mean scores, frequency and percentage of participants who achieved > 67.3% for 17 education institutions with 10 or more participants.

University	Sample	Population	Response rate	Mean score	> 67.3%	> 67.3%
	n =	N =	%	%	n =	%
1.	86	450	19	60.01	23	26.74
2.	385	692	56	61.32	131	34.03
3.	232	670	34	62.84	87	37.50
4.	171	503	34	64.21	68	39.77
5.	84	268	31	65.09	39	46.43
6.	197	412	48	65.24	90	45.69
7.	78	379	27	66.49	36	46.15
8.	31	62	50	67.19	18	58.06
9.	56	450	12	67.33	31	55.36
10.	224	224	100	67.89	111	49.55
11.	187	353	53	68.03	104	55.61
12.	31	104	30	68.51	20	64.52
13.	65	397	16	69.19	42	64.62
14.	15	39	38	69.35	7	46.67
15.	63	90	70	70.58	38	60.32
16.	66	167	40	72.23	45	68.18
17.	10	10	100	77.64	9	90.00

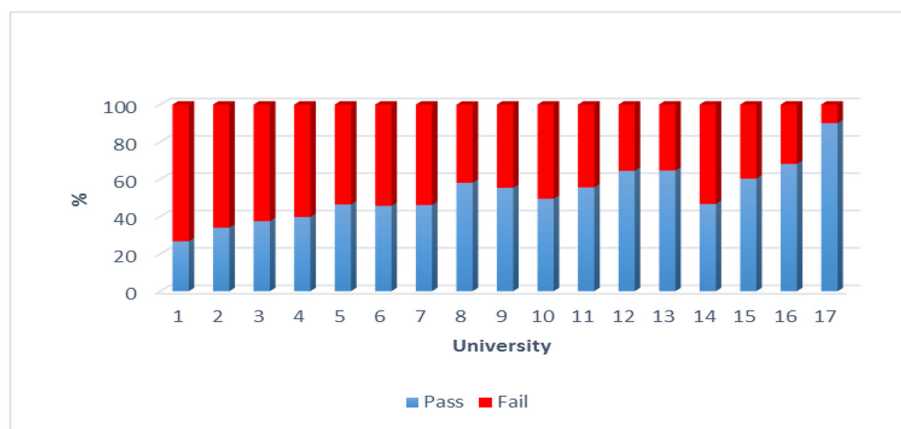


Fig. 1. Proportion of students who achieved > 67.3% from the 17 institutions with 10 or more participants.

Table 3

Mean scores and percentages for each of the nine patient safety domains.

Domain	Mean score/5	Mean percentage
1. Person-centred care	4.08	81.57
2. Therapeutic communication	3.83	76.55
3. Cultural competence	3.29	65.72
4. Teamwork and collaborative practice	3.66	73.19
5. Clinical reasoning	3.74	74.71
6. Evidence-based practice	2.75	55.02
7. Preventing, minimising and responding to adverse events	3.02	60.43
8. Infection prevention and control	2.48	49.58
9. Medication safety	2.51	50.29

motivations and, although we have little influence over these, we believe that the topic of patient safety is likely to be perceived by students to be of benefit to themselves as beginning practitioners, as well as to their patients. We also addressed benefit to self through intrinsic (learning and knowledge gain) and extrinsic rewards (certification of completion and individual feedback). The varied response rates may reflect “the local educational context, culture, expectations and beliefs” (Thomas et al., 2019, p. 87). We acknowledge that Australian Commission on Safety and Quality in Health Care, 2019 potential volunteer bias may mean that participants were those students who felt most confident in their patient safety knowledge. Given that these students may have scored higher than the cohort as a whole, this potential over-estimate raises concerns for overall graduate preparation for safe patient care. Further, as curricula vary from university to university, it is also possible that some educational programs may prepare nursing students better with regard to patient safety than others, and students from those programs may have been more open to participating. However, our findings provide important insights for refocusing curricula in the future.

7. Conclusion

Despite significant attention to improving patient safety, quality and safety reports suggest that than 10–25% of hospitalised patients will experience an adverse outcome (ACSQH, 2019; Makary and Daniel, 2016). Given the importance of a competent workforce to patient safety, ensuring that final year nursing students have the requisite knowledge to transition effectively to their roles as registered nurses is a key priority. The results of this study suggest that educational institutions have the opportunity, and we argue the responsibility, to refocus curricula to pay greater attention to patient safety. This initiative may well make a significant impact on graduates' clinical practice and ultimately patient outcomes.

Table 4

Levels of difficulty of items by patient safety domains.

Domain	Item	p-Value	Level of difficulty
Person centred care	1	0.91	Easy
	2	0.60	Moderate
	3	0.99	Easy
	4	0.87	Easy
	5	0.82–0.89	Easy
Therapeutic communication	6	0.58	Moderate
	7	0.75–0.93	Moderate–easy
	8	0.87	Easy
	9	0.72	Moderate
	10	0.96	Easy
Cultural competence	11	0.96	Easy
	12	0.70–0.92	Moderate–easy
	13	0.48	Moderate
	14	0.35	Moderate
	15	0.81	Easy
Teamwork and collaborative practice	16	0.94–0.98	Easy
	17	0.68–0.94	Moderate–easy
	18	0.74	Moderate
	19	0.62–0.75	Moderate–easy
Clinical reasoning	20	0.78	Easy
	21	0.92	Easy
	22	0.66	Moderate
	23	0.68	Moderate
	24	0.72	Moderate
	25	0.76	Easy
Evidence based practice	26	0.70–0.89	Moderate–easy
	27	0.60	Moderate
	28	0.78	Easy
	29	0.36	Moderate
Preventing, minimising and responding to adverse events	30	0.75	Easy
	31	0.36	Moderate
	32	0.46–0.90	Moderate–easy
	33	0.54	Moderate
	34	0.84	Easy
	35	0.86	Easy
Infection prevention and control	36	0.52	Moderate
	37	0.50	Moderate
	38	0.78	Easy
	39	0.25	Fair
	40	0.43	Moderate
Medication safety	41	0.66–0.98	Moderate–easy
	42	0.62–0.86	Moderate–easy
	43	0.65	Moderate
	44	0.33	Moderate
	45	0.37–0.66	Moderate–easy

Author statement

Levett-Jones: Conceptualization, Methodology, Writing - Original draft preparation

Andersen: Writing - Reviewing and editing

**Bogossian:** Writing - Original draft preparation and Reviewing and editing  
**Cooper:** Data analysis, Original draft preparation and Writing - Reviewing and editing  
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#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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