



The influence of situation awareness training on nurses' confidence about patient safety skills: A prospective cohort study



Norman Stomski*, Heather Gluyas, Prue Andrus, Anne Williams, Martin Hopkins, Jennifer Walters, Martinique Sandy, Paul Morrison

School of Health Professions, Murdoch University, 90 South St, Murdoch, 6150, WA, Australia

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ABSTRACT

Background: Several studies report that patient safety skills, especially non-technical skills, receive scant attention in nursing curricula. Hence, there is a compelling reason to incorporate material that enhances non-technical skills, such as situation awareness, in nursing curricula in order to assist in the reduction of healthcare related adverse events.

Objectives: The objectives of this study were to: 1) understand final year nursing students' confidence in their patient safety skills; and 2) examine the impact of situation awareness training on final year nursing students' confidence in their patient safety skills.

Methods: Participants were enrolled from a convenience sample comprising final year nursing students at a Western Australia university. Self-reported confidence in patient safety skills was assessed with the Health Professional in Patient Safety Survey before and after the delivery of a situation awareness educational intervention. Pre/post educational intervention differences were examined by repeated measures ANOVA.

Results: No significant differences in confidence about patient safety skills were identified within settings (class/clinical). However, confidence in patient safety skills significantly decreased between settings i.e. nursing students lost confidence after clinical placements.

Conclusion: The educational intervention delivered in this study did not seem to improve confidence in patient safety skills, but substantial ceiling effects may have confounded the identification of such improvement. Further studies are required to establish whether the findings of this study can be generalised to other university nursing cohorts.

1. Introduction

Health professional education emphasises acquisition of technical psychomotor skills and evidence-based knowledge that leads to the proficient implementation of such skills in clinical practice (Mansour 2013). In nursing, technical skills include physical assessment, physiological observations, wound management, and medication administration. Despite continual advances in health professional education, one in ten patients will experience an adverse event, of which one in five will be serious, and one in three will be fatal (Aljadhey et al. 2013; IOM 2000; Wilson et al. 1995; Wilson and Van der Weyden 2005).

Initiatives to minimise the occurrence of adverse events in the delivery of healthcare have focused on correcting system and organisational processes that contribute to errors, and also on enhancing health professionals' knowledge and technical skills (Carayon and Wood 2010). Addressing such issues plays an essential role in enhancing

patient safety, but an area that has received relatively less attention involves the improvement of non-technical skills (White 2012). These non-technical skills broadly concern the manner in which health professionals communicate and co-operate with each other (Crichton et al. 2013; Yule et al. 2006). The importance of non-technical skills needs to be emphasised, as estimates suggest that 70–80% of medical errors result from a breakdown in non-technical skills (Dunn et al. 2007; Glavin and Maran 2003).

Situation awareness is a non-technical skill that contributes to the reduction of errors that lead to medical adverse events (Brady and Goldenhar 2014; Gillespie et al. 2013; Stubbings et al. 2012). It has been defined as “the perception of elements in the environment within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future” (Endsley 1995). In plain terms, within clinical settings, situation awareness assists health professionals to handle and process information about what is occurring

* Corresponding author.

E-mail address: N.Stomski@murdoch.edu.au (N. Stomski).

around them.

Issues that detrimentally impact on situation awareness can be categorised as either context, individual, or cognitive factors (Gluyas and Morrison 2013). Context factors comprise noisy environments, distractions and interruptions, poor workplace and equipment design, workload, and poor teamwork (Endsley 2012; Thomas et al. 2014). Individual factors include experience and competency in clinical practice, along with issues such as anxiety, illness, fatigue, and negative life events (Endsley 2012). Finally, cognitive factors consist of attentional tunnelling, information overload, and the propensity to undertake familiar tasks automatically which results in an inability to recognise changes in the situation (Endsley 2012; Flin et al. 2008; Gluyas and Harris 2016).

Limited evidence indicates that poor situation awareness may be responsible for almost half of the serious adverse events that occur in hospital settings (Brady et al., 2013a, 2013b; Muething et al. 2012). The essential principles of situation awareness, and the techniques that enhance situation awareness, can readily be taught to individuals (Endsley 2015). Such training results in the acquisition of skills that maintain situation awareness and an understanding of conditions that impair situation awareness. Health professionals may not be able to influence some context, individual, or cognitive factors that degrade situation awareness, but understanding these factors can nonetheless assist in the maintenance of situation awareness (Brady et al., 2013a, 2013b; Gartenberg et al. 2014; Salas et al. 2008; Stubbings et al. 2012). Therefore, inclusion of these skills in undergraduate health professionals' curricula is important as it is reasonable to assume that they will not be gained through clinical experience alone (Flin et al. 2008; Milligan 2007).

This study reports on the implementation of a situation awareness educational intervention that was developed to improve nursing students' confidence in their patient safety skills. The objectives were to: 1) understand final year nursing students' confidence in their patient safety skills; and 2) examine the impact of situation awareness training on final year nursing students' confidence in patient safety skills.

2. Methods

A single-group, two-time point repeated measures design was used in this study. Nursing students' self-reported confidence in patient safety skills was assessed with the Health Professional in Patient Safety Survey (H-PEPSS) before and after the delivery of a situation awareness educational intervention (Ginsburg et al. 2012). Ethical approval was obtained for this study from the Murdoch University Human Research Committee (approval number: 2016/009).

2.1. Participants

Participants were enrolled from a convenience sample comprising final year nursing students at a Western Australia university. A research staff member publicised the study in lectures and distributed information letters. Participation was voluntary and students were notified that withdrawal at any point in the study would have no adverse effect on their enrolment or grades. Potential participants were asked to complete the H-PEPSS shortly before undertaking the situation awareness educational intervention, and also ten weeks later at the conclusion of a clinical placement. In total, 96 students were recruited to the study.

2.2. Educational Intervention

The situation awareness educational intervention was delivered as a two-hour interactive workshop at the commencement of the second semester. The intervention covered fundamental principles that promote the maintenance of situation awareness, situation and organisational factors that inhibit situation awareness and lead to errors, and strategies that enhance situation awareness. In addition, videos and

interactive scenario problem solving were used to enable students to implement situation awareness strategies in situations that provoke errors.

2.3. Survey Instrument

Data were collected using the previously validated H-PEPSS, which captures details about six socio-cultural dimensions that are integral to patient safety (Ginsburg et al. 2012). These dimensions comprise: working in teams with other health professionals (three items); understanding human and environmental factors (two items); managing safety risks (three items); communicating effectively (three items); culture of safety (three items); and recognising and responding to adverse events. For each item, respondents are directed to report separately about their confidence in what they learnt in the classroom setting and clinical setting. Each item is scored from 1 to 5 on five-point Likert scale with response options that range from strongly disagree to strongly agree. Mean scores are reported separately for the class and clinical settings across each of the six socio-cultural dimensions.

2.4. Data Analysis

Data were analysed in SPSS v.22. Demographic characteristics and aggregated scale scores were reported descriptively. Principal components analysis, with a direct oblimin rotation, was used to evaluate the structure of the survey instrument. Cronbach's alpha was used to assess the internal consistency of the six social dimensions associated with patient safety. Pre/post educational intervention differences in the six dimensions aggregated scale scores were examined by repeated measures ANOVA. Finally, floor and ceiling effects were examined by using the 15% threshold for respondents recording the lowest and highest possible score (Lim et al. 2015; Terwee et al. 2007; Wang et al. 2009).

3. Results

The response rate for this survey was 65.6% ($n = 63/96$).

3.1. Demographic Characteristics

The overwhelming majority of participants were female (90.3%). The mean age of the participants was 28.1 years (SD = 8.9).

3.2. Evaluation of the H-PEPSS' Structure

Table 1 displays the results of the principal components analysis (note that only item loadings above 0.30 are shown). As the results demonstrate, the items strongly loaded onto the dimensions established in the initial validation study (Ginsburg et al. 2012). Cronbach alpha values for each of the HPEPSS dimensions are shown in Table 2. All dimensions evidenced adequate levels of internal consistency, which further supports the dimensionality of the instrument.

3.3. Between Setting Changes in the H-PEPSS Scores

Tables 3 and 4 display the between setting mean scores for the six HPEPSS dimensions before and after the administration of the educational intervention. Pre-intervention, significant differences between the class and clinical settings were identified for all dimensions with the exception of "Managing Safety Risks". Post-intervention, significant differences between the class and clinical settings were only identified for the "Working in Teams with other Health Professionals" and "Recognising and Responding to Adverse Events" dimensions.

3.4. Within Setting Changes in the H-PEPSS Scores

Tables 5 and 6 display the within setting mean scores for the six

Table 1
Principal components analysis of the H-PEPSS.

Item	Component					
	1	2	3	4	5	6
I feel confident in what I learnt about...						
Managing inter-professional conflict			0.658			-0.392
Sharing authority, leadership and decision-making			0.916			
Encouraging team members to speak up, question, challenge			0.787			
Enhancing patient safety through clear and consistent communication with patients	0.826					
Enhancing patient safety through effective communication with other healthcare providers	0.883					
Effective verbal and nonverbal communication abilities to prevent adverse events	0.892					
Recognising routine situations in which safety problems may arise		0.722				
Identifying and implementing safety solutions		0.906				
Anticipating and managing high risk situations		0.959				
The role of human factors, such as fatigue, which effect patient safety				0.733		
The role of environmental factors such as work flow, ergonomics and resources, which affect patient safety				0.869		
Recognising an adverse event or close call						0.720
Reducing harm by addressing immediate risks for patients and others involved	0.381					0.626
The importance of having a questioning attitude and speaking up when you see things that may be unsafe					-0.884	
The importance of a supportive environment that encourages patients and providers to speak up when they have safety concerns					-0.910	
The nature of systems and system failures and their role in adverse events						-0.768

Table 2
Cronbach alpha values for H-PEPSS dimensions.

Dimension	Setting	Cronbach alpha
Working in teams with other health professionals	Clinical	0.83
	Class	0.74
Communicating effectively	Clinical	0.93
	Class	0.91
Understanding human and environmental factors	Clinical	0.68
	Class	0.58
Managing safety risks	Clinical	0.90
	Class	0.83
Recognising and responding to adverse events	Clinical	0.84
	Class	0.77
Culture of safety	Clinical	0.89
	Class	0.80

Table 3
Comparison of pre-intervention class and clinical scores.

Dimension	Mean class scale score	Mean clinical scale score	P value
Working in teams with other health professionals	12.3 (SD = 2.1)	11.2 (SD = 2.5)	0.01
Communicating effectively	13.7 (SD = 1.6)	13.0 (SD = 7.3)	0.03
Understanding human and environmental factors	8.9 (SD = 1.1)	8.7 (SD = 1.1)	0.006
Managing safety risks	13.3 (SD = 1.7)	12.4 (SD = 1.9)	0.2
Recognising and responding to adverse events	9.4 (SD = 1.0)	8.7 (SD = 1.3)	0.002
Culture of safety	13.9 (SD = 1.5)	12.9 (SD = 2.0)	0.001

Table 4
Comparison of post-intervention class and clinical scores.

Dimension	Mean class scale score	Mean clinical scale score	P value
Working in teams with other health professionals	12.6 (SD = 2.2)	11.6 (SD = 2.3)	0.01
Communicating effectively	13.7 (SD = 2.0)	13.3 (SD = 2.1)	0.2
Understanding human and environmental factors	8.8 (SD = 1.6)	8.4 (SD = 1.8)	0.07
Managing safety risks	13.2 (SD = 1.9)	12.6 (SD = 2.4)	0.1
Recognising and responding to adverse events	8.9 (SD = 1.6)	8.4 (SD = 1.9)	0.06
Culture of safety	13.6 (SD = 2.3)	12.5 (SD = 2.6)	0.009

HPEPSS dimensions before and after the administration of the educational intervention. Repeated measures ANOVA did not identify significant changes within the class or clinical settings in the HPEPSS dimension scale scores post educational intervention.

3.5. Floor and Ceiling Effects for the H-PEPSS' Dimensions

For five of the six dimensions in the clinical setting, and in all six dimensions in the class setting, over 15% of the respondents achieved the highest score (Tables 7 and 8).

4. Discussion

Our findings indicate that final year nursing students were highly confident about the patient safety skills they gained during their education. The lack of a significant increase in confidence in patient safety skills after implementation of the situation awareness training program suggests that the program had no impact. However, the presence of ceiling effects in H-PEPSS dimensions before the delivery of the training program indicates that the instrument may have been unsuitable to measure change in confidence in patient safety skills. Previous studies that have used the H-PEPSS have not examined ceiling effects (Ginsburg et al. 2013; VanDenKerkhof et al. 2017). But the H-PEPSS dimension scores in the prior studies in nursing cohorts were very similar to the scores reported in this study, which suggests the ceiling effects may have also been an issue in the previous studies (Ginsburg et al. 2013; VanDenKerkhof et al. 2017).

The developers of the HPEPSS note that the instrument may be used to assess patient safety behaviour at different stages in training (Ginsburg et al. 2012). Our findings indicate that because of ceiling effects the H-PEPSS may not be able to detect change in such behaviour beyond the final year of undergraduate training in nursing cohorts (Terwee et al. 2007). It seems reasonable to assume that the H-PEPSS may be used to understand change in patient safety skills as nursing students' progress through undergraduate programs, but further studies are warranted to establish the responsiveness of the H-PEPSS for this purpose.

Previous studies that had used the H-PEPSS in nursing cohorts reported mixed findings about the difference between class and clinical scores across the six dimensions of the H-PEPSS. In one of these studies, the clinical scores were higher than the class scores for all but two of the dimensions, which was generally consistent with the expectation that nurses' confidence in patient safety skills would improve once they had gained clinical experience (VanDenKerkhof et al. 2017). However, in the other study the clinical scores were higher than the class scores for

Table 5
H-PEPSS clinical mean scale scores.

Dimension	Mean pre-intervention scale score	Mean post-intervention scale score	P value
Working in teams with other health professionals	11.2 (SD = 2.5)	11.6 (SD = 2.3)	0.2
Communicating effectively	13.0 (SD = 7.3)	13.3 (SD = 2.1)	0.6
Understanding human and environmental factors	8.7 (SD = 1.1)	8.4 (SD = 1.8)	0.3
Managing safety risks	12.4 (SD = 1.9)	12.6 (SD = 2.4)	0.4
Recognising and responding to adverse events	8.7 (SD = 1.3)	8.4 (SD = 1.9)	0.6
Culture of safety	12.9 (SD = 2.0)	12.5 (SD = 2.6)	0.5

only half of the dimensions (Ginsburg et al. 2013).

In contrast to the prior studies that had used the H-PEPSS in nursing cohorts (Ginsburg et al. 2013; VanDenKerkhof et al. 2017), all of the class scores were higher than the clinical scores in our study both pre and post educational intervention. It should be noted, though, that in the previous studies and present study the largest absolute difference between the clinical and class scores was only about 5% of the possible range in score. Notwithstanding the observed significant statistical associations, it seems unlikely that such a difference in score would translate in meaningful change in clinical safety practices and the results therefore should be interpreted with caution.

The loss of confidence in our cohort's patient safety skills that accompanied the transition from a classroom to clinical setting suggests that workplace culture detrimentally impacts on nurses' confidence levels. This notion is supported by the findings of several studies that have shown that nurses have less positive perceptions of collaboration and communication than physicians (Mills et al. 2008; O'Leary et al. 2010; Thomas et al. 2003; Wauben et al. 2011). Such differences in perceptions tend to result from physicians' privileged position within the healthcare system (Leape et al. 2012; Skjorshammer 2001; Sundin-Huard 2001). However, intra-professional hierarchical attitudes may also influence confidence levels, as nursing faculty incivility towards students impairs self-esteem and self-efficacy (Del Prato 2013).

Although clinical experience impacted on our cohort's confidence in patient safety skills, they nonetheless remained highly confident over the course of the study. It might be the case that the confidence levels observed in this study reflect naivety about the difficulties of maintaining situation awareness and achieving patient safety in the error provoking conditions of a busy clinical environment. Nursing curricula emphasises adherence to technical skills and pre-determined procedures and standardised plans, and as such the high degree of confidence may result from nurses' familiarity with working within the boundaries of their professional scope of practice (VanDenKerkhof et al. 2017).

4.1. Limitations

The interpretation of our findings should be viewed in light of several caveats. This study was conducted within a single Australian university, and it is unclear if the results can be generalised to other Australian university nursing cohorts. However, the demographic characteristics, in terms of age and gender, of our participants were very similar to details reported in other Australian undergraduate nursing studies, which to some extent supports the generalisability of our findings (Gaynor et al. 2007; Salamonsen et al. 2012). We used a

Table 6
Class H-PEPSS mean scale scores.

Dimension	Mean pre-intervention scale score	Mean post-intervention scale score	P value
Working in teams with other health professionals	12.3 (SD = 2.1)	12.6 (SD = 2.2)	0.2
Communicating effectively	13.7 (SD = 1.6)	13.7 (SD = 2.0)	0.4
Understanding human and environmental factors	8.9 (SD = 1.1)	8.8 (SD = 1.6)	0.4
Managing safety risks	13.3 (SD = 1.7)	13.2 (SD = 1.9)	0.4
Recognising and responding to adverse events	9.4 (SD = 1.0)	8.9 (SD = 1.6)	0.5
Culture of safety	13.9 (SD = 1.5)	13.6 (SD = 2.3)	0.4

Table 7
Floor and ceiling effects for class H-PEPSS dimensions.

Dimension	Proportion recording lowest possible score	Proportion recording highest possible score
Working in teams with other health professionals	0%	20.3%
Communicating effectively	0%	55.2%
Understanding human and environmental factors	0%	35.7%
Managing safety risks	0%	43.6%
Recognising and responding to adverse events	0%	62.1%
Culture of safety	0%	52.6%

Table 8
Floor and ceiling effects for clinical H-PEPSS dimensions.

Dimension	Proportion recording lowest possible score	Proportion recording highest possible score
Working in teams with other health professionals	0%	13.6%
Communicating effectively	0%	39.7%
Understanding human and environmental factors	0%	33.9%
Managing safety risks	0%	23.2%
Recognising and responding to adverse events	0%	39.0%
Culture of safety	0%	32.8%

self-report instrument and social desirability bias may have influenced the high levels of confidence. In addition, the use of a self-report measure may mean that respondents underestimated or overestimated their confidence in patient safety skills.

5. Conclusion

Our findings indicate that final year nursing students generally had high levels of confidence in their patient safety skills. Such confidence was eroded to a modest extent when students were exposed to clinical environments. At the very least, the lack of improvement in confidence about patient safety skills indicates that workplace cultures are not building on competencies nursing students' gained during undergraduate education and may in fact be undermining these emergent skills. The educational intervention delivered to the nursing cohort in this study did not seem to result in improved confidence in patient

safety skills. However, substantial ceiling effects may have confounded the identification of any such improvement. Further studies are required to establish whether the HPEPSS may be responsive to longitudinal change, and determine whether situation awareness training may improve health professionals' patient safety competencies.

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