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Effect of an evidence based quality improvement framework on patient safety

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ABSTRACT

Key Words
The Productive Ward Program™, patient safety, quality, falls, medication errors

Objectives
To investigate the impact of the introduction of The Productive Ward Program™ on two patient safety indicators; patient falls and medication errors.

Design
Retrospective quantitative study.

Setting
The study was conducted at a major metropolitan acute care hospital in Sydney, Australia.

Subjects
This study was conducted in a medical, surgical and two aged care wards, with a combined total of 120 inpatient beds over a 32 month time period.

Main Outcome Measures
The number of patient falls and medication errors for each of the participating wards.

Results
The implementation of The Productive Ward Program™, did not have an overall significant statistical reduction in the number of falls and medication incidents. Aged Care 1, had a reduction of 13 falls between intervention and post intervention phase, these results were not statistically significant (OR 1.17; 95% CI 0.86, 1.59). For Aged Care 1 ward there was a statistically significant reduction in medication errors from 66 errors pre intervention to 27 medication errors post intervention (OR 2.73; 95% CI 1.71, 4.38).

Conclusion
The results of this small study indicate that the implementation of The Productive Ward Program™, did not have an overall significant statistical reduction in the number of falls and medication errors. This paper highlights the need for future research on the impact of the Productive Ward Program on patient safety.

INTRODUCTION

The acute healthcare environment is complex and rapidly changing in part due to increasing patient acuity, staff shortages, decreasing length of hospital stays, and the aging population (El Haddad et al 2013). In light of this, the provision of safe quality care remains an ongoing challenge for clinical staff. Patient safety is important to reduce harm to patients and prevent adverse consequences thus, it is important that ways are found to transform care cultures in an effort to provide safe and effective care. Better patient outcomes and quality of care have been attributed to improvements in hospital work environments and processes, for example staffing, decision making and multidisciplinary relations (White et al 2014; Aitken et al 2012; Lennard 2012). The Productive Ward Program™ (PWP) is one such strategy designed to empower the Multidisciplinary Team (MDT) to make changes towards improving the safety, quality and delivery of care (White et al 2014; Wilson 2009) with the main aim of improving clinical and safety outcomes for patients (Van Bogaert et al 2014)

BACKGROUND

Numerous indicators have been defined to monitor patient safety, however the commonly used indicators included the incident of patient falls and medication errors. (Burston et al 2014; DuPree et al 2014; Heslop and Lu 2014; Burston et al 2011; Dykes et al 2011). The literature is rife with studies relating to strategies to prevent incident of patient falls and medication errors. However, the focus of these studies has been mainly on the development of screening tools, patient self-efficacy, nurse to patient ratios, staffing numbers and the relationship between the care provided, patient outcomes and existing processes. Whilst these studies acknowledged the importance of patient safety indicators and the limitation of current studies they also noted the limitations of existing risk screening tools and challenges with the reporting and prevention of falls and medication errors. In order to draw attention to patient safety, two common key patient safety indicators, namely patient falls and medication errors, have been utilised to measure and determine the appropriateness, effectiveness and quality of care strategies (Burston et al 2011).

Falls

Falls are the most common and often preventable adverse component of acute hospital care. In a recent survey undertaken in England, there were 314,314 patient falls in the National Health Service (NHS) hospitals accounting for 19% of all incidents notified in the NHS reporting system (NHS National Reporting and Learning System, 2015). Similarly, the incidence of falls in the United States of America (USA) hospital system has been reported to be between 700,000 and 1,000,000 per year (Agency for Healthcare Research and Quality, 2013). In Australia, the number of patient falls were 298,709 across both private and public hospitals. (Australian Institute of Health and Welfare, 2014). The number of inpatient falls notified in New South Wales (NSW) public hospitals in 2013 was 27,073.

In New South Wales falls are classified according to the severity assessment code (SAC). SAC is a numerical score applied to an incident based predominantly on its consequence. SAC 1 and SAC 2 incidents are those that resulted in the death or serious injury or harm to the patient (NSW Clinical Excellence Commission, 2008). Of the 27,073 incidents of falls in NSW, 464 were classified as SAC 1 and SAC 2 incidents (NSW Clinical Excellence Commisssion, 2014).

The demographics of patients admitted to acute hospital in Australia is predominantly aged 65 years and older. This combined with the severity of illness and unfamiliar surroundings of hospitals are predisposing factors which add to the increased risk of patient falls and the consequences of falls (Healey et al 2014). Harm to patients from falls include fractures, head injuries, soft tissue injuries, psychological trauma, extended length of stay and cost for the health care services (Dunne et al 2014). A study undertaken with 250 patients

aged 60 years and over demonstrated a one-year cumulative mortality was 25.2% among those who have fall related fractures (Coutinho et al 2012).

Medications

Medication errors and intravenous fluid incidents account for the second most reported clinical event in Australian health contexts (Hayes et al 2015) with 10,475 medication errors and intravenous incidents recorded over a six month period between July to December 2010 and 11,132 in 2013 for the same period (Australian Commission on Safety and Quality in Health Care 2009).

Medication errors account for one of the most significant causes of harm to patient safety and are attributed to increased length of stay, readmissions, distress, mortality and, increasing financial costs (Wittich et al 2014; Flynn et al 2012; Evans 2009). Patient safety remains a concern for health care despite continual monitoring of medication errors (Folkmann and Rankin 2010). To decrease the likelihood of medication errors, strategies have been implemented to improve the practice environment. These include participation in decision making for staff, improved teamwork between the MDT, fostering continuity of care and ongoing educational opportunities (Flynn et al 2012). In addition, the introduction of electronic medical records with medication components has been reported to decrease the incidence of medication errors by up to 50% (Geneve et al 2015).

Strategies

Falls and medication errors prevention strategies in acute care are complex (Dykes et al 2011) hence, a number of evidence-based quality improvement frameworks have been implemented to address patient safety. These include 'Transforming Care at the Bedside (TCAB), and the 'Studor Group', both conducted initially in the USA. The TCAB is a nurse led initiative, where staff work in a supportive team and focus on four key areas: care that is safe, reliable and effective; patient-centred, efficient and minimal waste. These initiatives are key to sustainable healthcare in the future (Burston et al 2011).

Results from an observational study in Australia that utilised TCAB, noted an improvement in patient safety indicators with a reduction in the incidence of both medication errors and patient falls. However, the authors acknowledged that further evaluative studies were needed (Burston et al 2011). Comparatively, the Studor Group focused on creating purpose, making a difference and valuing the work undertaken (Braaf et al 2015). Rounding performed by nurses was one approach which had a positive result in improving patient safety by reducing the incidence of falls in a number of USA hospitals.

In Australia, the Essentials of Care Program is another evdience-based quality improvement framework that has been employed to improve patient care and outcomes. The Essentials of Care Program is focused on nine domains which link to clinical standards, including 'preventing risk and promoting safety'. The program is structured into six phases and is ongoing with a two year evaluation cycle. Research and evidence gained in the clinical context is used by the team to review, change practice and achieve improved patient outcomes (NSW Department of Health 2009).

The Productive Ward Program™ (PWP) is another evidence-based quality improvement framework that has been implemented in Australia to improve patient outcomes, particularly in relation to the reduction of patient falls and medication errors. The Productive Ward Program™ is designed to assist wards to streamline work processes, reduce inefficient activities, declutter the work place and release more time to care for patients (Dunne et al 2014; White and Waldron 2014).

The quality improvement project reported in this paper is The Productive Ward Program™ (PWP). The PWP was developed by the United Kingdom's National Health Service Institute for Innovation and Improvement (NSHI) in

2005; with widespread implementation in 2008 (Wilson 2009). Since then, The PWP has been introduced in numerous countries including Australia, Canada, Denmark, Ireland, New Zealand, The Netherlands, Scotland and the USA (Oregon) (White et al 2014). The program utilises lean thinking methodology (Wilson, 2009) and principles of complexity theory to improve flow, reduce waste and empower staff to review the ward environment and clinical processes, in order to identify areas of improvement and initiate positive change (Dunne et al 2014). Complexity theory highlights the need for change at all levels of healthcare and seeks to explain the relationship between macro-structures and micro-level behaviour (Chandler et al 2016; Lanham et al 2013). The PWP attempts to address this complex relationship by aiming to involve all layers of the health care system in order to increase direct patient care time, enhance the staff and patient experience and, improve safety and efficiency of care (Burston et al 2011). The PWP was implemented at the major metropolitan acute care hospital with the aim of it becoming a long term evidence-based quality improvement framework involving all members of the MDT. For this reason, patient safety indicators involving a multidisciplinary approach to reduce harm have been applied as measures to determine the effects of The PWP.

The PWP is comprised of three foundation modules which are completed in order, followed by ten process modules (White et al 2014). Before beginning implementation, a selection of staff from the ward attend a two-day training program. The training has a strong focus on the processes of the three foundation modules and the basic principles of The PWP. Each module includes a prepare, assess, diagnose, plan, treat and evaluate cycle. The first foundation module required to be completed is 'Knowing how we are doing (KHWD)', which involves implementing measurement systems to collect baseline data regarding the ward's performance. The collection of baseline data informs the decisions that are made by the staff to improve performance (Lennard 2012; Armitage and Higham 2011). As a component of the measurement system, each ward undertakes an 'activity follow'. The 'activity follow' includes the observation of nurses for a 12-hour period as routine work is performed. The percentage of direct patient care time, the number of interruptions, inefficient activities and barriers to provide care are identified during this activity (Wright and McSherry 2013; Armitage and Higham 2011). Additional measurement systems include patient and staff satisfaction surveys and safety crosses. A safety cross (figure 1) is a visual tool representing each day of the month and is used to track the number of days in which a particular incident occurred.

Figure 1: A safety cross
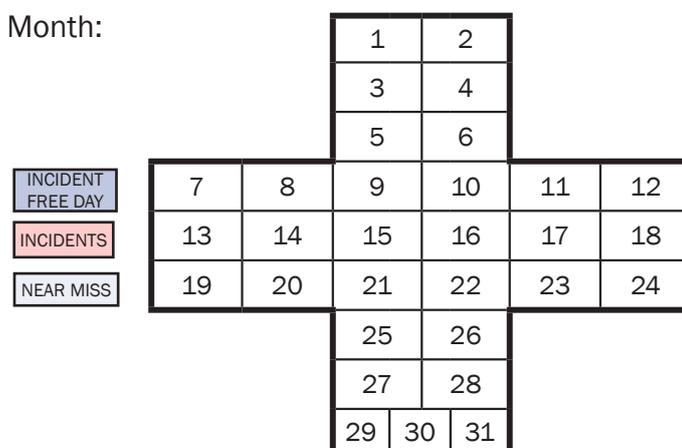
The subsequent foundation module is 'Well Organised Ward (WOW)'. The aim of this module is to review and address environmental issues to streamline the location and holdings of stock and equipment. This is designed to ensure access and standardisation of strategies that will improve functionality and work processes (Armitage and Higham 2011). Data and information collected from KHWD assists ward staff identify the areas to 'WOW', resulting in staff spending less time looking for equipment and stock (Lennard 2012). The final foundation module is 'Patient Status at a Glance (PSAG).' The aim of this module is to ensure information regarding a patient's status and hospital journey is clear and accessible. Thus, as a result, there are less interruptions and time spent looking for patient information (Lennard 2012; Armitage and Higham 2011).

On completion of the three foundation modules, the ward teams identify priorities that inform their decision regarding what process module to commence. The process modules are all fundamental components of clinical care. They include falls, pressure injury prevention, patient observations, admissions and planned discharge, shift handovers, meals, medicines, patient hygiene, nursing procedures and ward rounds. The process modules follow a prepare, assess, diagnose, plan treat and evaluate continuous cycle based on the Plan, Do Study, Act (PDSA) methodology, to identify and eliminate activities that add no value to patient care and safety (Van Bogaert et al 2014).

METHOD

This retrospective study was conducted in a major metropolitan acute care hospital in Sydney, Australia in 2016. The PWP was introduced to the research site in 2013. Four demonstration wards were purposefully selected and included: an aged care ward without a rapid assessment unit (Aged Care 1), an aged care ward with a rapid assessment unit (Aged Care 2), a medical ward and, a surgical ward; with a combined total of 120 inpatient beds.

Aim
The aim of this study was to investigate the impact of The PWP™ on patient safety in regards to two patient safety indicators; patient falls and medication errors.

Inclusion criteria
The wards selected to participate in the study were The PWP start up wards. These wards were selected due to the availability of retrospective data.

Data collection
Data was collected for patient falls and medication errors for each of the participating wards at three time periods: pre implementation (13 months), implementation (6 months) and the post implementation period (13 months) to assess the effects of the PWP on falls and medication errors.

The data was retrieved from the Incident Information Management System (IIMs) which is a system utilised by all NSW Health facilities for recording and reporting healthcare incidents. IIMs was selected as the data collection tool in preference to safety crosses. The rationale for this decision was that the recording of data using safety crosses is solely reliant on staff recording the incidents daily. Because of this potential variability, the number of incidents per day cannot be accurately accounted for. This compares to the integrity of the IIMs data collected which is reflective of the reporting accountabilities of patient incidents. The number of falls per 1,000 occupied bed day (OBD), the falls rates and the total number of medication incidents for the study period were sourced.

Data Analysis
Data was entered into Excel and analysed using SPSS. The researchers were not able to conduct any further checks in data integrity as data was downloaded straight from IIMS. Data relating to patient falls were analysed

per 1,000 ODB to ensure standardisation. Frequencies and percentages were used to measure the number of patient falls and medication errors. Differences between pre and post data were measured using t-test. Results were considered to be significant if p=<0.05.

Ethics approval

Approval to conduct this quality project was obtained from the South Eastern Sydney Local Health District Research and Ethics Committee.

Demographics

Twenty-nine staff attended a two-day Productive Ward training program conducted on the research site. The participants included nurses, a physiotherapist and a ward clerk. Data was collected from the four participating wards and all had a profile of 30 beds. See table 1 for the data relating to the number of OBD for each ward during the three time periods.

Table 1: Number of Occupied Bed Days per ward during the three time periods

Ward	Pre intervention No of OBD (13 months)	Intervention period Monthly average of OBD	Post intervention No of OBD (13 months)	Post intervention monthly average of OBD
Surgical	11.130	856	10.892	838
Medical	11.193	861	11.118	855
Aged Care 1	11.725	902	11.608	893
Aged Care 2	9.408	724	11.324	871

FINDINGS

Falls

The combined total of falls incidents in the pre implementation phase was 337 per 1,000 OBD and in the post implementation phase this reduced to 307 falls per 1,000 OBD. However, overall, there was no statistical significant reduction in the incident of falls in any of the participating wards (p= 0.20).

For the surgical ward although there was an increase in the number of falls from 36 per 1,000 OBD to 39 per 1000 OBD, these results were not statistically significant (OR 0.92; 95% CI 0.58, 1.46) (figure 2). The medical ward had a reduction of only 1 fall per 1,000 OBD; 70 falls per 1000 OBD pre intervention to 69 falls per 1,000 OBD post intervention. These results were not statistically significant (OR 1.02; 95% CI 0.72, 1.43) (figure 2). Although Aged Care 1, had a reduction of 13 falls between the intervention and post intervention phase, these results were not statistically significant (OR 1.17; 95% CI 0.86, 1.59) (figure 2). For Aged Care 2 the results were not statistically significant, even though there was a reduction of 20 falls per 1,000 OBD; from 133 falls per 1,000 OBD pre intervention to 113 falls per 1,000 OBD post intervention (OR 1.20; 95% CI 0.92, 1.57) (figure 2).

Medications

For the surgical ward although there was a decrease in the amount of medication errors from 30 incidents to 17 incidents, the decrease was not statisticaly significant (OR 1.83; 95% CI 0.99, 3.37) (figure 3). The medical ward had an increase in medication errors from 24 incidents to 34 incidents, however, this result was not statisticaly significant (OR 0.69; 95% CI 0.40, 1.18) (figure 3). For Aged Care 1 ward there was a statistically significant reduction in medication errors from 66 medication error pre intervention to 27 medication errors post intervention (OR 2.73; 95% CI 1.71, 4.38) (figure 2). Aged Care 2 ward had an increase in medications from 27 errors pre intervention to 34 errors post intervention, these results were not statistically significant (OR 0.78; 95% 0.46, 1.32) (figure 3).

Figure 2: Incident of falls in all wards over the three time periods
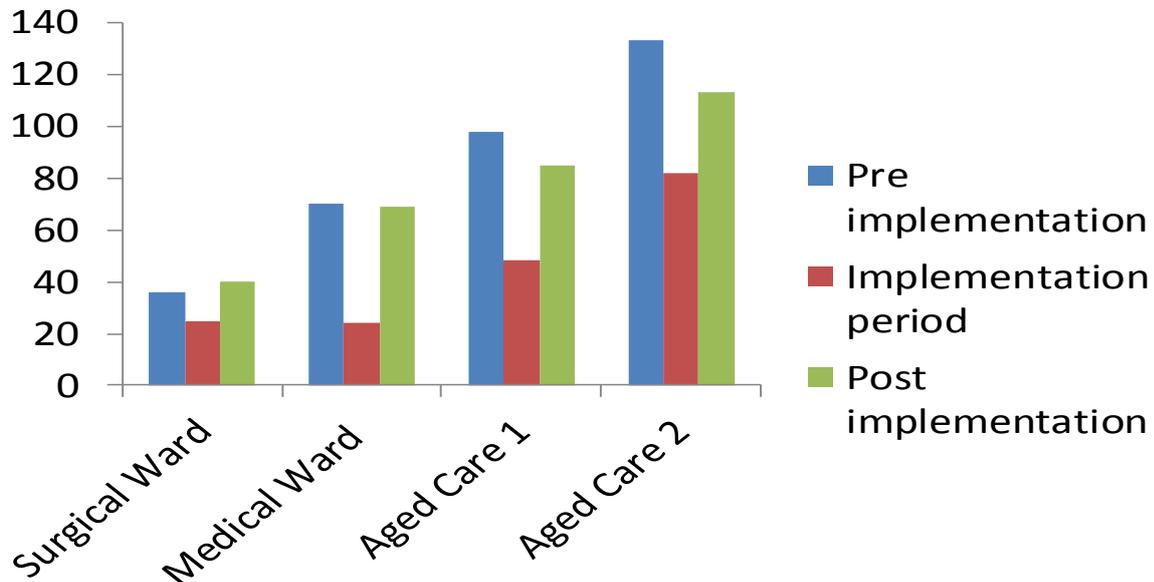
Figure 3: Medication errors in all wards over the three periods
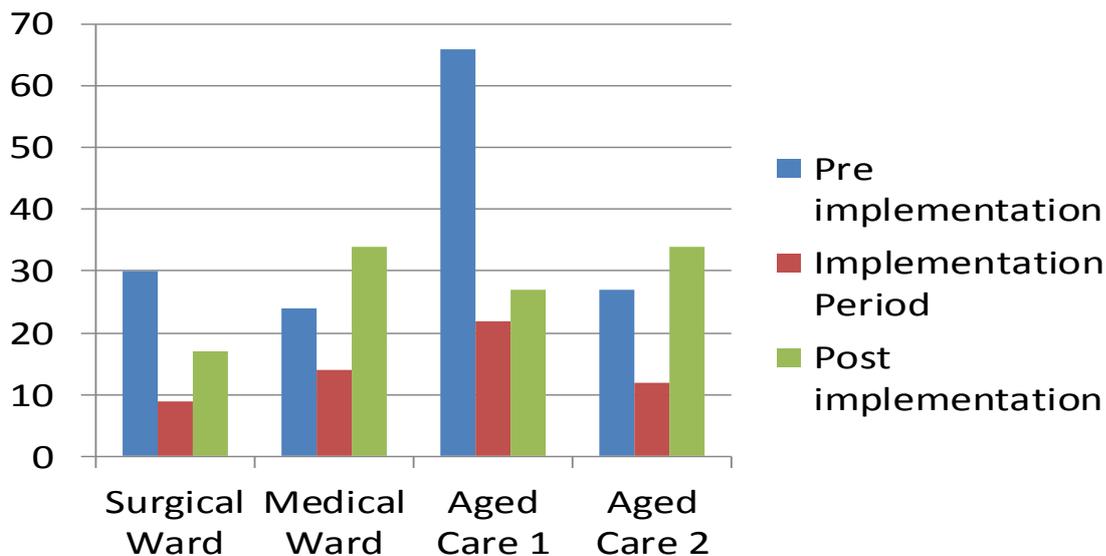
STUDY LIMITATIONS

There were a number of limitations to this study. Only two patient safety indicators were analysed in the study. It would be beneficial to broaden the inclusion of patient safety indicators in further research for example, the inclusion of pressure injury incidence. Data for pressure injury incidence was not available for all wards in the PWP and hence was not included in this study. Another limitation of the study is the IIMS data relies strongly on staff entering the falls and medication incidents, thus, it is unknown if all incidents have been reported. As this research was retrospective, nurses and other staff who completed the IIMs reports were not research participants in this study. In addition, the study was conducted over a short period of time, and may not reflect an accurate trend in data related to the chosen indicators.

DISCUSSION

This study was undertaken to investigate the effect of The PWP™ on two patient safety indicators; patient falls and medication errors. In order to reduce adverse events and improve patient safety, various strategies have been employed at the research site.

There is a strong probability that the number of reported medication incidents increased for two of the participating wards due to increased reporting of incidents. This can be directly attributed to the visual display of the safety crosses and the supportive environment for staff to report incidents (Wilson 2009). Safety crosses are a visual tool used to display and draw attention to key clinical domains which have been identified by staff as priorities to measure and track incidences. The participating wards used safety crosses to measure the number of days on which a fall or medication error occurred. The safety crosses aim to enable positive discussion, review and feedback amongst staff regarding fall and medication incidents.

Overall, the number of reported patient safety incidents has increased at this site. This is consistent with a study by Flowers et al (2016) who noted that the supportive learning environment was a key factor in incident reporting. During the implementation period of The PWP, staff were encouraged to complete IIMs reports on patient falls and medication errors. The reporting behaviour of staff was maintained in the post implementation phase due to open communication and belief that patient safety if shared encourages incident reporting (Moon and Kyoung 2017). The PWP created a 'no blame' platform for feedback and joint discussion regarding patient safety incidents (Moon and Kyoung 2017; Hazan 2016; Lennard 2012).

Each ward had the benefit of a designated team leader to facilitate and drive the process of The PWP. As discussed by Dogherty et al (2013), an effective facilitator is vital to ensure success of quality improvement activities. However, as complexity theory argues, implementation of changes cannot be located to a single individual (Chandler et al 2016). A potential reason for the downward trend of some incidents may be contributable to the fact that change was allowed to occur from the micro level and all members of the MDT were encouraged to put forward their ideas for change in the workplace. Complex systems, such as the healthcare environment, are often resistant to 'top down' macro level changes but more responsive to small micro level changes that diffuse through the system, resulting in a more substantial change (Chandler et al 2016).

The WOW foundation module most likely contributed to the statistically significant reduction in medication errors for Aged Care 1. The wards as part of the WOW foundation module, streamlined, reorganised, and standardised the placement of equipment and stock. Thus, improving the work environment, reducing interruptions for the MDT and increasing direct patient care time (Lennard, 2012). Research has identified that a functional work environment has a positive impact on many safety, quality, experience and, value measures (Press Ganey Associates 2015). During the WOW module, Aged Care 1, had an emphasis on the redesign of the medication room. The redesigning of the medication room may have attributed to the reduction of medication errors. However, further studies would need to address the impact of the design of medication rooms on the occurrence of medication errors.

The foundation module has likely contributed to the downward trend of the number of patient falls for the two aged care wards. Both Aged Care wards had a reduction in falls in the post implementation period, this may be attributed to the removal of wasteful activities, interruptions and time spent looking for equipment. Both wards had a strong focus on the organisation of stock and the accessibility of observation equipment during the WOW module, thus, releasing time to care and providing closer supervision of patients at high risk of falls. Research has highlighted the success of increased observation in reducing the incidence of falls (Australian Commission on Safety and Quality in Health Care 2009). Another potential contributing factor to the downward trend in falls for both of the Aged Care wards was the implementation of a modified version

of Intentional Rounding (Flowers et al 2016) as part of the Ward Round module. The Intentional Rounding involved assessing patients for warmth, pain, hunger and thirst and, the need for toileting every two hours. Studies have reported that Intentional Rounding is effective in reducing the incidence of falls. However, not all studies have reported a statistical significant reduction (Flowers et al 2016).

The medical and surgical wards also had a strong focus on the WOW module and while the surgical ward had a reduction in medication errors, neither ward had a reduction in falls between the pre and post implementation period. This potentially suggests that organising and standardising the placement of equipment is not sufficient enough to reduce the incidence of falls and medication errors. The medical ward had a strong focus on the PSAG foundation module, after the activity follow highlighted numerous interruptions in the morning during handover and medication round. The medical ward had a strong focus on reducing interruptions during the morning medication period, with the aim of reducing adverse outcomes. However, the medical ward had an increase in medication errors between the pre and post implementation period. This suggests that further interventions are needed to reduce medication errors.

A literature review conducted by Raban and Westbrook (2013) found limited evidence that reducing interruptions assists in reducing adverse medication incidents. Raban and Westbrook (2013) argue that some interruptions contribute to patient safety and a greater understanding of the relationship between adverse incidents and interruptions is needed. The surgical ward undertook the observation module first and focused on standardising and streamlining the completion of post-operative vital signs. While this module would have contributed to increased patient safety on the ward, it is unlikely to have resulted in a reduction of medication errors and falls.

Strength

The strength of this paper is the diversity of the participating wards which included medical, surgical and two aged care wards. Additionally, these wards comprised a broad classification of nurses and other MDT members and patients with varying acuity and reasons for admission. Flowers et al (2016), examined the effect of transforming care strategies on nurse-sensitive outcomes on only two medical wards. The 13 month pre and post implementation period was also selected to incorporate a full year, ensuring both the quieter summer months and high acuity winter months were accounted for. Falls and medication errors were graphed as 12 month moving average rates to compensate for any potential seasonal variation of incidents (Danai et al 2007).

CONCLUSION

Overall, this paper found that the implementation of the evidence-based quality improvement framework, The PWP, did not have a statistical significant reduction in the incidence of falls and medication incidents.

RECOMMENDATION

Given the small sample size the findings from this research have highlighted the need for further studies on the effect of The PWP on patient safety indicators in multicentre sites. This study will provide a foundation for future work to review other wards undertaking The PWP within the hospital. One aspect of falls that was not assessed in this paper was the number of falls that resulted in harm. Whilst there was no reduction in falls on the medical and surgical wards there may have been a reduction in the number of patients who sustained an injury post fall. Future research should also investigate the number of SAC 1 and SAC 2 falls related incidences pre and post the implementation of The PWP. Further research must also address the sustainability of the PWP within the complex health system.

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Incorporating an Undergraduate Student in Nursing program into the workforce: a prospective observational study

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KEY WORDS

health workforce; nursing students; paediatric nursing; undergraduate; hospitals, paediatric

ABSTRACT

Objectives

The objective was to describe the organisational perspective of the implementation of the Undergraduate Student in Nursing (USIN) program and to describe the experience of nursing staff working with these Undergraduate Students in Nursing.

Design

Prospective, observation design.

Setting

The study took place at a large tertiary paediatric hospital in Brisbane, Australia over a twelve month period.

Subjects

Participants were registered nurses (n=169) employed in a permanent capacity in the following clinical areas – medical, surgical, rehabilitation, paediatric intensive care unit and perioperative.

Interventions

Pre and post staff questionnaires were distributed to staff based on three domains; anticipated thought; assertion in the workplace and role delineation; and reflective practice.

Results

Prior to implementation of USINs, the primary concerns of staff surrounding the introduction of the role included; impact on patient safety, poor skill mix, decrease in quality of care and patient and family satisfaction, impact on unit/ward operation, and the potential attitudes of the students. At 12 months post-implementation, respondents felt that patient safety had increased, skill mix had not been adversely impacted, workload had improved, overall quality of patient care and satisfaction had increased among children and parents.

Conclusion

This introduction improved important elements within the clinical space such as patient safety and quality of care. Registered nurses perceived their workload was reduced and parent and child satisfaction was increased. The results of this study could be generalised beyond paediatrics to adult facilities. We would recommend other organisations consider this model if faced with similar workforce demands.

INTRODUCTION

Nurses are pivotal to global healthcare systems, making up 40 to 50% of the global healthcare workforce (Gaynor et al 2008). With ongoing attention being given to current nursing shortfalls within Australia, it is imperative for the Australian health care system to consider new strategies to address workforce demands (Franklin 2013).

The paediatric healthcare environment is no exception in the challenge to develop the future workforce that is adaptive and skilled with experienced paediatric nurses. As a strategy to address workforce demand, a large tertiary paediatric hospital in Brisbane Australia, developed a new workforce model which incorporated a 'grow your own' approach to developing the future workforce. A pilot program was developed to introduce an Undergraduate Student in Nursing (USiN) model. The USiN is an undergraduate completing a Bachelor of Nursing or equivalent that entitles them (at completion) to apply for registration with the Australian Health Practitioners Registration Authority as a Registered Nurse. The aim of introducing the USiN role within the paediatric setting involved exposing nursing students to paediatric nursing as a recruitment initiative; decreasing orientation time and costs by improving gaps in transition to practice; creating a pipeline to paediatric nursing and; decreasing casual and agency assistant in nursing usage. In essence, the USiN role offers students the opportunity to work part time in the hospital whilst completing their studies.

This paper will examine the process of implementing and coordinating a USiN pilot program in the paediatric setting. This paper will explore the impact of the USiN pilot program from an organisational perspective as well as identify the benefits and challenges felt by the registered nurses and Nurse Unit Managers working alongside these USiNs.

BACKGROUND

The nursing workforce in Australia is experiencing stressors similar to our international counterparts; there is an overall shortage of graduate positions coupled with an increasingly ageing workforce (Duffield 2008). Interestingly, the specialty of paediatrics is difficult to recruit to and this effect is amplified within paediatric specialties such as critical care and oncology. As a strategy to address workforce demand, new workforce models were considered which incorporated a 'grow your own' approach to develop the future workforce. A pilot program, supported by the Office of the Chief Nursing and Midwifery Officer, Queensland Government was developed to introduce the USiN nursing model at our paediatric tertiary hospital. The USiN is an undergraduate completing a Bachelor of Nursing or equivalent that entitles them (at completion) to apply for registration with the Australian Health Practitioners Registration Authority as a Registered Nurse. Funding for the pilot supported recruitment of 18.6 full time equivalent USiN plus 0.5 full time equivalent Clinical Nurse- Clinical Practice Facilitator to support the introduction of USiN role to the organisation.

The concept of the USiN program was borne out of a need to create a pipeline for paediatric nursing. The organisation's aim was to develop a program that would entice undergraduate students to the hospital with paid, part-time positions during their final year at university. This would provide the student with the opportunity to have increased exposure to paediatrics which traditionally is only briefly covered in general undergraduate programs. The program involved a great deal of preparatory work ensuring the USiN's scope of practice was aligned with their curriculum and that safe practice was paramount. As a risk mitigation strategy, initial USiN practice scope was conservative and well below mapped levels of academic theoretical preparation.

The objective of this study was to describe the organisational perspective of the implementation of the USiN program and to describe the experience of nursing staff working with the USiNs.

METHOD

In this descriptive and observational study an anonymous staff questionnaire was developed based on three domains; anticipated thought; assertion in the workplace and role delineation; and reflective practice. All nursing staff with a permanent position were eligible to participate in the study. Demographic data was limited to position grade and clinical area of employment. The staff pre-implementation survey was distributed on paper to each inpatient clinical area within our hospital in April, 2015 just prior to the start date for the USiN's. The staff post USiN implementation survey was distributed electronically using Survey Monkey™ software 12 months after the USiN commencement date. Each questionnaire comprised of a range of multiple choice questions and free text options.

The questionnaires were each piloted prior to dissemination. Data from each of the questionnaires was exported into Excel for the purposes of analysis. Descriptive statistics were generated. Free text responses were input into Nvivo© and thematically analysed.

This study was endorsed by the local Human Research Ethics Committee. Each questionnaire contained an opening statement explaining the purpose of the project and giving assurance of confidentiality and stating that participation was voluntary. Return or submission of a completed questionnaire was taken as consent to participate.

RESULTS

The staff pre-implementation and 12 month evaluation surveys were distributed to five clinical areas; medical ward, surgical ward, rehabilitation ward, the paediatric intensive care unit and the operating theatres. Sixty four responses were collated from the pre-implementation survey representing 19.46% of their full time equivalent staff members at that time. Respondents were all nurses ranging from Assistants in Nursing (Grade 1) through to Nurse Unit Managers and Nurse Educators (Grade 7). The majority (62.5%) of respondents were Registered Nurses (Grade 5). The 12 month evaluation survey focused on Registered Nurses from Grade 5 to Grade 7. There were 105 respondents to the 12 month evaluation survey representing 29% of the full time equivalent workforce.

Prior to the implementation of USiN's the principle concern of staff respondents was that patient safety and skill mix of staff could be reduced (45.3% and 50% respectively) (figure 1). The respondents did anticipate their overall workload would be reduced (43%) and most respondents (85%) felt the quality of care provided would remain the same or increase. Staff respondents also felt that child and parent satisfaction would remain the same or increase (85.2%). A clearly defined scope of practice for the USiN was identified early in the project as an essential element for implementation; 70.3% of respondents were confident in their understanding, 17% were unsure and 12.5% did not know the scope of practice.

Figure 1. Pre-implementation responses on overall workload, patient safety & skill mix

Respondents were asked to describe any concerns they had around the introduction of USiN's into their clinical area. The responses were analysed and the dominant themes were; impact on ward unit operations, additional responsibility subsequent to having unlicensed workers in the clinical area and the USiN's attitude in the clinical area. Impact on ward unit operations includes scope of practice, communication and distribution of workload. Scope of practice was the greatest area of concern with staff expressing concern that there was ambiguity around the USiN's scope of practice and their level of responsibility.

> *"May increase work load initially as they will need an increased requirement for supervision. Also need very clear communications around scope of practice." (Intensive care Registered Nurse)*

The additional responsibility associated with having unlicensed workers in the clinical area was a source of concern for many respondents. Many responses highlighted anxiety surrounding working alongside unlicensed health care workers such as accountability, responsibility and supervision.

> *"Registered Nurses will be expected to carry all the responsibility. Our job will be non-stop med checks & administration. No time for thorough assessment or rapport building, yet if something goes wrong it will be on the Registered Nurse's shoulders." (Medical ward Registered Nurse)*

The final dominant theme in the pre-implementation survey of staff focused on the anticipated attitude of the USiN in the clinical area. Respondents expressed concern around USiN's potentially wanting to avoid menial tasks in favour of more advanced level skills which were outside of their scope of practice.

Figure 2: Word map of respondents' descriptive text

In the evaluation survey conducted 12 months after the USiN implementation 86.9% of respondents perceived patient safety had substantially increased (figure 3). Appropriate skill mix in the clinical area had been a source of concern however at 12 months respondents stated there had been a 0% reduction in skill mix. Perceptions of changes in workload initially suggested that USiNs would reduce the burden of workload. At 12 months 85.8% of respondents perceived their workload had improved. Respondents anticipated in the pre implementation survey that child and parent satisfaction would increase with the introduction of USiNs into the clinical area. At the 12 month evaluation, respondents felt child and parent satisfaction had increased, 25.6% more than initially anticipated. Confusion around the scope of practice was a significant concern prior to the USiN implementation, yet at 12 months greater than 90% of respondents' state they were confident in their understanding and knew what resources were available to provide clarity. In the evaluation survey staff were given an opportunity to provide feedback or suggestions on how to improve the utilisation of the USiN role. There was equal proportions of staff that advocated for or against an increase in scope of practice. This increase included skills such as taking blood sugar levels, performing neurovascular observations, removing intravenous cannulas and enteral feeding. At 12 months 85.37% of respondents stated the USiN role had met their expectations and 87.9% of respondents saw the introduction into the clinical area as a positive change.

"Having USIN's on the ward allows us as a multilevel team to provide better holistic care to children and families in the sub-acute/ rehab format. Team nursing with USIN's means children are supported therapeutically by staff who have the time to spend the "extras" with them." (Rehabilitation ward Senior Registered Nurse)

"Brilliant program. As a senior Registered Nurse I was completely overwhelmed with our workload and felt unable to provide the support required to my patients and team members. The USiNs have taken over a lot of the time consuming tasks that now free me up to focus on providing excellent care and leadership. I have noticed an enormous improvement." (Intensive Care, Senior Registered Nurse)

Figure 3: Staff perception of patient safety in the clinical unit pre and post implementation of the USiN program
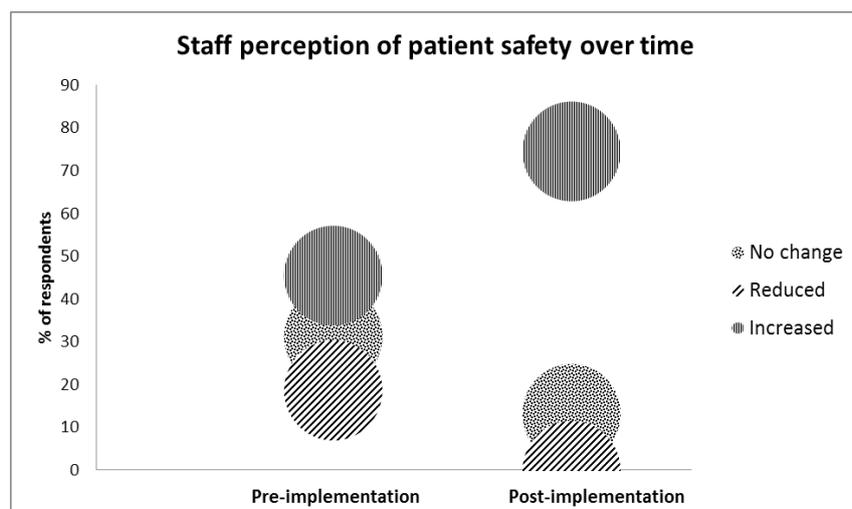
DISCUSSION

The challenges around securing adequate human resources for health is recognised globally (Berland et al 2016). Workforce shortages are predicted across all sectors of health but the greatest deficit is predicted to affect middle and high income countries leading up to 2020 (Berland et al 2016). Locally, competition between hospitals and health service districts to secure nursing graduates is stiff and retaining your workforce demands executive attention. To pro-actively manage this challenge a range of innovative strategies needed consideration such as the USiN program. Nursing executives at our hospital were emboldened to undertake this initiative which aimed to act as both a recruitment drive and a means to address a workforce shortage.

The scope of practice was developed after extensive consultation with Nursing Management, Nurse Educators and utilising the experiences of The Prince Charles Hospital who had previously run a USiN program. The nursing workforce initially had reservations around unlicensed workers in the clinical area and the scope of practice they would be given. To address this prior to commencement, education occurred in pilot areas around the USiN role and the agreed practice scope as negotiated with nursing leaders, Nurse Educators, clinical teams and the Queensland Nurses Union. Supporting procedures, learning resources and competency based assessment tools were developed to support the practice scope. Pivotal to the success of the USiN implementation was the dedicated Clinical Nurse Facilitator who supported the USiN and addressed issues and any ambiguity around the role with staff in the clinical areas. Some variance to practice scope occurred in the critical care areas context based on staffing ratios and patient stability. Success of this strategy was evidenced by the increased understanding of the scope of practice of the USiN plus the perceived positive addition to the clinical space at 12 months. The evaluation results indicated that a review of the scope of practice may be warranted. Many staff suggested a range of skills that could be added to the scope of practice of the USiN which better aligned with their academic progression. A pilot proposal was made to increase the USiN scope in one clinical area however the proposal was declined due to industrial concerns.

Safe practice for the USiN and patient safety were principle considerations in the implementation of USiNs. Staff were originally concerned that patient safety may be jeopardised by the presence of unlicensed healthcare workers and that skill mix would be reduced. Evaluation illustrates this was not the outcome and clinicians felt safety had substantially increased and skill mix was either unaffected or improved. Original staff scepticism may be attributed to staff concern around changes in workforce structure and professional identity which is an acknowledged barrier (Fowler et al 2006; Hayman et al 2006). For example, the employment of USiNs prompted a shift towards team nursing and some staff felt that this may reduce their holistic approach to nursing care. Team nursing or hybrids of this model have illustrated improvements in safety and quality of care and staff satisfaction (Fernandez et al 2012; Fairbrother et al 2010; Tran et al 2010). Some staff felt that by delegating some of these more simple tasks would negatively impact on their ability to provide complete patient and family centred care. Reluctance to delegate and supervise may also be borne from inexperience (Hall et al 2012).

The introduction of USiNs into the clinical area had an overwhelmingly positive affect for parents and children as perceived by the respondents. The 'extras' that USiNs had the time to undertake included rounding, spending time with patients, playing and tidying in patient areas. These simple tasks contribute substantially to the parent and patient experience. By utilising the USiN to undertake these tasks this had the added benefit of allowing the registered nurse time to practice to top of licence.

CONCLUSION

Innovations in the workforce are essential given the global pressures associated with nursing shortages. Paediatric specialties are not immune to this pressure. Our organisation developed a model with a supportive framework to introduce USiN's into the clinical area in a paid part time capacity. With a defined scope of practice this introduction improved important elements within the clinical space such as patient safety and quality of care. Additionally the registered nurses perceived their workload was reduced and that parent and child satisfaction with the hospital experience was increased. The results of this study could be generalised beyond paediatrics to adult facilities. We would recommend other organisations consider this model if faced with similar workforce demands.

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Validity testing of a tool for assessing nurse safety behaviour against blood borne infections

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ABSTRACT

Objective
This study was conducted to develop and verify a tool for assessing nurse safety behaviour against blood borne infections.

Design
A cross-sectional correlation study design was used.

Setting and Subjects
Items were developed based on reviews of related literature, published guidelines regarding the prevention of blood borne infections, and existing tools designed to assess compliance with blood borne infection control precautions. Face and content validities of the tool was assessed by expert panels. Construct validity and reliability were examined on 320 staff and charge nurses whose duties involved direct contact with patients.

Results
A 12-item, 5-point Likert-type assessment tool of nurse safety behaviour against blood borne infections was devised. Construct validity, which was investigated by exploratory and confirmatory factor analysis, and reliability of the devised tool were well supported. The devised tool has a three-factor structure, 'use of personal protective equipment', 'hygiene', and 'compliance with precautions'. These factors were found to be interrelated, were not independent of each other, and their correlations and loading coefficients indicated good discriminant and convergent validities.

Conclusion
The devised 12-item assessment tool offers a clinically useful means of properly assessing safety related behaviours, and provides specific guidelines for preventive practices that should be followed by healthcare workers.

INTRODUCTION

Global risk of occupational exposure to blood borne pathogens among healthcare workers was reported to be 40% (Wilburn and Eijkemans, 2004). According to An et al (2010), 43% of sick leave taken by healthcare workers in Korea was due to blood borne infections and 75% of them were nurses. In clinical settings, the most frequent causes of blood borne infections are needle stick and sharps injuries (Kang 2011; Ayranci and Kosgeroglu 2004). Gabriel (2009) reported that there were approximately 180 sharps injuries per annum in a general 600-bed hospital in the United Kingdom (UK). Ko et al (2009) estimated an annual incidence rate of 1.3 needle stick and sharps injuries per person among healthcare workers in Taiwan.

The Center for Disease Control and Prevention (CDC) in the United States of America (USA) has issued standard precautions to provide specific guidelines for hand hygiene, the use of personal protective equipment, and the handling and disposal of clinical wastes and medical equipment (Siegel et al 2007). Although CDC standard precautions are most commonly recommended for preventing blood borne infections in healthcare settings, studies have shown low compliance rates among healthcare workers (Jeong et al 2008; Kim et al 2003), due to lack of knowledge, risk perception, time, personnel issues, uncomfortable personal protective equipment, inconvenience, or work stress (Kermode et al 2005).

Our literature review revealed that the majority of previous studies on blood borne infections have focused on epidemiology of blood borne infections, compliance with precautions regarding the prevention of blood borne infection, or the assessment of knowledge related to blood borne infections among healthcare workers (Kang 2011; An et al 2010; Cho and Choi 2010; Gabriel 2009; Ko et al 2009; Jeong et al 2008; Kermode et al 2005; Ayranci and Kosgeroglu 2004; Kim et al 2003). This literature revealed that most of the assessment tools used to evaluate compliance with precautions or preventive behaviours related to blood borne infections have been developed based on CDC general/standard precaution guidelines. Despite the reliability checks performed in previous studies, the processes used to develop and determine the reliabilities and validities of these assessment tools were not completed systematically. In particular, no previously described assessment tool has been subjected to validity testing. Because periodical assessments of adherence to safety precautions and preventive behaviours against blood borne infections should be conducted in clinical settings using adequate assessment tools, we recognised the need for a valid and reliable tool for assessing nurse safety behaviours against blood borne infections.

Therefore, the present study was conducted to develop and verify an assessment tool of nurse safety behaviour against blood borne infections. The specific aims of this study were: 1) to develop qualified items based on a review of; related literature, guidelines previously devised for preventing blood-borne infections, and of existing tools designed to assess compliance with blood borne infection control precautions or preventive behaviours, and 2) to determine the content and construct validities and reliability of the devised assessment tool.

METHODS

Item development
Because CDC standard precautions are considered to be the basis of good infection control practice, initially, we reviewed major principles and components of the CDC standard precautions. CDC standard precautions describe specific safety behaviours regarding: the safe handling and disposal of used needles, medical devices, and blood or body fluid samples; the cleaning and disinfecting of areas contaminated with blood or body fluids; hand hygiene; the use of personal protective equipment, such as, gloves, gowns, facemasks, or goggles; the management of biomedical wastes arising from and devices used for patient care; and rules and procedures regarding action taken after accidental exposure to blood borne pathogens. Those guidelines

result in specific tasks for individual healthcare workers (individual-level guidelines) and for institutions with respect to preparation and commitment (organisational-level guidelines). Because the present study aimed at developing a tool for assessing individual nurse safety behaviour against blood borne infections, assessment tool items were developed mainly based on individual-level precautions. A 17-item tool was initially developed, which contained four items on hygiene, seven items on personal protective equipment, and six items on compliance with precautions.

To determine whether additional items were needed, a review was performed of existing tools designed to assess compliance with precautions or preventive behaviours associated with blood borne infections (An et al 2010; Cho and Choi 2010; Choi and Kim 2009; Kermode et al 2005; Kim et al 2003). As a result of adopting this process, two additional items were identified as potentially useful, namely, 'used needles should not be removed from syringes by hand' and 'infectious equipment or waste containers should not be filled more than two-thirds', and these two were included to construct a provisional 19-item tool. Because Likert scales are widely used to measure attitude, belief, and behaviour, 5-point Likert-type response options, that is, always, often, sometimes, seldom, and never, were adopted.

Face and content validity tests on the items primarily included

Face validity of the 19-item provisional tool was assessed by an expert panel comprised of four infection control nurses employed at the two university hospitals in which data was collected. Discussions continued until an acceptable level of agreement was reached. The expert panel concluded most items appeared to be adequate and they were in-line with CDC standard precautions and institutional guidelines for preventing blood borne infections. However, three items were considered ambiguous and in need of modification. In addition, one item deemed to be irrelevant and two overlapping items were deleted. After these modifications and deletions, the assessment tool contained 16 items.

The content validity of the 16 items was assessed by a second expert panel comprised of three infection control nurses, who participated in the face validity testing, and four nursing professors with experience of developing assessment tools. Content validity testing was conducted to evaluate the correspondence between each item and the conceptual definition and attributes of nurse safety behaviours against blood borne infections using a 3-point scale: (1) invalid, (2) valid, and (3) highly valid. Content validity index (CVI) was computed as the number of items that the experts gave a rating of either (2) or (3) divided by the total number of items. In the present study, the CVIs of the 16 items ranged from 0.67-1.00, and the two items with a CVI of ≤0.90 were deleted (table 1).

Pre-test

Pre-testing of the then 14-item assessment tool was conducted using ten nurses to ensure that items were understandable and the time taken to complete the assessment was acceptable. Pre-testing indicated the devised tool was understandable, had no obvious problems, and it required only 1-3 minutes to complete.

Table 1: Exploratory factor analysis (n=120) and reliability testing (n=320)

Items	Factors		
	I	II	III
12. I wear a face shield (or mask) to protect my eyes if splashing of blood or body fluids is likely.	.83	-.01	-.02
11. I wear a gown or vinyl apron if splashing of blood or body fluids is likely.	.82	.09	.10
13. I wear mask to protect my mouth if splashing of blood or blood or body fluids is likely.	.77	.18	.07
14. I always wear gloves if I have a hand wound.	.71	.09	.32
10. I do not remove used needles from disposable syringes by hand.	.43	.37	.40
8. I wash my hands before and after handling blood and body fluids	.06	.80	.07
7. I treat instruments or devices contaminated with blood or body fluids as infectious.	.02	.79	.26
6. I wash my hands after removing gloves.	.06	.74	.24
9. I instantly clean and disinfect the area where blood or body fluids are splashed or spattered.	.34	.60	.13
3. I use special precautions when drawing blood samples from patients with infectious diseases.	.43	.09	.76
1. I do not fill containers of biomedical wastes or contaminated objects/device more than two-thirds full.	-.01	.17	.71
4. I use standard precautions when handling blood or body fluids.	.46	.16	.69
2. I always put potentially infectious objects or device in biohazard containers.	-.26	.35	.57
5. I do not recap used needles.	.23	.27	.42
Cumulated variance (%)	35.0	50.7	60.1
Kaiser-Meyer-Olkin		.81	
Bartlett Sphericity test (Chi-square/p-value)		820.06/<.001	

CONSTRUCT VALIDITY AND RELIABILITY TESTING OF THE DEVISED TOOL

Design

A cross-sectional correlation design was adopted to test construct validity and reliability of the devised 14-item, 5-point Likert-type assessment tool of nurse safety behaviour against blood borne infections.

Settings and participants

The study participants were 320 nurses that worked at two university hospitals located in Incheon and Kyungi province, South Korea. Only staff and charge nurses whose duties involved direct contact with patients were included in the present study.

Exploratory and confirmatory factor analyses were performed to determine the construct validities of the devised assessment tool, and therefore, sample sizes were separately computed for each analysis. Although sample sizes for testing validity of an assessment tool vary widely across studies, a minimum of five subjects per item is recommended in literature (Yu 2015; Tak 2007). Based on this recommendation, we considered 112 subjects were required for exploratory factor analysis (eight subjects per item for 14 items). In addition, a sample size of at least 200 subjects is recommended for stable and reliable statistical estimates of structural equation model analysis with confirmatory factor analysis. Accordingly, a total of 312 subjects appeared to be appropriate. Data was collected from 328 subjects based on expectations of missing or erratic responses. Of the 328 subjects, eight subjects were excluded because more than 20% of data was missing. Finally, 320 subjects were included in the analysis.

Data collection

The study was initiated after receiving an approval from the human research committee of the authors' affiliated university (IRB number: 11-0496) and permission from the two university hospitals involved. Data collection for the construct validity and reliability testing was performed on 320 nurses after the study purposes and procedures had been explained and informed consent obtained. All data collection was conducted by a previously trained research assistant (clinical nurse) in a quiet conference room in the hospitals.

Ethical considerations

It was made clear to all subjects they were free not to participate and could withdraw from the study at any time without prejudice. It was also explained information would be collected anonymously and that data would be presented as mean values (not as individual values). Study purposes and procedures in detail were explained and subjects were then allowed to decide upon participation. Written informed consent was obtained from all that agreed to participate.

Data analysis

Descriptive analyses of subject characteristics, item analysis, reliability testing, and construct validity testing were performed using SPSS ver. 21/PC (IBM, SPSS Korea, Seoul) and Lisrel 9.2 (Scientific Software International Inc., Illinois). Of the various types of validity tests, construct validity is particularly important when developing instruments for measuring psychosocial concepts. In the present study, factor analysis was used because it is the most frequently used method to examine construct validity (Park et al 2014). To elucidate the underlying factor structure of the devised assessment tool, we performed exploratory factor analysis using SPSS 21/PC. Confirmatory factor analysis was then conducted to validate the factor structure identified by exploratory factor analysis (Yong and Pearce 2013; Hurley et al 1997), using Lisrel 9.2. Internal consistency coefficients (Cronbach's alpha) were computed to evaluate the reliability of the devised 14-item tool.

FINDINGS

Descriptive analysis of subject general characteristics and major variables

A total of 320 nurses were included in the study. Mean subject age was 30.10 (±5.41) years. The majority of subjects were working in general medical/surgical units (68.4%). In terms of career years as a registered nurse, 159 subjects (49.7%) had worked for less than 5 years, 76 subjects (23.7%) for 5-10 years, and 85 subjects (26.6%) for more than 10 years. In addition, 284 subjects (88.8%) had previous experiences of skin contact with contaminated blood or body fluid (n=206, 64.4%) or with sharps or needles (n=163, 50.9%).

Construct validity: exploratory and confirmatory factor analyses

Exploratory factor analysis yielded three components with eigenvalues greater than one, that is, 'use of personal protective equipment' (component 1), 'hygiene' (component 2), and 'compliance with precautions' (component 3). Factor names were based on the characteristics of the items that had the highest factor loading scores. The total variance explained by these three components was 60.1%, that is, 60.1% of variance in nurse safety behaviour was explained by these three components. Because the communality value of the fraction of variance should be ≥0.60 (Kim 2005), our tool appeared to be acceptable in terms of its explanatory power. As presented in table 1, five of the 14 items loaded onto component 1 (35.0% variance), four onto component 2 (15.6% variance), and five onto component 3 (9.4% variance). All of the loadings were above the minimum recommended level of 0.40. The 10th item, "I do not remove used needles from disposable syringes by hand." was found to have similar loadings onto components 1 (0.43), 2 (0.37), and 3 (0.40). After careful consideration, this item was allocated to component 3 based on item attributes (table 1).

For confirmatory factor analysis, the measurement model was designed such that there were three factors (use of personal protective equipment, hygiene, and compliance with precautions), and these three were correlated with and were composed of items with high loadings as determined by exploratory factor analysis (figure 1). Model fit was examined using two alternative models and comparing fit indices to determine which model provided the better fit. The first alternative model was constructed using all three factors, but not correlated to each other. The second alternative model was a one-factor model in which all items were loaded on a single factor.

Figure 1: The measurement and alternative models

A. Measurement model   B. Alternative model I   C. Alternative model II
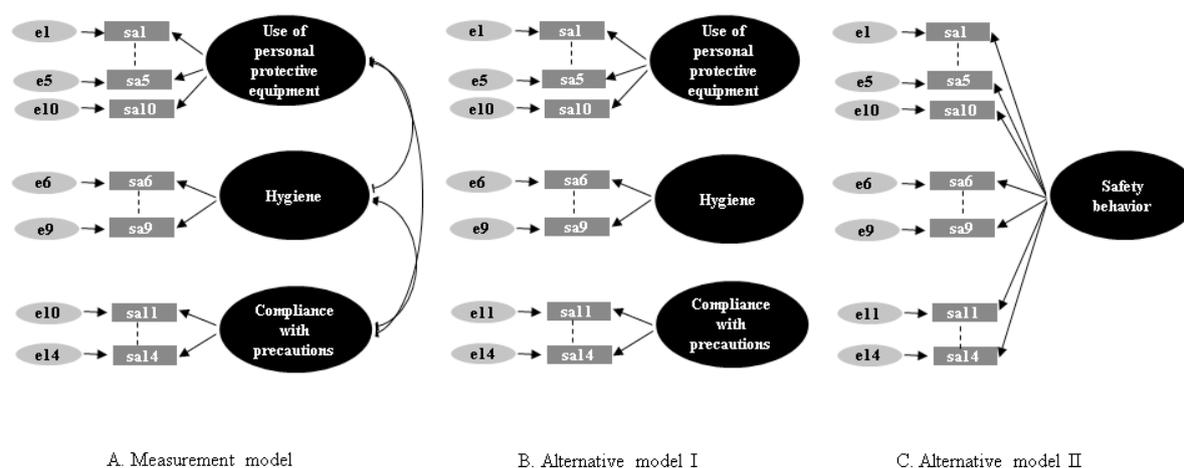
We found that the measurement model had a significant Chi-square value (p>.001), which indicated the model was unacceptable. The Chi-square statistic has been known to be highly sensitive to sample size, and hence virtually any model is likely to be rejected by the chi-square test when large samples are used (Bentler and Bonnet 1980). All other fit indices were satisfactory or acceptable [χ2/df=2.14 (optimal values: 1~3), RMSEA=0.07 (optimal values: ≤.06~.08), NFI=.86 (optimal values: ≥.90), NNFI=.90 (optimal values: ≥.90), CFI=.92 (optimal values: ≥.90), GFI=.91 (optimal values: ≥.90), and AGFI=.87 (optimal values: ≥.90)] (table 2).

Table 2: Goodness of fit tests for measurement and alternative models (n=200)

χ2/p	χ2/df*	RMSEA† (95% CI)	NFI‡	NNFI§	CFI||	GFI**	AGFI††	BIC‡‡
<Original measurement model >								
158.68/<.001	2.14	0.07 (0.06~0.09)	.86	.90	.92	.91	.87	2502.67
<Modified measurement model>								
95.77/<.001	1.88	0.06 (0.04~0.08)	.91	.94	.96	.93	.90	2144.94
<Alternative model I| >								
313.24/<.001	4.23	0.12 (0.10~0.13)	.73	.74	.78	.85	.80	2630.71
<Alternative model II>								
291.95/<.001	3.79	0.11 (0.10~0.13)	.75	.76	.80	.79	.71	2651.57

*χ2/df≤3   †Root mean square error of approximation (≤.06~.08) (95% confidence interval)

‡Normed fit index (≥.80~.90)   §Non-normed fit index (≥.80~.90) ||Comparative fit index (≥.80~.90)

**Goodness of fit index (≥.80~.90) ††Adjusted goodness of fit index (≥.80~.90) ‡‡Bayesian information criteria

To improve model fit, standardised coefficients were then estimated. Standardised coefficients are considered sample specific, and need to be ≥.40~.50 and ≤.99 for a sample size of >200 (Yu 2015; Hair et al 2010). In the present study, most items had acceptable standardised coefficients (range 0.49-0.88), except item 1 (0.27) and 2 (0.19). Accordingly, the model was modified by removing items 1 and 2, and model fit was re-examined. This 12-item model showed better goodness of fit indicators: $\chi2/df=1.88$, RMSEA=0.06, NFI=.91, NNFI=.94, CFI=.96, GFI=.93, and AGFI=.90 (table 2).

This modified 12-item model was accepted as the final assessment tool and contained the following items: four items for 'use of personal protective equipment' (standardized coefficient: .72~.88), four items for 'hygiene' (standardised coefficient: .49~.53), and 4 items for 'compliance with precautions' (standardised coefficient: .49~.80). All of their standardised coefficients were statistically significant (table 3). Correlation coefficients were r=.39 between 'use of personal protective equipment' and 'hygiene', r=.66 between 'compliance with precautions', and r=.67 between 'use of personal protective equipment' and 'compliance with precautions' (figure 2).

**Figure 2: Confirmatory factor analysis of the measurement model**
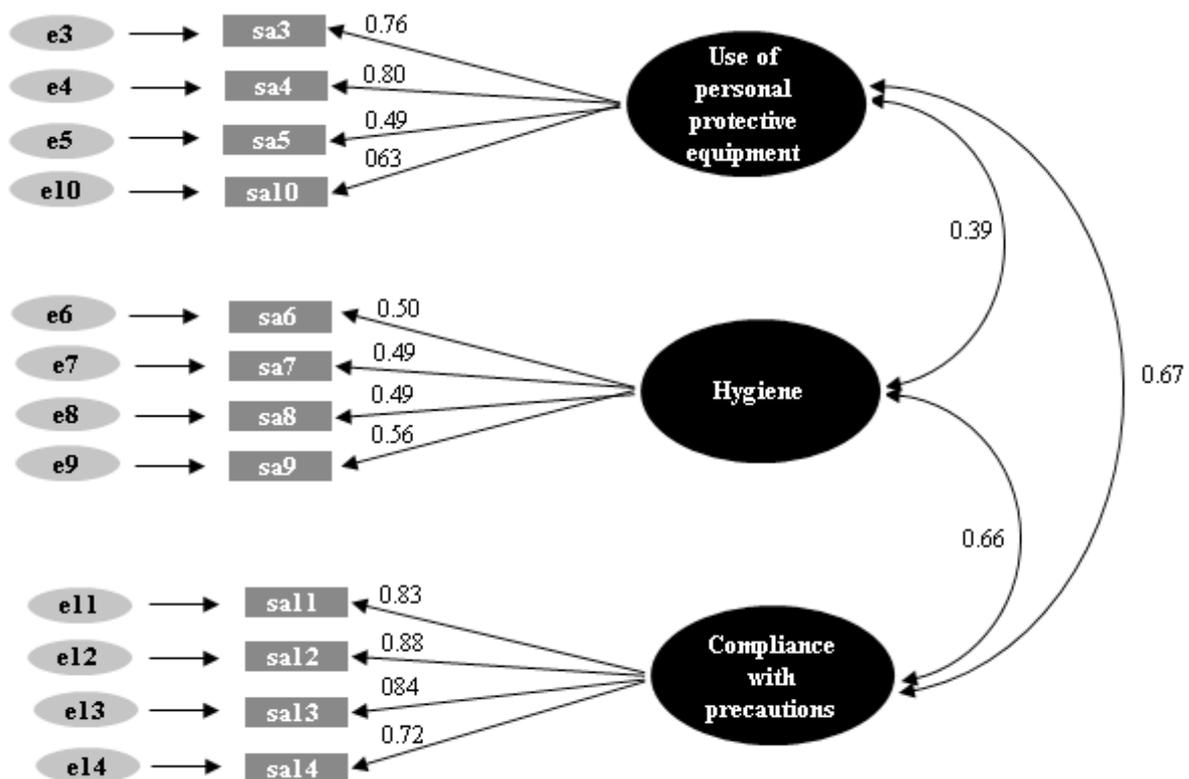
Reliability testing

The internal consistency of the devised assessment tool was found to be well supported. Cronbach's alpha (reliability coefficient of internal consistency) for all three components was 0.88 (was 0.89 for 'use of personal protective equipment', 0.79 for 'hygiene', and 0.76 for 'compliance with precautions').

Table 3: Measured variables estimated of the confirmatory factor model (n=200)

Factors	Items	B*(SE) †	β‡	t(p)	alpha§	
Use of personal protective equipment	12. I wear a face shield (or mask) to protect my eyes if splashing of blood or body fluids is likely.	1.00	.88		.89	
	11. I wear a gown or vinyl apron if splashing of blood or body fluids is likely.	0.97 (.06)	.83	15.74 (<.01)		
	13. I wear mask to protect my mouth if splashing of blood or blood or body fluids is likely.	0.93 (.06)	.84	16.22 (<.01)		
	14. I always wear gloves if I have a hand wound.	0.77 (.06)	.72	12.65 (<.01)		
Hygiene	8. I wash my hands before and after handling blood and body fluids.	1.00	.49		.79	.88
	6. I wash my hands after removing gloves.	1.12 (.28)	.50	3.98 (<.01)		
	7. I treat instruments or devices contaminated with blood or body fluids as infectious.	1.21 (.30)	.49	4.08 (<.01)		
	9. I instantly clean and disinfect the area where blood or body fluids are splashed or spattered.	1.39 (.33)	.53	4.28 (<.01)		
Compliance with precautions	3. I use special precautions when drawing blood samples from patients with infectious diseases.	1.00	.76		.76	
	4. I use standard precautions when handling blood or body fluids.	1.01 (.09)	.80	11.14 (<.01)		
	5. I do not recap used needles.	0.57 (.08)	.49	6.90 (<.01)		
	10. I do not remove used needles from disposable syringes by hand.	0.79 (.09)	.62	8.83 (<.01)		

*Unstandardised beta　　†Standardised error　　‡Standardised beta　　§Reliability test: Cronbach's alpha

DISCUSSION

Face and content validity tests indicated the devised items appeared to reflect important individual-level safety behaviours adequately in clinics and well corresponded with conceptual definitions and attributes of nurse safety behaviour against blood borne infections. The factor structure of the devised assessment tool was found to contain three factors, 'use of personal protective equipment', 'hygiene', and 'compliance with precautions', and the total variance explained by these three factors was acceptable. The 'use of personal protective equipment' yielded the highest explained variance of 35% and contained four subscale items that assessed the use of personal protective equipment, that is, gloves, face shield, mask, or gown.

It is well known that gloving provides an excellent means of preventing hand contamination while touching body fluid, blood, mucous membrane, or broken skin of patients with specific infections, and thus, routine gloving is required to protect healthcare workers and patients (Tenorio et al 2001). However, it has not been clarified how well gloving prevents against blood borne infections caused by needle or sharps injuries. Therefore, sharp instruments must always be handled carefully, even when wearing of gloves. The use of mask, face shield, and goggles also has been proposed to prevent contamination of eyes, nose, and mouth (CDC 2001).

Subscale items under the second factor 'hygiene' consisted of items relating to hand washing before and after handling blood or body fluids and after removing gloves. Empirical evidence demonstrates hand washing is the most important and effective intervention for preventing the spread of infectious diseases (CDC 2001), and is an essential part of CDC standard precautions (Siegel et al 2007). Items related to the management of devices and areas contaminated with blood or body fluids were also under the second factor 'hygiene'.

The third factor 'compliance with precautions' consisted of subscale items concerning compliance with procedures for the handling of blood, body fluids, or needles. It has been suggested healthcare worker safety regarding blood borne infections could be significantly improved by following existing protocols or guidelines, such as, those related to the use of protective equipment, routine sanitary inspection, preventive efforts to reduce percutaneous injuries from sharp devices or objects, and proper cleaning and disposal of used devices or instruments (Do et al 2003). The high incidence of needle stick injuries supports the need for such precautions (Gabriel 2009). Needle stick injuries commonly occur during needle recapping (Kim et al 2003), and an item was included to assess such risk behaviour in our tool.

Confirmatory factor analysis showed that the three factors, 'use of personal protective equipment', 'hygiene', and 'compliance with precautions', were interrelated, that is, they were not independent of each other. Correlation coefficients were of medium strength, which supported discriminant validity of the assessment tool (Yu 2015). In addition, all subscale items had loading coefficients of >0.49, indicating excellent convergent validity.

Safety is an important issue for nurses, especially those who are clinically based. Close patient contact means nurses are at particularly high risk of exposure to blood borne pathogens. To develop a valid assessment tool of nurse safety behaviour against blood borne infections, 12 items were systematically devised based on a review of related literature, CDC standard precautions, and of existing tools designed to assess compliance with blood borne infection control precautions or preventive behaviours in the present study. We expect this assessment tool may be beneficial to help nurses understand safety issues, identify unsafe practice, and therefore promote their practice. However, its validity and reliability were tested with a sample of Korean nurses (n=320) recruited from two university hospitals, which limits the generalisability of the study findings to other populations. Accordingly, this tool still needs further verification and refinement with multi-centre multi-ethnic studies to be a standardised instrument for assessing nurse safety behaviour against blood borne infections.

CONCLUSION

The 12-item assessment tool produced, though concise, includes most of the essential components of the precautions that should be taken to prevent infection by blood borne pathogens, and offers a clinically useful means of properly assessing nurse safety related behaviours. In addition, we believe this tool could aid the identification and correction of problems associated with the adoption of safety behaviours and preventive practices related to blood borne infections, consequently reducing incidence of blood borne pathogen transmission. Furthermore, it provides specific information on safety precautions and on the preventive practices that should be followed by healthcare workers.

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Is provision of professional development by RNs to nursing students a choice?

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ABSTRACT

Objective
This paper reports on a major category that emerged as a result of a Grounded Theory study that explored Registered Nurses' (RN) understanding of the nursing standard requirement to provide nursing students with professional development during their clinical placements.

Design
Grounded Theory study.

Setting
Nursing clinical education.

Subjects
Fifteen registered nurses participated in this study (n=15). Thirteen were female and two were male.

Main outcome measures
In-depth semi-structured interviews were the means of data collection. Constant comparative method was used to analyse data.

Results
The notion of choice emerged as a major finding. Choice is conceptualised as choosing whether or not to be involved in the professional development of nursing students. The category choice is informed by two themes; unsuited to teaching, and respecting peers.

Conclusion
According to the Australian nursing standards RNs are responsible for providing professional development to nursing students on clinical placements. Results from this Grounded Theory study revealed that participants perceived it is an RNs choice whether or not to provide professional development to nursing students.

INTRODUCTION

When an RN renews their annual licence to practice in Australia they must declare they will practice (or begin to practice) according to the national nursing standards (NMBA 2016b). This process is similar in other countries such as the United Kingdom (UK), New Zealand and Canada, who also have annual registration renewal systems that require RNs to declare they will practice according to their respective country's nursing standards (Nursing and Midwifery Council 2015a; Nursing Council of New Zealand 2015; Canadian Nurses Association 2014). Embedded within the Australian registered nurse standards for practice is the requirement for RNs to contribute to the professional development of nursing students (NMBA 2016a). According to these standards "as part of practice, RNs are responsible and accountable for supervision and the delegation of nursing activity to enrolled nurses (ENs) and others" (Nursing and Midwifery Board of Australia 2016a, p.1) where the term 'others' includes nursing students. Furthermore standard number 2.7 states the RN "actively fosters a culture of safety and learning that includes engaging with health professionals and others, to share knowledge and practice that supports person-centred care" (NMBA 2016a, p.3). Similarly, other countries including Canada, the Republic of Ireland and the UK, have the expectation that RNs will provide nursing students with professional development embedded within their own nursing standards (Nursing and Midwifery Council 2015b; Nursing and Midwifery Board of Ireland 2014; College of Registered Nurses of British Columbia 2012).

Nursing students depend on RNs to teach and support them during their clinical placements (Daly et al 2014). Students rely on the knowledge and experience of RNs to teach them how to apply the skills they have learned in the classroom to a clinical environment (Rhodes et al 2012). However, the research literature suggests students do not always have good learning experiences when they are on clinical placements (Kassem 2015). In fact, sometimes they are "perceived as a burden and teaching not part of the registered nurse role" (Ó Lúanaigh 2015, p.451). According to Sanderson and Lea (2012) role confusion can occur in regards to RNs function with nursing students who are on clinical placements. This Grounded Theory study explored RNs understanding of the nursing standard requirement to provide nursing students with professional development during their clinical placements. This paper reports on a major category that emerged as a result of this Grounded Theory study, that is, choice.

METHODOLOGY

Grounded Theory methodology was used in this study. Grounded Theory was chosen as a research methodology because there was no known research about RNs understanding of the nursing standard that requires them to provide professional development to nursing students on clinical placements.

Ethics approval for this research was granted by the University Health and Medical Human Research Ethics Committee (Approval No: HE12/141). The study site was in Queensland, Australia. Fifteen participants were interviewed and included RNs with a minimum of five years' experience who had prior involvement working with nursing students on clinical placements. Of the fifteen participants, thirteen were female and two were male. One of the participants worked as a clinical nurse educator, three had nursing management roles and the remaining eleven participants were employed as clinical nurses (working clinically). Participation was voluntary and participants could withdraw at any time without prejudice. No participants withdrew from this study.

Individual semi-structured interviews were conducted with the participants to collect data. Each interview was approximately 45 minutes in length. Data from each individual interview was analysed using the constant comparative analysis technique. As data was collected it was analysed and sorted into codes and categories.

Data collected from subsequent interviews was then analysed and compared to existing codes and categories (Strauss and Corbin 1998). When no new data emerged the categories that were formed eventually became saturated, that is, data saturation had occurred (Liamputtong 2009). This paper reports on one of the categories from this research project, namely, *choice*.

FINDINGS

Choice

The category *choice* emerged from the notion that participants believed it acceptable to choose whether or not to provide professional development to nursing students on clinical placements. Participants expressed that it should be a personal choice whether or not to provide professional development to nursing students.

> *So it should still be a choice but you would want to have a -- I would think that you would want to have a good reason for not wanting to be involved as a registered nurse (P10).*

Two subcategories inform choice. These are: unsuited to teaching and respecting peers. The subcategory unsuited to teaching is about how participants described that it was preferable for some RN's not to be involved in the professional development of nursing students because they were deemed as being unsuited to teaching students. The subcategory respecting peers explains how RNs would accept their peers' decision whether or not they wanted to contribute to the professional development of nursing students. Figure 1 provides a visual illustration of the category choice.

Figure 1: Choice
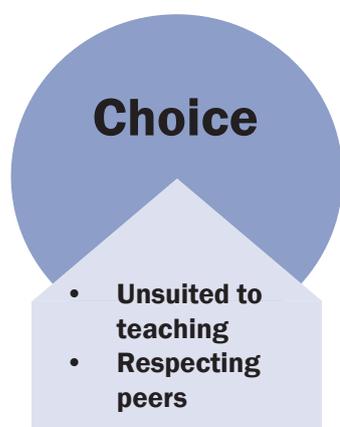
Unsuited to teaching

Participants generally believed that some RN's were *unsuited to teaching* and were better off not contributing to the professional development of nursing students.

> *Yeah, no. She's just, yeah. I love her to death but as a student I would not want her as my preceptor. And she's too old to look at her own self and say "Hey, they might actually take me the wrong way", or, "Hey I can be a little bit abrupt maybe I need to change how I interact with people." You'll never change her now. It's too late. So I said we need to evolve people out (P1).*

> *I think it's better for the students if they're placed with someone who wants to teach them, rather than someone who sees them as a major burden and really don't want them there. You still try to get the staff to have students and sometimes they don't have a choice, but feedback I've heard from students is they often have better experiences with the staff that want to teach them (P9).*

There was suggestion that some RNs are not comfortable with providing professional development to students.

> *Yes, I know some people, yes, some people are really put off by it. They are just not comfortable doing it (P2).*

Others were considered harsh to students.

> *But sometimes they're more critical of the students. So, like more destructively critical of the students (P15).*

Burnout in nursing is well known (Melvin 2015). Participants highlighted burnout in respect to providing professional development to nursing students.

> *So if you've had say a student Monday to Friday for a week and you've given your heart and soul into it, and then the next Monday you've got a start all over again with a new student, eventually if you're not careful you'll burn that person out (P8).*

> *And there are times when I know myself I've gone, Oh my God, not another student for goodness sake (P9).*

> *Maybe we get a bit jaded about having the students because it just seems to be that week after week after week there's a new lot of students coming in or we just have some that are there for 4-weeks, they go, then the following -- we get another lot of students and sometimes you know, I mean it's good for us as it keeps us on our toes and makes sure that we're kept up to speed and fresh about policies and doing the right things, don't get into bad habits, but sometimes you just wish you didn't have someone with you because it can be very draining especially if your shift is very, very busy (P13).*

Sometimes participants said they just did not feel like having to provide professional development to students.

> *If I'm really ragged and I can't -- and I know that I haven't got perhaps as much patience or I just haven't -- I'm not thinking as clearly as I'd like to, I'd always say that to my colleagues and I say look maybe not today, maybe today's not a good day for me to do this. And we've talked about that as well at times because it's not fair on the students if you try and take on that responsibility and then you're not ready for it and that poor student will go home at the end of the day and probably think to themselves right, I don't really want to do this again (P5).*

As well as expressing how some RNs are *unsuited to teaching,* participants respected their peers' *choice* whether or not to provide professional development to students.

Respecting peers

The theme *respecting peers* is about participants being respectful of their peers' decision not to provide professional development to students. Participants indicated a general acceptance of the practice of not contributing to the professional development of students despite the nursing standard saying they should. Sometimes students were purposively not allocated to particular RNs:

So, they avoid -- say for example the person in charge would avoid giving them to somebody that they know that wouldn't teach them properly I suppose you could say (P7).

There was acceptance that some RNs did not want to contribute to the professional development of students.

They've had students and they just don't want to do it anymore. They've sort of -- well I've done my time, I've put in the time and it's my time not to do it anymore, there's other people that you can ask you know (P2).

There was also recognition that RNs sometimes needed a rest from students:

If you have students for 2 or 3 months and just about every shift you work you're working with students, mentally it's draining and sometimes it's just nice to be able to go, okay I just want to do my work and not have to worry about a student. So yes, I do think they -- and it's important for them, it's important for the staff and the student that the staff aren't becoming -- resentment towards the students, and come to work with the attitude of oh my God I've got a student again today (P9).

Being respectful of how an RN feels in regards to having students was further highlighted by the following participant:

I mean you have to respect the individual and how they're feeling because if they're not interested in having a student, the student is not going to get anything from it and it's probably going to even put a student off going back to their second year or – you don't want them to have bad experiences and if the nurse – registered nurse is not interested and not into it well then you know, I don't think it's fair to – that the student has to be submitted to that (P11).

In summary, participants believed that it was a personal choice whether or not to provide professional development to students. It was suggested that some RNs are unsuited to teaching nursing students. Being unsuited to teaching was considered appropriate justification for not being allocated nursing students. Participants were respectful of their peers' decision in regards to whether or not they wanted to be allocated students. To conclude, there was a belief that RNs could choose whether or not they wanted to be involved with the professional development of nursing students. This is relevant to nursing because according to the Australian nursing standards (NMBA 2016a) it is an RN's responsibility to provide professional development to nursing students and, furthermore, nursing students rely on RNs to teach them in the clinical environment in order to become competent practitioners.

DISCUSSION

This study explored RNs' understanding of the nursing standard requirement to provide nursing students with professional development during their clinical placements. Findings suggest that participants believed it is an RNs choice whether or not they contribute to a nursing student's professional development. The literature also suggests RNs tend to believe that providing professional development to nursing students is a choice.

Chuan and Barnett (2012) in their Malaysian study found RNs attitude toward students influenced students' learning. They found some RNs were not willing to teach students and were unpleasant to the students. This type of behaviour by RNs can adversely affect student learning (Levett-Jones and Lathlean 2009; Levett-

Jones et al 2007) which can ultimately effect the students' ability to deliver safe patient care. According to participants in this Grounded Theory study, RN's who behave in this way towards students tend to be referred to as *unsuited to teaching*.

Burnout which is a component of compassion fatigue, is emotional or psychological distress that can effect one's wellbeing (Gibbons et al 2011). Burnout from having students is known to occur to some RNs who regularly are allocated students on clinical placements (Courtney-Pratt et al 2012; Haydock et al 2011) and, according to this Grounded Theory study, can make some RNs become unsuited to teaching. Burnout from continuously having students should be managed within healthcare organisations however according to Brann and Gustavson (2013) management tends to overlook the extra work that goes with providing students with professional development.

Brown et al (2012) found sometimes students are not allocated to certain RNs because they [the RNs] were not considered suited to teaching students. In the same way findings from this Grounded Theory study describe how RNs were purposefully not allocated students because they were unsuited to teaching. Moreover, not all RNs feel confident with their ability to teach students (Luhanga et al 2010). Lack of confidence in teaching ability can deter some RNs from wanting to contribute to the professional development of students (Mather et al 2015).

Some RN's are simply hesitant to be involved in the professional development of nursing students (Brammer 2008). In their study, Levett-Jones and Lathlean (2009) found that RNs would argue during handover, directly in the presence of nursing students, over who would take the students because the RNs did not want to be allocated students. Lengthy debate of up to 'ten minutes' duration over who would or would not have the students would occur (Levett-Jones and Lathlean 2009, p.2874). This is an example of the behaviour of choosing not to contribute to the professional development of students as an accepted practice by some RNs. Similarly Brown et al (2012) describes negative body language and unfriendly behaviour towards students by RNs during handover. Brown et al (2012) found clinical teachers are inclined to accept this behaviour and focus on helping the students to get through their clinical placements.

Leners et al (2006) assert that some RNs just refuse to work with students. Dickson et al (2006, p.419) found clinical facilitators tend to avoid putting students with RNs who have the attitude of "Oh no not students again!" This demonstrates clinical facilitators (RNs) yielding to the negative attitudes of their peers toward nursing students. This is similar to the finding in this research where participants described they had observed RN's accepting their peers' decision whether or not to be involved in the professional development of nursing students.

Students depend on RNs to help them to develop their nursing skills and become competent in the clinical area. If RNs do not adhere to the practice standard requirements in regards to providing professional development to nursing students then students are at risk of not acquiring the necessary clinical expertise in order to become safe, competent practitioners when they graduate. This, in turn, could have implications for patient safety. Furthermore the NMBA (2017, para 1) states RNs must "meet the NMBA's professional standards in order to practise in Australia". RNs can be deregistered if they contravene professional boundaries, are unsafe and/or do not meet the nursing standards (AHPRA, 2017). If RNs do not adhere to the practice standards in regards to their responsibilities towards nursing students they are not meeting the professional standards.

LIMITATIONS

Limitations to this research project include that all participants were RNs from one state in Australia, Queensland and that the sample size was fifteen (n=15), meaning, the research was conducted on a specific group of

people and the sample size was small. With this in mind, a qualitative research project aims to develop an overall understanding of a phenomena rather than to generalise findings from a quantitative perspective. RNs who read this research may find they can relate to the research results because an understanding of the phenomena resonates with them.

CONCLUSION

Participants in this research believed it was an RN's choice, rather than a mandated nursing requirement, whether or not to be involved in the professional development of nursing students on clinical placement. Findings revealed that being unsuited to teaching was justification for not being allocated nursing students. Furthermore participants explained how they were respectful of their peer's decision (choice) whether or not to be involved in the professional development of nursing students. This provides insight into why sometimes students on clinical placements do not feel supported by RNs. The findings demonstrate lack of consistency in the level of professional development provided to students on clinical placements. This is important because even though students are taught clinical skills at university; the students depend on RN's assistance and support in order to safely practice the nursing skills they have learnt in the classroom on real live patients. In other words, nursing students rely on the support and clinical expertise of qualified RNs to help them to become competent.

RECOMMENDATIONS

- Education is needed to raise RNs awareness that it is a nursing standard requirement to provide professional development to nursing students on clinical placement.

- Workshops are needed to educate RNs how to teach and support nursing students in the clinical environment so RNs can confidently provide students with professional development.

- To avoid burnout, additional time should be factored into RNs' workloads when they are allocated students.

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Long term effects of child abuse: lessons for Australian paediatric nurses

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Child abuse, long term effects, stress response, mental health

ABSTRACT

Objective
Child abuse has short and long term consequences. Literature that explores the long term effect of child abuse on children has been reviewed.

Setting
Prevalence of the long term consequences of child abuse within the Australian paediatric population

Sample
The search utilised medical search terms of 'child abuse', 'long term effects', 'adverse childhood events', 'violence', 'cortisol response to stress', 'post-traumatic stress disorder', 'nurs*', 'paediatric', 'abuse', 'neglect' and 'prevention' in health related databases to locate literature published from 2007 until present.

Primary argument
Data concerning child abuse and neglect in Australian children is sparse and inconsistent with no literature found specifically relating to the role of paediatric nurses.

Conclusion
Further analysis on the effects of child abuse and neglect on Australian children will help to gauge its health burden on the country, and to help health professionals better understand this contemporary child safety concern.

INTRODUCTION

The purpose of this review is to examine the current research and evidence outlining how child abuse affects an individual over the long term. The aspects of abuse that will be explored include, physical, verbal and sexual within a broad range of socio-economic backgrounds and populations. This review will focus on the evidence surrounding long term effects of childhood abuse on physical and mental well-being, physiological changes from prolonged stress, tendencies towards substance abuse, nursing considerations and recommendations for how to reduce the occurrence of a child experiencing violence or abuse. After reviewing the current evidence on child abuse, including the immediate and long term effects, it was clear that this issue was extensive. Not only was it clear that direct abuse to the child was detrimental, but indirect forms of abuse through witnessing or hearing about violence towards others affected children in many ways. Mental health, substance abuse, poor physical well-being, difficulty forming relationships and impact on coping development are just a few of the recurring themes within the literature. As a result of child abuse and neglect, adults who have survived child abuse have the potential to suffer from prolonged socio-economic disadvantage. Registered nurses play a vital role in identifying children who are at risk of experiencing child abuse, however many nurses report a lack of knowledge and confidence on this topic, thus reducing their willingness to report any suspicions of abuse.

METHODOLOGY

The databases used for research include; Medline with Full text, EBSCO and CINAHL. The search terms included literature published from 2007 until present; and included the search terms 'child abuse', 'long term effects', 'adverse childhood events', 'violence', 'cortisol response to stress', 'post-traumatic stress disorder', 'nurs*', 'paediatric', 'abuse', 'neglect' and 'prevention'. Australian data was sourced in relation to child abuse and mental health statistics

CHILD ABUSE PREVALENCE

Child abuse encompasses a broad range of issues, and is defined as an act by the caregiver to intentionally do harm to the child (Klossner and Hatfield 2010). It can be delivered through physical domains, verbally, sexually, through household dysfunction including parental substance abuse, domestic violence, parental mental health issues and neglect (Austin et al 2016a and 2016b). The family unit is identified to have a significant impact on the prevalence of indirect and direct violence being experienced by a child. The experience of childhood abuse is influenced by environmental factors and demographics (Klossner and Hatfield 2010). Children who grow up in poverty, inadequate socialisation, diminished family support networks, parental mental health problems and substance abuse have shown to experience higher rates of adverse childhood experiences (Keane et al 2015). This type of environment is more likely to be experienced within the homeless and social housing population. Within Australia, 71% of the homeless population had experienced childhood trauma before turning 16 years old (Keane et al 2015). Socioeconomic status of the family, parental capabilities and stability in accommodation had a major impact on the child's increased risk to experience indirect violence such as, violence between parents, or violence towards another family member (Zimmerman and Posick 2016). The study conducted by Austin and et al (2016b) found that children with disabilities have higher incidence of experiencing adverse childhood events, especially sexual abuse from an adult. It is reported that children with disabilities experience sexual abuse three times more than a child without a disability. These children with disabilities who had experienced adverse childhood events, were also more likely to participate in unhealthy risk behaviours such as of smoking, and those which increased the risk of HIV (Austin et al 2016b). It appears that children who identify as lesbian, gay or bisexual later in life had higher incidences of experiencing more than one type of adverse childhood experience (direct or indirect abuse) compared

to the heterosexual population (Austin et al 2016a). Within this same study, Austin et al (2016a) found the homosexual population who had experienced child abuse had significantly increased rates of behavioural issues including substance use. In the United States of America (USA), the Centre for Disease Control and Prevention indicates that over 50% of adults have experienced abuse of some form (Salinas-Miranda et al 2015). Individuals who have been abused are more likely to engage in risk taking behaviours, such as excessive drinking as a coping mechanism. In the study conducted by Gospodarevskaya (2013), 8.3% of Australians had experienced some form of sexual abuse before the age of 21 years old. Within this same study, 40.2% of this Australian population met diagnostic signs and symptoms of Post-Traumatic Stress Disorder (PTSD) before the age of 18 (Gospodarevskaya, 2013). PTSD is a form of anxiety disorder characterised by a set of reactions that can develop in individuals who have been through a traumatic event which threatened their life or safety. Symptoms include flashbacks of the traumatic event, intrusive memories or nightmares, emotional numbing and heightened vigilance (Sane Australia 2016). According to the 2007 Australian Mental Health Survey, the average onset of PTSD occurred in children aged 11 years old. There is no doubt that all of these effects on a person's emotional and physical well-being has a negative impact on quality of life during adulthood.

PHYSIOLOGICAL STRESS RESPONSE TO TRAUMA

When the human body is exposed to traumatic and damaging experiences, a number of biological and physiological changes occur (Delima and Vimpani 2011). When a person is exposed to stressors, the biological response to stress is regulated through the sympathetic nervous system and the hypothalamic pituitary adrenal (HPA) system. During stress, the HPA system releases corticotropin releasing factor (CRF) from the hypothalamus, increasing secretion of adrenocorticotropin hormone (ACTH) from the anterior pituitary which creates glucocorticoid release from the adrenal (Bremner et al 2003). The release of these stress hormones, adrenaline and cortisol causes a cascade of immediate physiological effects. These signs and symptoms including, increased heart rate, increased respiratory rate, hypertension, vasoconstriction, increase blood glucose levels and increase in initial immune response (Carpenter et al 2011). In normal circumstances, once the stressor has been removed, the hypothalamus dictates for the stress response to dissipate, returning hormone function back to baseline. However, for people who experiences prolonged stress, the hypothalamus becomes damaged and is inhibited (Carpenter et al 2011). Long term activation of the stress response causes damage to the cardiovascular system due to persistent tachycardia and hypertension, increasing risk of stroke and myocardial infarction (Bremner et al 2003). Magnetic resonance imaging (MRI) has also shown evidence of accelerated depletion and metabolism of neurons, shearing of axons with hindering of neurogenesis in those who experience childhood trauma (Delima and Vimpani 2011). This prolonged activation of the stress response also causes damage to the structure and functional capacity of the brain including the hippocampus (Delima and Vimpani 2011). Damage to the hippocampus causes an inhibition to memory development and learning (Bremner et al 2003). It has been identified that children who experience prolonged stress early in life have an increased sensitivity of the noradrenergic system, which is consistent in the biological changes that occur in people with post-traumatic stress disorder (Bremner et al 2003). Chronic stress has been revealed to damage the process of naturally occurring dopamine and noradrenaline causing hypersensitivity, hyperarousal, mood disturbances and anxiety symptoms (Delima and Vimpani 2011). The study conducted by Carpenter et al (2011) explores the correlation between childhood trauma with neurohormonal and hypothalamic pituitary adrenal axis dysregulation. It is suggested that this dysregulation has a direct impact on an individual's immune system as seen by increased inflammatory markers of individuals with PTSD (Carpenter et al 2011). Deoxyribonucleic acid (DNA), is the hereditary material in humans. DNA methylation, or the epigenetic mechanism used by cells to control gene expression, may mediate persistent changes in gene function following chronic stress. These epigenetic alterations may contribute to the inflammatory and immune dysregulation observed in subjects with PTSD. (Smith et al 2011).

LONG TERM EFFECTS ON PHYSICAL HEALTH

Childhood abuse causes a life-time effect on an individual's physical well-being, causing serious harm. Within Australia, rates of foetal alcohol syndrome occurs in 0.68 in every 1,000 live births, with even higher rates among the indigenous population at 2.76 per 1,000 live births (Delima and Vimpani 2011). The exposure to high doses of alcohol while in utero is the earliest form of abuse, causing significant long term effects on the child once born. Through MRI imaging, it can be identified that children who are born with foetal alcohol syndrome have decreased brain size and thinning of the corpus callosum, inhibiting communication pathways from the left to right side of the brain (Delima and Vimpani 2011). Children with foetal alcohol syndrome also demonstrated functioning changes including, limited attention spans, low IQ, behavioural changes, difficulty with fine motor skills such as writing, inability for higher functioning, hyperactive and impulsive tendencies and poor judgement causing social deficits (Delima and Vimpani 2011). Delima and Vimpani (2011), further discuss the use of medical imaging, such as MRI, as a form of non-invasive diagnostic to illustrate the physical damage caused by other forms of childhood abuse. This damage can be seen through structural changes in the brain as well as behavioural changes (Delima and Vimpani 2011). MRI images also showed that children who suffered prolonged exposure to violence have decreased intracranial, cerebral and prefrontal cortex volumes. Problems in the pre-frontal cortex (reason, logic, problem solving, planning, and memory), amygdala (emotion) and hippocampus (learning and memory) associated with smaller brain volumes mean less neuron structure and have significant implications for learning (Hansen et al 2015).

Austin et al (2016a), reviewed the alarmingly high rate of adverse childhood experiences within the homosexual population and poor health in their adult life. The adverse childhood events include, physical, verbal, sexual abuse, violence within the family unit, substance abuse in the home, adults with mental illness, substance abuse and incarceration of a household member (Austin et al 2016a). Higher rates of asthma, cardiovascular disease and obesity have been reported in homosexual and bi sexual individuals. Not only does the individual experience higher rates of mental health issues related to abuse experiences, but there is also a link to diabetes, cancer, endocrine dysfunction, nervous system changes and increased mortality rates (Salinas-Miranda et al 2015). These effects on the body are chronic in nature and are often created as a result of higher incidences of risk taking behaviours, substance abuse and parental neglect (Klossner and Hatfield 2010). A direct link to mental health illness due to child abuse can contribute to the negative physical outcomes seen throughout the research.

LONG TERM EFFECTS ON MENTAL HEALTH

Epidemiological studies estimate that approximately one in every four young persons has experienced a traumatic event including abuse or violence (Gospodarevskaya 2013). These events may include direct violence directed towards them through personal victimisation or through witnessing a violent event occur to a friend, family member or within their household (Connor et al 2015). A traumatic event whether it is significant or frequent in nature can trigger stress responses that may or may not develop into post-traumatic stress disorder. Post et al (2015) explores the effects that verbal abuse alone can have on an individual's long term mental health. Childhood abuse, including physical and sexual, has been known to have a direct effect on early onset bipolar disorder and other mental health issues (Post et al 2015). The children within Post el al's (2015) study experienced verbal abuse and had a distinctly increased risk to developing bipolar disorder at an early age. Children who suffered from verbal abuse also had significantly higher risk of developing anxiety, substance abuse issues, rapid cycling between moods and more severe presentations of mania and depression. Hayashi et al (2015), found that children who experienced abuse including, sexual, physical, emotional and neglect, experienced a higher and more severe incidence of depression in adulthood. This may be related to

the possibility of abuse causing changes in personality development during the crucial developmental years of childhood through creating low self-esteem and poor confidence. The recovery process for children who develop PTSD from childhood trauma is up to 10 years. This is significantly longer than children with PTSD from accidents or disasters (Gospodarevskaya 2013). As a result of these long term mental health issues, it is no wonder that children who experience childhood abuse have higher tendencies to engage in substance abuse and develop addiction.

SUBSTANCE ABUSE

Childhood trauma causes a magnitude of emotional disturbances that profoundly increase the risk of engaging in risk taking behaviours such as substance abuse (Zimmerman and Posick, 2016). The study conducted by Elton et al (2015), illustrated a connection between childhood abuse sufferers and the influence it has on the addiction to cocaine. Alcohol abuse has also been widely identified as a coping mechanism for those who have suffered childhood trauma. Through the study of neuroadaptive responses to stress, Delima and Vimpani (2011), identify the use of alcohol and substances as a form of self-medication to reduce the hyperarousal symptoms of PTSD. Because of the numbing effect of alcohol and substances, children who experience abuse are more likely to partake in drugs, engaging in repetitive and compulsive use leading to addiction to deal with their stress (South et al 2015). The prolonged and abusive use of alcohol has shown to decrease hippocampal volume, affecting an individual's memory and cognitive ability (Delima and Vimpani 2011). Within Australia, among the homeless and social housing population, 43% of individuals meet the criteria for having a substance use disorder, with alcohol abuse being the most prevalent (Keane et al 2015). There is no doubt that the immediate effects of child abuse cause serious ramifications on a child's developmental stages (Seehuus et al 2015). A child who is exposed to multiple stressful situations means they are more likely to engage in risk taking behaviours, have higher incidence of addictive traits and utilise substances as a form of coping (South et al 2015).

THE ECONOMIC BURDEN

Child abuse and neglect has a huge economic burden for the individual and society. The 'direct' costs of child abuse and neglect include hospitalisation of injured children, psychological counselling and support for the victims of abuse and neglect. Direct costs include operating a child welfare system, the cost of law enforcement and the legal system necessitating family and juvenile courts (Gelles and Perlman 2012). The 'indirect' costs of child abuse and neglect are those costs associated with the consequences of abuse and neglect such as special education services and early intervention services to manage developmental and educational delays. Juvenile delinquency, adult criminal behaviour and adolescent/adult homelessness are also counted in the indirect costs (Gelles and Perlman 2012). Gelles and Perlman (2012) estimated the cost of direct and indirect costs of childhood abuse and neglect in the USA of the 1.2 million maltreated children in years 2005-2006 adjusted to 2012 dollars as $80,260,411,087. While this is data from the USA it does show how the costs can often be life-long.

Many of the consequences of child abuse and neglect may have an impact on the individual's subsequent economic productivity. Adults with histories of childhood abuse and/or neglect have been shown to have lower levels of education, employment, earnings, and fewer assets as adults (Currie and Spatz Widon 2010). Currie and Spatz Widdon (2010) suggest that the experience of maltreatment reduces peak earnings capacity by approximately $5,000 per year.

NURSING CONSIDERATIONS

Nursing a child who has experienced any form of abuse can be stressful and an emotionally draining experience for registered nurses. This type of situation raises many conflicts for nurses as they are educated to be professional and treat every patient and his/her family equitably. However, confronting the abuse of a child may present nurses with feelings of anger and distrust towards the caregivers who have instigated the abuse (Tingberg et al 2008). Nurses describe their ability to care for these families with emotional ambivalence where they may have very strong feelings of anger, however they present as professionals towards the family, which can prove to be extremely difficult. Tingberg et al (2008) explore this notion of nurses who want to provide the best care possible to their patients, and have as little contact with the parents or perpetrators as possible. This type of discord gives nurses feelings of dissatisfaction in this conflicting role and without appropriate strategies to deal with these situations, the risk of nurses burning out from the profession can increase drastically (Tingberg et al 2008).

Psychological support for nurses is vital when caring for abused children. This type of support can be provided in informal ways such as discussions about the situation with colleagues or as formal debriefing sessions or clinical supervision during an allocated time in the hospital environment (Chihak 2009). Being informed about what roles other authorities such as police, child protection unit and social workers have with cases of child abuse was another strategy that assists nurses in understanding the whole process of reporting and investigating instances of abuse. Nurses who were informed about the outcomes of reporting child abuse, even after the child was discharged from hospital, felt a sense of closure and considered themselves better prepared to care for abused children in the future (Tingberg, 2008). Hospitals and management must ensure that nurses feel supported while caring for children who have been abused. Providing follow up information about the outcome of the child and allowing nurses to have time away from the hospital environment to seek counselling services is paramount to ensure nurses have a decreased risk of feeling burnt out (Eveline et al 2012).

EDUCATION

There is no doubt that registered nurses have a legal obligation to report any signs of child abuse and neglect to the relative authorities. The factors that hinder a registered nurse from reporting include, experience, knowledge and confidence (Fraser et al 2009). Providing education for nurses is a key element in enhancing their ability to identify and report instances of suspected child abuse. Unfortunately, nurses show a major gap in their knowledge and ability to recognise child abuse, resulting in instances of child abuse not being reported and children left in vulnerable circumstances (Chihak 2009). As reported by Eveline et al (2012), without thorough and appropriate education for nursing staff, this barrier to reporting child abuse will increase. Throughout the literature it is very clear that nurses who had a lack of knowledge about signs and symptoms of child abuse, were also fearful about the misdiagnosis of child abuse and therefore being judged by the parents (Chihak 2009). Formal education sessions should be provided to all registered nurses regularly with content focusing on different types of abuse, symptoms of abuse, the mandated reporter and his/her role, the role of the bedside nurse, patient assessment, accurate documentation and steps to report suspected events of abuse (Eveline et al 2012). Education should also inform health professionals about the specific laws, hospital policies and procedures in place within the state they are working in. E-learning programmes have a much more positive impact on learning compared to didactic lectures as they increase learner participation, create engagement with the topic and improve learning through a more positive experience (Ward et al 2015). Smeekens et al (2011), discovered that emergency nurses who participated in e-learning programmes displayed higher levels of confidence and efficiency when assessing children for any signs of

child abuse. E-learning programmes should be utilised in addition to formal education sessions to ensure that nurses are becoming more aware of which children are at higher risks of experiencing child abuse and increase their knowledge and confidence (Ward et al 2015). It is clear that appropriate and concise education is a major benefactor in enhancing nurses' knowledge, confidence and understanding about the risk signs of children suffering abuse.

NURSING ASSESSMENT

As health care professionals, paediatric nurses in Australia, have a duty of care to be mandatory reporters of suspicion of child abuse. Assessing a child's risk for experiencing abuse is a vital part to preventing mistreatment and adverse childhood events in the future (Van der Put et al 2016). It is expected that Registered nurses will be able to identify children at risk of experiencing abuse, including the signs and symptoms of physical, sexual and psychological abuse. Nurses have a responsibility to conduct age and culturally-appropriate assessments on their patients and their families to identify these risks (Chihak 2009). Emergency nurses are often the first persons to interact with patients and their families, putting them in an advantageous position to assess a child and his/her family for signs of child abuse (Keane and Chapman 2008). Introducing mandatory child abuse screening tools into emergency departments have proved to be an effective way for nursing staff to identify risk factors and have the confidence to provide evidence behind their reports (Eveline et al 2012). In the study conducted by Eveline et al. (2012), a mandatory screening tool was introduced to an emergency department known as the 'escape form'. This form was presented to nurses alongside face to face teaching sessions about appropriate use of the form and screening each child that presented to emergency for signs of abuse. The form consisted of 6 questions identifying warning signs of child abuse and if any signs were marked then the physician must be notified to evaluate that child's risk of experiencing abuse. After using this checklist for a prolonged period of time, nurses reported they had a better understanding about the risk factors of child abuse and had more confidence when presenting suspicions to other nursing and medical staff (Eveline et al 2012).

When conducting the nursing assessment, a thorough physical examination should be conducted, looking for any bruising, abrasions, burns or marks that may not be conducive to the story given by the caregivers on presentation (Klossner and Hatfield 2010). If necessary, photographs should be obtained of the child with accurate, objective documentation in the medical notes being aware that these may be required in a court of law (Dixon and Crawford 2012). Observing the child and his/her interaction with his/her caregivers is another important element in identifying a potential abusive environment. There are a large array of signs that may assist the nurse in identifying child abuse or neglect (Klossner and Hatfield 2010). These signs may include, the child isolating himself/herself withdrawing from his/her caregiver, depressive symptoms, attention seeking, abnormal separation anxiety, poor school attendance, substance abuse, quick to anger and increased anxiety (Dixon and Crawford 2012). As a nurse, maintaining a professional and non-judgemental relationship is paramount. It can be difficult and can cause emotional distress to the nurse and medical team treating the child (Klossner and Hatfield 2010). Seeking appropriate support networks is important for nurses and doctors to be able to continue caring for children who have experienced child abuse.

PREVENTATIVE MEASURES

Children who experience one type of violence are more likely to experience another type and more frequently (Zimmerman and Posick 2016). Identification of these youths at risk is important in order to prevent further incidents of violence occurring. Zimmerman and Posick (2016) suggest education of community members and professionals on how to identify and assist these youths with their needs. Strategies to assist in preventing

incidences of violence include school initiatives based on strategies to de-escalate and avoid violent situations and coping mechanisms for indirect experiences of violence. Addressing the child's household stability is a crucial factor in preventing recurrences of direct and indirect violence. Zimmerman and Posick (2016), spoke about the need for creating safe and nurturing family environments as well as participation in community extracurricular activities. Youth organisations that aim to provide a safe, social and productive environment, assist young people to engage with others in a positive manner and thereby decreasing the likeliness to be involved in violent situations (Zimmerman and Posick 2016). McMillin et al (2016), suggests a key preventative measure in decreasing rates of child abuse comes from the appropriate education to parents about child development and milestones. The research suggests that parents with poor education on childhood development are more likely to engage in child maltreatment as they believe their child should be reaching much higher milestones than appropriate for their age (McMillin et al 2016). They then engage in physical punishment of their child when they do not perform as expected due to frustration, impatience, or inappropriate expectations of development milestones (McMillin et al, 2016). This trend is significantly higher for children with disabilities, at a rate of 3 to 4 times higher incidence of physical abuse among this population. Post et al (2015) recommends family-based treatments with an emphasis on psychoeducation, intra-family communication and education on coping mechanisms to ensure parents do not convert their frustration into aggressive behaviours. The study by Zimmerman and Posick (2016), concluded that perhaps indirect exposure to violence (witnessing violence or abuse) is more conducive to the household environment, meaning that a child who is raised in a loving, warm and nurturing household with effective communication and encouragement in developmental activities has a far less likely risk of experiencing violence.

CONCLUSION

Childhood abuse causes a manifestation of mental, emotional and physical health issues over the lifespan (Seehuus et al 2015). The literature research has found there is a vicious cycle that children who experience abuse face in life. Typically children who experience violence, abuse or neglect have caregivers that experienced this themselves in childhood (Zimmerman and Posick, 2016). Dysfunctional families and households that are unable to cope with stressors in life create dysfunctional environments for their children to grow up into. This causes a cascade of emotional insecurities, disruption to crucial developmental stages and triggers of stress. All of these factors attribute to the increased risk of mental health illness and substance abuse tendencies that have negative ramifications on the child's physical health throughout his/her lifetime (South et al 2015). Various preventative measures can ensure that incidences of violence, child abuse and neglect are decreased. Education for parents is reported as one of the most effective strategies to prevent abuse (McMillin et al 2016). As healthcare professionals, nurses play a vital role in identifying children at risk of abuse. As mandatory reporters of child abuse, it is paramount that nurses have an in-depth knowledge base about the risk factors as well as signs and symptoms of child abuse. Currently nurses are reporting a lack of confidence and knowledge base, hindering them from reporting suspicious presentations (Keane and Chapman 2008). Quality education that is tailored to nursing staff, including e-learning programmes and abuse screening checklists, can dramatically improve knowledge and confidence to report any suspicions of child abuse (Eveline et al 2012). Caring for children who have experienced any form of abuse can be emotionally draining for nursing staff. It is important for nurses to care for themselves through seeking emotional assistance and attending debriefing sessions in order to continue to care for children who have experienced abuse in the future. Lastly, nurses must maintain and provide professional, non-judgemental care in order to allow the child to feel safe and nurtured while in the hospital environment (Klossner and Hatfield, 2010).

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Improving pain management through addition of the functional activity score

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KEY WORDS

pain measurement; nursing assessment; pain management; pain, postoperative, Mainland China

ABSTRACT

Objective
This study investigated the benefits of adding a new measurement tool, the Functional Activity Score to a validated measurement tool, the Numeric Rating Scale.

Design
Prospective cohort comparing cases (with intervention) to controls (usual care).

Setting
Inpatients from a Chinese Mainland teaching hospital.

Subjects
Eighty three postoperative patients of mixed gender and Chinese ethnicity.

Interventions
Adding Functional Activity score, a subjective observer assessed pain measurement tool, to usual postoperative pain intensity assessment.

Main outcome measures
Median 24 hour dynamic pain rating intensity. Episodes of moderate to severe pain.

Results
Median 24 hour dynamic numeric rating pain postoperative pain intensity rating with cough 3 [2.25, 3.75] versus 6 [5, 7] (p< 0.001), and at rest 0 [0,0] versus 2 [0,3] (p < 0.001) were both significantly lower in the intervention group versus the control group. The intervention group also experienced significantly less episodes of moderate to severe pain (p=0.02) and reported significantly less cough related interference with pain (p=0.003).

Conclusion
Functional activity score is easy to teach and apply, complements existing objective pain assessment after surgery and is beneficial for patient care.

INTRODUCTION

Early postoperative mobilisation is associated with a decrease in pulmonary and thrombotic complications and reduced length of stay after pulmonary surgery (Epstein 2014). Conversely, immobility resulting from postoperative pain is linked to increased risk of pulmonary complications after open heart and knee surgery (Korean Knee Society 2012; Milgrom et al 2004).

Dynamic pain combines nociceptive and non-nociceptive signaling, for example deep breathing and coughing involving a thoracic or upper abdominal wound. Uncontrolled dynamic pain may promote hyperalgesia and allodynia (Gilron et al 2002).

Despite improvements in analgesic techniques, postoperative pain is still inadequately treated as a result of inadequate assessment (Joshi and Ogunnaike 2005). Recent patient estimates of moderate or severe postoperative pain were as high as 75% in a United States of America survey conducted in 2003 (Apfelbaum et al 2003), while a Swiss survey reported inadequate assessment of pain and provision of postoperative analgesia by nurses and physicians (Klopfenstein et al 2000).

Insufficient postoperative pain poses significant problems in Mainland China, as evidenced by high rankings of functional restriction reported by patients after thoracotomy (Ying Ge et al 2013). Inadequate pain assessment is thought to be a common accompaniment to inadequate pain management (Srikandarajah and Gilron 2011), a conclusion supported by authors of this study who estimate that 71% of nurses in Mainland China have never assessed the effect of pain on function among patients with pain (Ying Ge et al 2013).

Assessment and analgesia directed at dynamic pain has the potential to facilitate mobilisation, and improve outcomes after surgery (Breivik et al 2008). At present there is heavy reliance on patient rated static and dynamic pain assessment, which is subjective in nature and does not offer benefits arising from combination with objective assessment by health professionals (D'Arcy 2011; Wood et al 2010).

The Functional Activity Score (FAS), recommended by the Australian and New Zealand College of Anaesthetists (ANZCA) and Faculty of Pain Medicine of Australia and New Zealand has been recommended as an adjunctive measurement tool adopted for postoperative analgesia care in Australia (Victorian Quality Council 2008). One of the defining properties of the FAS is that it is undertaken by persons caring for and managing patients, making it objective. Statistical validation and reliability of Chinese version-FAS has been confirmed in a recent study involving Chinese patients (Cheng et al 2015). Moreover, this same study confirmed that Mainland Chinese Hospitals are ideally suited for evaluation of the effectiveness of educational intervention as nursing knowledge of dynamic pain management is currently at low levels.

Pain management programs conducted by nursing educators are essential in developing knowledge, improving attitudes and assessment skills in the context of managing patients experiencing pain (Tse and Ho 2014; Zhang et al 2008). Such programs offer an ideal environment to assess the usefulness of FAS to evaluate analgesia therapies directed at dynamic pain.

We propose a study which aims to confirm that FAS can be easily incorporated into nursing practice alongside standard more traditional observations such as patient rated pain intensity. A further aim is for nurses to be able to interpret and use information from FAS and pain intensity in a way that can lead to improved analgesia management.

This links in with our hypothesis that FAS guided escalation in analgesia management can be effectively implemented after intensive education of nursing and medical professionals in Mainland China, allowing for more effective postoperative analgesia rehabilitation through better timing of analgesia delivery. We hope

to prove this hypothesis by showing improved patient rated dynamic pain intensity ratings in an intervention group where nurses and doctors use FAS and pain intensity information to guide analgesia management compared with a control group where FAS and pain intensity were measured but not used to guide analgesia management.

METHOD

Quasi-experimental research was used for this controlled study.

Design

We received approval from the Institutional Review Committee of the participating hospital on 28 October 2014 for our prospective cohort. This study was conducted at a teaching hospital from March to June 2015. This teaching hospital was chosen because its nursing and medical staff had not received previous education as to the concept of using the FAS to guide escalation of analgesia care.

FAS is an objective observer rated measurement that assesses restriction of functional activities related to an anatomical area where a patient experiences pain following surgery. FAS has not been tested in research settings in Australia, but a Chinese version has undergone psychometric validation, reliability and clinical utility testing (Cheng et al 2015). Internal consistency reliability, Interclass Correlation Coefficient (ICC) and Content Validation Index (CVI) were 0.93, 0.93 and 0.97 respectively. Criterion validity was $r=0.48$; ($p<0.001$) between the FAS and the NRS for pain intensity. Clinical application of FAS was first explored in this same observational study involving 107 patients after major surgery (Cheng et al 2015).

FAS involves an observer requesting a patient is to complete a physiological task relevant to the site of their pain. An example relevant to this study might be to deep breathe and cough after thoracic or upper abdominal surgery. The observer then uses a simple ordinal scale to objectively rate how the pain affects their ability to perform this task. Scoring the patient at "A" indicates the patient is unrestricted by pain when performing the chosen activity. Scoring the patient at "B" indicates the patient's activity is only partly limited by pain and the activity can be largely undertaken. Scoring the patient at "C" indicates the patient's activity is severely limited by pain (Victorian Quality Council 2008).

Sample size

Primary Hypothesis: Group 1(experimental group, N1) =Group 2 (control group, N2).

According to the $N_1 = N_2 = 2 \times \left[\dfrac{\left(u^\alpha + u^\beta \right)}{\delta/\sigma} \right]^2$ "δ" is mean difference (MD) of two groups, "σ" is combined standard deviation of two groups, $\alpha=0.05, u^a=1.96, \beta=0.01, u^\beta=1.282$. According to the results of a preliminary experiment whose evaluation index is pain interference with coughing (0-10), the MD of experimental group (3.87) and control group (5.03) is 1.16, and the combined standard deviation of two groups is 1.59. These calculations suggest that each group needs 39 cases in this study. We have added 15% to the sample size to account for loss of subjects, resulting in a sample size of 45 for each of the control and intervention groups.

Participants

To be included in this study, patients had to provide informed consent, be aged 18-80 years, be capable of understanding questions provided in the survey, be able to accurately rate their pain, and present for elective open thoracic or upper abdominal surgery. Patients with allergy or contraindication to opioid or nonsteroidal anti-inflammatories, or who had a diagnosis of severe renal or hepatic impairment were not eligible for inclusion. Nurses who were employed by the participating hospital were eligible for educational intervention. All nurses included in the educational intervention had to provide informed consent.

During the research, five patients of the Intervention Group quit the study because of personal reasons. In the Control Group, two patients refused to answer the whole questionnaire. As a result, eighty three patients were included in the study. There were forty patients in the Intervention Group and forty three patients in the Control Group.

Procedures

Prior to recruitment of the patients, two education programs were developed by the research team, comprising a pain specialist nurse and senior nursing staff from the participating hospital. The same team validated the content of the educational programs.

Eighty three patients who underwent open thoracic and open upper abdominal surgery were included in this study. Consent discussions with patients did not include explanations of the use of the FAS to guide pain management; rather patients were informed that usual medications for pain management would still be employed and the study would evaluate how the patient controlled analgesia (PCA) was used to treat postoperative pain. The consent described NRS pain assessment where patients were shown the NRS and educated to describe their pain intensity in relation to the numeric scale where zero indicated no pain and 10 the worst pain imaginable. Patients had to demonstrate appropriate understanding of the NRS and ordinal rating scales used for collection of additional data before they were recruited to the study. NRS was the favored measure of patient rated pain intensity in this study owing to its reliable and valid qualities as a measurement tool (Wood et al 2010). All patients in the study were instructed both in the consent and by nurses to use their PCA to reduce their pain levels at rest and when undertaking painful activities, as is usual practice at this hospital.

All patients had demographic variables of age, gender, educational attainment, and surgical operation recorded.

Forty three subjects were initially enrolled to the control group. The control group received usual analgesia care for the participating hospital. This involved PCA boluses of 0.5 ml of a solution of Flurbiprofen (2 mg/ml) and Sufentanyl (1ug/ml) with a 15 minute lockout together with a background infusion of 1.5 ug Sufentanyl per hour.

Prior to recruitment of controls, nursing staff from surgical wards in the participating hospital attended the first education program and received education in measurement of the FAS, so they were able to record FAS scores for the purpose of comparison with controls. The pain specialist nurse and one of the research team members delivered lectures to the nurses.

After surgery, control patients provided static and dynamic NRS ratings at 4 hourly intervals, and staff also recorded FAS of controls at 4 hourly intervals for the first 24 postoperative hours.

Following recruitment of controls, a second intensive educational program was provided to the same nurses from surgical wards and also to medical staff. This program comprised a series of lectures and printed material describing the FAS and how to use the FAS to improve analgesia care. The lectures were given by the same pain specialist nurse and researcher as the first program, and followed by case scenarios encouraging interactive discussion about analgesia care based on FAS assessment. Nurses and medical staff were required to pass a test based on educational content before they were allowed to further participate in the study.

Recruitment of forty subjects to the intervention group followed the intensive education of medical and nursing staff. Patients in the intervention group received FAS guided analgesia intervention.

FAS was assessed by nurses in the intervention group at four hourly intervals in the first twenty four postoperative hours. An FAS of B or C accompanied by a dynamic NRS patient rated pain intensity of greater than 4 activated

an intervention whereby the patient was instructed to deliver a bolus injection from their PCA. Two consecutive FAS of C in combination with an NRS pain intensity of greater than 4 elicited an intervention from a doctor who provided appropriate escalation of analgesia care irrespective of patient rated dynamic pain intensity. The intervention consisted of additional doses of opioid or non opioid analgesic other than NSAID. Patients who had FAS of A alone, or B in combination with dynamic pain intensity reports of less than or equal to 4 did not require an intervention.

Data Collection

Twenty four hours after completion of surgery, patients in both control and intervention groups were asked a series of questions in relation to their pattern of PCA use and experience of pain. The survey questions were mostly derived from "Quality indicators and suggested measures for pain management" adapted from a survey recommended by American Pain Society Quality of Care Task Force (Gordon et al 2005). Six quality indicators were analysed from 20 studies performed at eight large hospitals in the United States of America from 1992 to 2001. The study suggested that although there were no perfect measures of quality, longitudinal data support the validity of a core set of indicators that could be used to obtain benchmark data for quality improvement in pain management in the hospital setting (Gordon et al 2002). In 2013, six quality indicators and a set of standardised measures were translated to Mandarin Chinese, and used to evaluate quality of post-surgery management at five hospitals in China (Ying Ge et al 2013.). Content Validation Index (CVI) was 0.97. A similar survey was used in a pilot for this current study (Cheng et al 2015). The questionnaire used in our study has been specifically adapted for our aims, replacing one question from the survey by Gordon (Gordon et al 2005), "how does pain interfere with your activity, mood and sleep" with more specific questions about pain interference with coughing and mood.

Five survey questions covered patterns of PCA use prior to undertaking painful activities (Yes/No response), worst and least pain intensity, pain interference with coughing, pain interference with mood, with the last three questions involving use of a numeric rating scale.

The final two questions utilised ordinal assessment scales and enquired about the amount of time where moderate to severe pain was experienced; and adequacy of preoperative explanation of analgesia technique. The survey questionnaire is included in figure 1.

Figure 1: Patient survey questions at 24 hours after surgery

Survey Question	Measurement
During the first postoperative 24 hours did you push the PCA button before undertaking painful activities?	Yes/No
On this scale please circle the number that indicates the worst pain intensity that you experienced in the first 24 hours after surgery (0 means no pain, 10 means worst imaginable pain)	Rating placed on 100mm numeric rating scale
On this scale please circle the number that indicates the least pain intensity you experienced in the first 24 hours after surgery (0 means no pain, 10 means worst imaginable pain)	Rating placed on 100mm numeric rating scale
Please circle the number that best describes how much pain interfered with your coughing during the first 24 hours after surgery (0 means does not interfere at all, 10 means interferes completely)	Rating placed on 100mm numeric rating scale
Please circle the number that best describes how much pain interfered with your mood during the first 24 hours after surgery (0 means does not interfere at all, 10 means interferes completely)	Rating placed on 100mm numeric rating scale
How often did you experience moderate to severe intensity pain in the first 24 hours after surgery?	Never, almost never, often, almost always, always.
Describe the adequacy of information that you received about the best way to control your pain	Poor, fair, good, very good, excellent.

Data Analysis

SPSS version 17.0 for windows (Chicago, IL, USA) was used for data analysis. Descriptive statistics were used for sample characteristics of demographic data including age, gender, education and types of surgery. Chi squared testing compared categorical variables such as use of PCA prior to functional activity, frequency of moderate to severe pain and adequacy of information about pain during hospitalization. Mann–Whitney U test was used for evaluation of the questionnaire such as current pain (at rest and during cough), worst and least pain in the past 24 hours, pain interference with coughing and with mood. A p value of less than 0.05 was considered significant.

FINDINGS

Demographic data are included in table 1. Mean age of subjects was 60-63 years, approximately two thirds male, with educational attainment mostly at or below primary school level, with both control and intervention groups undergoing similar surgeries.

Table 1: Demographic characteristics of study participants. Data are presented as number (%), mean (SD), and median [interquartile range] as appropriate.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Age (years)	60.4 (11.5)	62.9 (10.5)	0.50
Gender			
Male	25 (62.5)	27(62.8)	0.96
Female	15(37.5)	16(37.2)	
Educational attainment			
College	2(5)	1(2.3)	0.32
High School and Middle School	18(45)	16(37.2)	
Primary School and Below	20(50)	26(60.5)	
Type of surgery			
open pneumonectomy	11(27.5)	21(48.8)	0.71
open partial gastrectomy	11(27.5)	8(18.6)	
open proctectomy	10(25)	6(14)	
Open colectomy	8(20)	8(18.6)	

Static and dynamic patient rated and observer rated FAS are included in table 2. Subjects in the intervention group reported significantly lower static (p< 0.001) and dynamic pain (p< 0.001), while observer rated FAS was higher in the intervention group (p=0.02)

Table 2: Static and *Dynamic pain intensity measurement over 0-24 hours following surgery and observer rated FAS. Data presented as median [interquartile range] and number (percentage) as appropriate. P< 0.05 is considered significant.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Static pain intensity	0[0-0]	2[0-3]	< 0.001
Dynamic pain intensity	3[2.25-3.75]	6[5-7]	<0.001
Observer rated FAS			
A	4(10)	3(7)	
B	33(82.5)	27(62.8)	0.02
C	3(7.5)	13(30.2)	

* Denotes primary end point

Survey of pattern of use of PCA before undertaking painful activities are included in table 3. The intervention group also reported more preemptive PCA use (p=0.02).

Table 3: Pain measurements and responses to survey questions taken from patients 24 hours following surgery. Data presented as median [interquartile range] or number (percentage) as appropriate. P< 0.05 is considered significant.

Variable	Intervention Group (n=40)	Control Group (n=43)	P Value
Worst pain intensity	6[5-6.75]	7[5-8]	0.029
Least pain intensity	2[0-2.75]	2[2-3]	0.150
Frequency of moderate to severe pain			
Always	3(7.5)	4(9.3)	
Almost always	3(7.5)	11(25.6)	0.020
Often	5(12.5)	12(27.9)	
Almost never	21(52.5)	13(30.2)	
Never	8(20)	3(7)	
Pain interference with mood	4[3-5]	5[3-6]	0.284
Pain interference with cough	5[3-5]	5[5-6]	0.003
Adequacy of information			
Poor	3(7.5)	3(7)	0.076
Fair	2(5)	5(11.6)	
Good	12(30)	23(53.5)	
Very good	17(42.5)	8(18.6)	
Excellent	6(15)	4(9.3)	
Using PCA before painful activity			
Yes	14(35)	5(11.6)	0.01
No	26(65)	38(88.4)	

Worst pain intensity, episodes of moderate to severe pain, together with pain interference with coughing were all statistically significantly lower in the intervention group compared with the control group (refer table 3). Lowest pain intensity, impact of pain on mood, and adequacy of information about pain at 24 hours following surgery were not statistically different (refer table 3)

DISCUSSION

Our prospective cohort has confirmed that intensive education of Mainland Chinese nurses and medical staff in the role of FAS combined with dynamic NRS pain intensity can successfully influence delivery of analgesia after major surgery. This is highlighted by improved patient rated dynamic pain intensity in the 24 hours following chest and upper abdominal surgery.

The current study involved a hospital setting where staff were introduced to FAS for the first time. This contrasts with our pilot study involving a different hospital, where nursing staff were familiar with the FAS (Cheng et al 2015). This meant that control subjects were able to receive usual analgesia care free from nursing bias and that the intervention (addition of FAS to help guide escalation of usual analgesia care) was assessed as accurately as possible. This contrasts with the previous study whose aim was to confirm the validity, reliability and utility of the FAS as a clinical measurement tool in a Mainland Chinese population.

Our experience in Mainland China is that nursing staff do not yet appreciate the significance of measuring dynamic pain, and will usually only record pain at rest (Ying Ge et al 2013). It is also likely that doctors and

nursing staff in Mainland China as well as other countries can not differentiate between subjective and objective measures of pain intensity as the FAS is not in common use throughout the world. Pain intensity is currently evaluated subjectively by adult patients in normal practice, and objectively using behavioral, subjectively by visual cues in pediatric (Voepel-Lewis et al 1997; Wong and Baker 1988) and objectively by carers in critical care settings (Payen et al 2001). It is our belief that objective pain assessment should extend to all clinical settings and be combined with subjective patient assessment where possible, to direct analgesic intervention.

Our intervention group was more likely to preemptively use their PCA to facilitate painful activities compared to controls. This is despite both groups receiving the same advice about reducing pain at rest and with painful activities prior to surgery, as is part of usual care in this Mainland Chinese hospital. It is possible that the intervention group recognized the pattern of PCA use in the setting of low FAS and began to use the PCA autonomously in the setting of potentially painful situations. This represents a situation where a concept that is discussed and demonstrated through nurse led intervention is more effectively understood by the patient.

Patients of Chinese ethnicity are more likely preoperatively to expect severe pain and prefer to exercise less autonomy in the control of their own pain management (Konstantatos et al 2012). This is combined with the wrongful perception that rest is more beneficial than early rehabilitation after surgery (Liu et al 2013). It appears that patients in this study were able to overcome these preconceived beliefs and favorably change their behaviours through adoption of patterns of PCA use initiated by nurses to facilitate postoperative rehabilitation.

We were unable to show a difference in pain intensity effect on mood. Age and educational attainment, both similar among intervention and control groups, are correlated with anxiety levels among Mainland Chinese (Xie et al 2010). Age and educational attainment may have stronger influence on mood than pain intensity in people of Mainland Chinese ethnicity.

A limitation of our study was that we did not evaluate patient satisfaction with pain management in our cohort. We evaluated satisfaction in our pilot study that preceded this cohort (Cheng et al 2015) and found that satisfaction did not vary between the control and intervention groups. We felt that Chinese patients may have had trouble conceptualising the benefits brought about by active rehabilitation, given their low educational attainment and contrasting belief that rest is beneficial after surgery (Liu et al 2013). Another potential limitation is the ethnic context of our study. People of Chinese ethnicity are known to exhibit less autonomy in the management of their pain in the postoperative setting compared with Caucasian Australians (Konstantatos et al 2012), making them less likely to self- deliver bolus doses of PCA without prompting from nurses. A Caucasian population experiencing conditions similar to the controls in our study may have initiated more PCA analgesia without prompting from nurses, and may have experienced less increase in dynamic pain intensity compared to an intervention group.

CONCLUSION

This study's findings have highlighted the importance of nursing assessment for improving patient analgesia following painful surgery. Evaluation combining FAS with dynamic NRS allows nurses to guide and educate patients to better use PCA dosing to facilitate functional recovery. Skillful patient management, in turn, requires that nurses be educated competently to record and accurately interpret FAS to improve analgesia care. These findings may be of universal benefit, especially where nurses require more experience in the use of multiple pain management tools to deliver effective postoperative analgesia.

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