

# Enhancing Graduate Nurses' Health Assessment Knowledge and Skills Using Low-fidelity Adult Human Simulation

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**Purpose:** Although simulation technology in nursing education is becoming increasingly commonplace, a review of the literature reveals a paucity of rigorous, high-level research comparing the effectiveness of simulation with other traditional education methods in the acquisition of clinical knowledge and skills. This research aimed to investigate the impact of three learning interventions on graduate nurse health assessment knowledge and skills. It was hypothesized that the patient assessment skills of graduate nurses who completed a simulation learning activity would be superior to those who completed traditional education activities.

**Methods:** Graduate nurses ( $n = 74$ ) were randomly allocated to three groups (1: self-directed learning package [SDLP] only; 2: SDLP plus two scenario-based PowerPoint workshops; and 3: SDLP plus two simulation education sessions using a manikin with low-fidelity capabilities. Following the education activities, graduates completed an individual test involving a systematic patient assessment upon a manikin. They were scored using a checklist of relevant responses.

**Results:** Analysis of variance results suggest that the mean test score for nurses in the simulation group (mean = 135.52, SD = 26.63) was significantly higher ( $P < 0.001$ ) than those in the learning package group (mean = 107.42, SD = 29.82) and the PowerPoint group (mean = 102.77, SD = 31.68).

**Conclusions:** Simulation appears to be an effective educational tool for teaching patient assessment knowledge and skills to graduate nurses. Incorporation of such technology into graduate nurse education may decrease the time required to become clinically proficient, resulting in more confident and work-ready practitioners.

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Southern Health is a tertiary referral public health service in Melbourne, Australia that employs over 4,000 registered nurses (RN), of which a proportion are newly graduated RNs. The approach to professional support and development of these graduates within the clinical environment of this organization has until recent times been largely via traditional educational strategies. The expectation is that through these

traditional processes, there is a level of knowledge and skill transit, and the graduate develops and sustains the requisite capacity and capability to provide safe, competent, timely, and appropriate care.

In a relatively stable setting, much of that educational activity may occur and much of the expectations may be realized. However, current challenges facing clinical nursing practice in the workplace, such as significant shifts in skill mix and supply, increased patient acuity, and the increased pressure for clinical learning placements, are placing inordinate pressure on the ability to support learning in the clinical setting and the subsequent knowledge and skills transit.<sup>1–4</sup> It is within this environment that the new graduate is expected to commence employment, apply knowledge, practice skills, and develop professionally.

In the Australian context, an RN has completed a 3-year Bachelor of Nursing degree, and although the curricula around the nation meet national standards, there is significant variation between the educational providers in the undergraduate's preparation, both in theory and clinical experience.<sup>5</sup> As a result, graduate nurse programs (GNP) have evolved to facilitate the transition from theory to practice. The majority of RNs commence their professional career as a participant of a GNP. The GNP not only provides healthcare services the opportunity to recruit large numbers of graduate nurses, but also enables the organization to guide the graduate through the transition phenomenon from novice to expert practice.<sup>6,7</sup>

## Alleviating the Transition Phenomenon

Research suggests that nurses find the transition from student nurse to graduate nurse difficult and stressful.<sup>1</sup> Undergraduate programs commonly finish in November of each academic year and then there is a period where the graduate awaits the commencement of employment in the healthcare sector and their placement in the GNP. During this period, evidence supports the contention that there is a level of knowledge and skill decay leading to reduced levels of competence and confidence.<sup>8,9</sup>

Furthermore, research suggests that newly graduated nurses often feel overwhelmed and ill prepared for the reality of working in the clinical setting.<sup>1,2,4,5</sup> Graduates themselves report a lack of competence and confidence in key clinical skills required to survive the daily demands of a busy acute hospital.<sup>10,11</sup> Tensions arise when overworked senior nurses feel that they have to carry the extra burden of their inexperienced new colleagues. The education sector is then criti-

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cized for producing graduates with insufficient clinical training and expertise.<sup>1,5,6</sup>

Southern Health recruits in excess of 120 nurses to its GNP annually, with intakes in February, April, and August of each year. The Southern Health GNP is a 12-month program and graduates complete three rotations of 4 months' duration in a variety of acute clinical settings. Graduates are allocated preceptors to guide and support them through their rotations, and clinical nurse educators provide direct and indirect teaching via study days and tutorials, along with clinical supervision on an as-needed basis.

It is a challenge of any GNP to develop teaching and learning strategies that enhance opportunities for deep clinically relevant learning and reflective practice rather than "surface learning," which is characterized by exerting the minimum effort required to meet learning requirements.<sup>12</sup> Indeed it could be contended, in light of the various organizational and professional challenges identified, that early exposure to educational processes, which will facilitate and foster independent critical and reflective learning processes, is essential if graduate nurses are to overcome the transition to practice as expediently as possible and develop as safe, competent, and confident clinical practitioners. Scenario-based low-fidelity patient simulation is an emerging educational intervention that encourages health care workers such as nurses to attain and sustain clinical knowledge and skills in the workplace.<sup>13-17</sup>

## Simulation in Healthcare Education

Simulation has been used in healthcare education for nearly 40 years, and has been identified in the seminal report "To Err is Human" as a means of preventing and mitigating patient harm.<sup>18</sup> Others have identified that the use of simulation allows for repeated and reflective practice, and is particularly useful for complex conditions that perhaps occur infrequently in the real world.<sup>13,14</sup> Scenario-based simulation provides an opportunity to identify and reason through a clinical problem and make a clinical decision in a safe and controlled environment, without the risk of harming an actual patient.<sup>15-17</sup>

Importantly, Gaba<sup>19</sup> points out that simulation can be used from the "cradle to grave" (p. i3) and has applications in nursing education from undergraduate nursing students through to experienced nurses working in the critical care environment. This viewpoint is relevant when taking into account the changes in service delivery that have occurred in the clinical setting in recent years that impact on learning and practice opportunities.<sup>1-3</sup>

Furthermore, in response to increasing workforce shortages, student numbers in both nursing and medicine have increased, resulting in greater competition for clinical placements.<sup>4</sup> A major ongoing praxis issue is ensuring that students gain appropriate and timely clinical exposure, which should meet learning objectives. In the absence of this clinical exposure being timely and appropriate, simulation may help close the theory-practice gap. Indeed, simulation has been suggested as a method of better preparing students, in terms of practical and interpersonal skills, to maximize the learning opportunity that clinical placements provide.<sup>16</sup>

Patient simulation incorporates a range of products ranging from sophisticated computer-driven high-fidelity simulators to low-fidelity simulators and part-task trainers. Regardless of fidelity, the use of simulation in healthcare has potentially many applications. For that potential to be realized, rigorous research is required to help facilitate its wider acceptance and use.

There are now hundreds of papers published regarding simulation in healthcare education both in the nursing<sup>20-22</sup> and medical<sup>23-25</sup> disciplines. However, scrutiny of the wider literature suggests that there is a paucity of rigorous, scientific research identifying that simulation is more effective than more traditional methods of education. This is supported by a 2002 literature review highlighting a lack of high level, quantitative research that consistently demonstrates the effectiveness of simulation in healthcare education.<sup>26</sup>

A more recent systematic review of the literature about effective learning outcomes associated with high-fidelity simulation highlights the increasing numbers of comparative studies that are providing further evidence about the educational role, capacity, and effectiveness of high-fidelity simulation and suggests that high-fidelity simulation is effective under certain conditions. Interestingly, the review found that approximately 80% of papers reported findings that were ambiguous, and less than 20% presented findings that were clear and most likely true.<sup>27</sup> Weller identifies the scarcity of randomized, controlled trials as a deficit also.<sup>28</sup>

The rigour of the emerging simulation research is improving however. High-fidelity simulation has been shown to be more effective in trauma training for surgery interns than using moulaged actors to play the patient role. In this randomized trial, those in the simulation practice group had significantly higher test scores than those in the moulage practice group overall. Furthermore, the simulation group also scored significantly higher than the moulage practice group on the moulage test scenario.<sup>29</sup>

Another study of interest is a recent randomized controlled trial that compared high-fidelity simulation, low-fidelity simulation, and traditional didactic education for teaching a microsurgical technique. This study found that training on the low-fidelity model was just as effective as the high-fidelity model, and that both were typically more effective than the didactic education.<sup>30</sup> Furthermore, research conducted by Wilson and colleagues demonstrated the user-friendliness and realism of low-fidelity simulation as an education tool.<sup>31</sup>

Prominent social learning theorist Albert Bandura discusses the reciprocal relationship between cognitive, environmental and behavioral factors in the learning process.<sup>32</sup> The use of simulation within an educational framework is a perfect reflection of this theory, where the simulation activity (learning environment), the actions of the learner (behavior) and critical thinking (cognition) all interact to provide a deep, multidimensional learning experience.

## Research Aims and Hypotheses

Recent international systematic literature reviews demonstrate a limited number of rigorous quantitative research papers in the area of simulation in healthcare education.

Although it is often assumed that simulation is an effective education method, this research aimed to quantify this assumption, using a randomized controlled trial methodology. This research compared the impact of three different patient assessment learning interventions on graduate nurses' knowledge and skills to determine if particular interventions were more effective than others. A self-directed learning package was compared with traditional didactic classroom education (using PowerPoint presentations) and education sessions involving low-fidelity simulation. After the education phase of the study, all graduate nurses completed a patient assessment test scenario using a manikin with low-fidelity simulation capabilities.

It was anticipated that the patient assessment skills of those nurses exposed to the simulation education would be superior to those in the other two groups. Given that those in the PowerPoint group participated in two interactive education sessions that were not provided to the learning package group, it was also expected that the patient assessment skills of those who completed the PowerPoint sessions would be greater than those who had completed only the learning package.

## MATERIALS AND METHODS

### Sample

Eighty graduate nurses commenced the GNP in February 2005 across four campuses of Southern Health. These nurses were randomly assigned to one of the three education intervention groups, outlined in Table 1. All participants in the final sample completed the self-directed learning package. Those in Group 1 did not receive any additional education, whereas those in Group 2 completed two PowerPoint education sessions and those in Group 3 completed two simulation education sessions. Six nurses did not complete the final test scenario, including one nurse who withdrew from the GNP, two nurses who did not receive the learning package in time, one nurse who inadvertently changed groups during the education phase, and two nurses who were absent during the final test scenario dates (Table 1).

Throughout the GNP, the graduate nurses participate in five formal study days that cover a range of information pertinent to their professional development. The GNP does not typically include any formal education concerning patient respiratory assessment. Therefore, all three interventions were over and above what would be normally provided in the GNP, so those in Groups 1 and 2 were not necessarily disadvantaged by missing out on the simulation education.

**TABLE 1.** Number of Graduate Nurses in Each Education Intervention Group

Education Intervention	Original Sample	Test Sample
	n	n
1. Self-directed learning package (SDLP)	27	25
2. SDLP + PowerPoint scenarios	27	26
3. SDLP + simulation scenarios	28	23

An overview of the research protocol was forwarded to the Southern Health Human Research Ethics Committee for consideration. Based upon National Health and Medical Research Council guidelines, the project did not require a full Human Research Ethics Committee submission and was subsequently classified and endorsed by the Southern Health Human Research Ethics Committee as a quality assurance exercise.

### Materials

Southern Health's Adult Clinical Assessment self-directed learning package (SDLP) was sent to the graduate nurses before they commenced the GNP and they were asked to complete and return an enclosed pretest before they started working through the package. This package contained a module on respiratory assessment that was the focus of the research, in addition to other modules including cardiovascular, neurological, abdominal, and limb assessment.

Three Laerdal Nursing Anne Complete manikins (FCS-4000) were used for the simulation education sessions and for the final test scenario. This sophisticated manikin is a lifelike, full-body manikin, and enables the practice of a diverse range of nursing skills. The manikin is controlled by VitalSim technology, a simulator that not only provides functions such as the heart and lung sounds, pulse, and blood pressure, but it also allows the user to build a scenario that can either progress automatically or can be advanced by the controller. The authors regard the Nursing Anne manikin and VitalSim hardware as low-fidelity simulation given the limited interactive capacity, particularly when compared with high-fidelity simulators such as the Laerdal SimMan.

### Outcome Measures

A panel of nurse experts developed a checklist for the test scenario that contained all the essential actions that the novice graduate nurse might reasonably be expected to perform. This checklist was tested with several graduate nurses from a previous cohort and subsequently refined. Space was also provided on the checklist for additional comments because it was not possible to preempt every action the graduate nurse might take. A weighting system was adopted for scoring the various items on the checklist. This system was developed by the research team and was based upon the relative importance of each action to the wellbeing of the patient. A copy of the Clinical Response Verification Tool is shown in Table 2.

### Scenarios

Three patient assessment scenarios were developed around respiratory issues. The first two scenarios, with an asthma and pneumonia focus, were used respectively for the two education sessions for Groups 2 (PowerPoint) and 3 (simulation). The test scenario was acute pulmonary edema (APE), and all graduate nurses completed this scenario individually.

As indicated previously, the simulation scenarios were developed using the VitalSim hardware of the manikin and were programmed to follow three different paths (a "traffic light" approach), depending on the actions of the learner.

**TABLE 2.** Clinical Response Verification Tool

**Clinical Response Verification Tool (CRVT)**

Checklist A: APE Scenario Frames 0, 1, 2, 4, 5, 6, 7

ID Code: \_\_\_\_\_

Frame No: \_\_\_\_\_

Place a tick in column 1 the first time a response is observed. If it is observed again within the same frame, tick column 2

Response	Observed		Response	Observed	
	1	2		1	2
<b>Talk</b>			<b>Oxygen</b>		
Introduce self to patient	_____	_____	Administers via nasal prongs	_____	_____
Asks questions related to symptoms	_____	_____	Administers via Hudson mask	_____	_____
Reassure patient/encourage to relax	_____	_____	Administers via Venturi mask	_____	_____
Checks progression of symptoms	_____	_____	Administers via Aquapak	_____	_____
			Correct flow rate for device used	_____	_____
<b>Observations</b>	_____	_____	Administers <b>incorrect</b> flow rate for device (-ve)	_____	_____
Temperature	_____	_____	Identifies need to alter flow rate	_____	_____
Respiratory rate	_____	_____	Identifies need to change delivery device	_____	_____
Pulse oximetry	_____	_____			
Blood pressure	_____	_____	<b>Charting</b>	_____	_____
Checks IV rate	_____	_____	Checks care plan	_____	_____
Checks IV fluid against current order	_____	_____	Checks medication orders	_____	_____
Checks IV site	_____	_____	Checks post-op order	_____	_____
Assess pain level	_____	_____	Checks FBC	_____	_____
Assess wound	_____	_____	Checks previous observations	_____	_____
			Changes observation schedule	_____	_____
<b>Respiratory Assessment</b>	_____	_____	Records observations	_____	_____
Assess ability to talk/Quality of speech	_____	_____	Updates basic care on care-plan	_____	_____
Effort of breathing/Chest movements	_____	_____	Records on medication chart	_____	_____
Use of accessory muscles	_____	_____	Documents in history	_____	_____
Auscultates using stethoscope	_____	_____			
Identify audible noises respiratory noises	_____	_____	<b>Help</b>	_____	_____
Identifies difference between L & R lung sounds	_____	_____	Reports to other senior nurse	_____	_____
Identify hypoxia (e.g., irritability, confusion)	_____	_____	Calls doctor	_____	_____
Colour of skin, nail beds, mucous membranes	_____	_____	Initiates MET call/Red emergency buzzer	_____	_____
			Requests urgent assistance	_____	_____
<b>Identify</b>	_____	_____	Makes referral to allied health care staff	_____	_____
Identify correct patient	_____	_____	Identifies need for further assistance	_____	_____
Identify development of cough	_____	_____			
Identify characteristics of cough	_____	_____	<b>Suggested prompts</b>	_____	_____
Identify change in cough characteristics	_____	_____	Can you ask the pt how they are feeling?	_____	_____
Identify sputum production	_____	_____	What do you notice about noises pt is making?	_____	_____
Identify characteristics of sputum	_____	_____	Who will you notify about the pts condition?	_____	_____
Identify change in sputum characteristics	_____	_____	What effect has the Lasix had?	_____	_____
Identify deterioration in patient	_____	_____			
Verbalises improvement in sign & symptoms	_____	_____	<b>Comments:</b>		
<b>Actions</b>	_____	_____			
Correct IV rate	_____	_____			
Checks oxygen & suction	_____	_____			
Helps patient to reposition/sit upright	_____	_____			
Discuss care plan with other nurse/RMO	_____	_____			
Observes effect of Lasix (measure urine)	_____	_____			
Stop/Turns off IV	_____	_____			

(Continued)

TABLE 2. (continued)

Clinical Response Verification Tool (CRVT)			
Checklist B: APE Scenario Frames 3 & 8 (Handover)		ID Code: _____	Frame No: _____
Place a tick in the performed column for each piece of information conveyed during handover to another staff member.			
Response	Observed	Chest X-Ray	Observed
Increased heart rate	_____	More white areas in recent X-ray	_____
Increased BP	_____	White areas probably extra fluid	_____
Increased respiratory rate	_____	X-ray shows pulmonary edema	_____
Decreased O <sub>2</sub> sat	_____	<b>Comments</b>	
Difficulty with talking (Short of breath)	_____		
Using accessory muscles	_____		
Has s/s hypoxia	_____		
Confusion & agitation	_____		
Blue nailbeds & lips	_____		
Pale skin	_____		
Has developed a cough	_____		
Cough is productive – white frothy sputum	_____		
Has coarse crackles in both lungs	_____		

Although there was no score set for a pass or fail, the graduates were classified as green, amber, or red, depending on their performance. Graduates were said to move down the green path if they recognized that the intravenous (IV) infusion was running too fast and corrected the flow rate in the first frame of the scenario (the subsequent deterioration of the manikin condition was less severe for those who traveled this path). If the graduate failed to notice the IV rate was running too fast in the first frame of the scenario, but did recognize the need to call for medical assistance in the early stages of APE, they were considered to have followed the amber path. If they failed to recognize the incorrect fluid rate or call for medical assistance until the manikin was in a state of APE, this was classed as the red path, which could be likened to a fail.

To improve scenario realism, props such as artificial sputum, intravenous therapy, and urinary collection devices were used. Furthermore, to increase the practical aspects of the scenario, graduates were encouraged to demonstrate their skills using other props such as oxygen delivery devices and to document observations on the relevant charts.

### Procedure

Scenario-based education sessions were conducted across 4 Southern Health campuses by a nurse educator with groups of two to five graduate nurses per session. Regardless of whether the session involved PowerPoint or simulation, the same handover and verbal information was provided in the education sessions for Groups 2 and 3. This was to maximize the similarity between the two forms of education session so that the only significant difference between them was that those in the simulation group had a more hands-on practical experience using the manikin. Under the guidance of a nurse educator, graduate nurses in the PowerPoint and simulation groups worked through the same two scenarios,

using principles of problem-based learning and clinical reasoning. The small cohort of nurse educators who ran these sessions were provided with either a PowerPoint presentation or a simulation scenario running sheet as appropriate and all were fully briefed before facilitating these education sessions. Education sessions ran for approximately 30 minutes and took place 8 weeks apart. This time frame was chosen because it was long enough to plan and schedule the nurses into the next education session or test scenario without being too long to compromise retention of information from the previous session. To reduce discussion between graduate nurses in different intervention groups, those in Groups 2 and 3 were asked to sign a confidentiality agreement.

The final test scenario took place approximately 6 weeks after the last education sessions and graduate nurses in all three intervention groups were allocated an individual time. Two nurse educators were present during the test scenario. One was responsible for running the scenario which involved reading relevant information such as handover details, and also operating the manikin which included providing a voice for the manikin. This person was provided with a list of acceptable patient responses for each stage of the scenario to standardize the verbal information provided to the graduate nurse. For consistency, only three nurse educators performed the role of running the scenario, and given that there were often three teams running simultaneously, this was a minimum requirement.

The second nurse educator performed the role of the observer and was responsible for recording the actions of the graduate nurse on the checklist and writing any relevant additional comments. All observers received the same preparation and where possible, observed several trial scenarios to familiarize themselves with the checklist. In most cases, the observer was blind to the education intervention the graduate

nurse had received, unless they had conducted the particular education session in which the graduate participated.

A brief familiarization scenario was run immediately before commencing the test scenario so that the graduate nurse was more comfortable with the manikin before the test (particularly those in Groups 1 and 2 who had not yet been exposed to the manikin). The capabilities and limitations of the manikin were explained and the graduate nurse was provided the opportunity to listen to the heart/lung sounds, take a pulse, check blood pressure and ask any questions, before commencing the test. This familiarization experience took approximately 5 minutes and allowed enough time to cover the basic attributes of the manikin.

A short individual debrief took place immediately after the test scenario to discuss with each participant any issues that may have arisen, to offer suggestions about how the situation may have been managed more effectively and to answer any of the graduate nurses' questions or concerns. No information about these debriefing sessions was recorded and they varied according to the performance and the individual needs of each graduate nurse.

### Statistical Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS), and included simple descriptive statistics and analysis of variance (ANOVA) for comparison of mean scores among the three research groups.

### RESULTS

Although it would have been ideal for all graduate nurses to complete a scenario-based assessment of their skill level prior to the research, time, and logistical constraints prevented such an activity. Although not a substitute for the assessment of practical skills, as an alternative all participants completed the same written pretest included in the respiratory SDLP which assessed their respiratory patient assessment knowledge. One of the key assumptions of ANOVA is that the variance of the three groups is equal, or homogenous, and in this case the Levene Statistic suggested that this assumption was not violated. ANOVA was conducted to compare the pretest mean scores of the three education intervention groups and indicated that there were no significant differences among them, whereby  $F_{(2, 71)} = 0.28$  and  $P > 0.76$  (Table 3).

Using the traffic-light approach outlined above to provide a preliminary overview of results, only 4.3% of those in the simulation group followed the red path (worst performance) compared with 19.2% of those in the PowerPoint group and 14% of the learning package group. Almost 87% of those in the simulation group followed the green path (the

**TABLE 3.** Pre-test Results for Graduate Nurses in Each Education Intervention Group

Education Intervention	Mean	SD
1. Self-directed learning package (SDLP)	18.28	3.61
2. SDLP + PowerPoint scenarios	17.88	3.92
3. SDLP + simulation scenarios	18.65	3.13

**TABLE 4.** Test Scenario Results for Graduate Nurses in Each Education Intervention Group

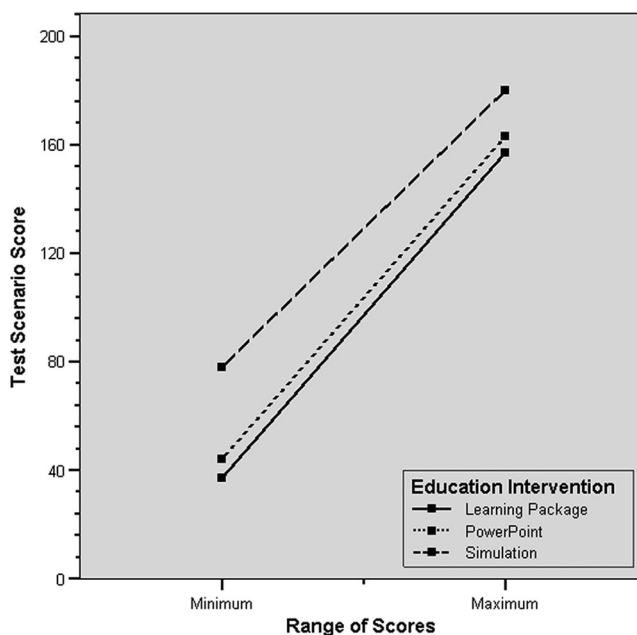
Education Intervention	Mean	SD
1. Self-directed learning package (SDLP)	107.42	29.82
2. SDLP + PowerPoint scenarios	102.77	31.68
3. SDLP + simulation scenarios	135.52	26.63

best performance), compared with 72% of the learning package group and only 53.8% of the PowerPoint group.

Table 4 provides the mean test scenario score and standard deviation for graduate nurses in the three education intervention groups. Again the Levene Statistic indicated that variance of the three groups was homogenous. ANOVA results indicated that there was a significant difference among the mean scores of the three groups, whereby  $F_{(2, 71)} = 9.12$  and  $P < 0.001$ . Post-hoc analysis using Tukey's Honestly Significant Difference (HSD) suggested that the mean score of graduate nurses in the simulation group (Group 3) was significantly higher than both the SDLP (Group 1) and the PowerPoint (Group 2) intervention groups. Furthermore, there was no difference between graduate nurses in Groups 1 and 2.

Figure 1 shows the range of scores for graduate nurses in each education intervention group. The lowest score for any graduate nurses in Group 3 was 78 points, compared with 37 points for Group 1 and 44 for the Group 2. Similarly, the highest scores for Groups 1 and 2 were 157 and 163 points, respectively, compared with a maximum score of 180 for a graduate in the simulation group.

As discussed previously, data were weighted so that those skills or actions thought to be of critical importance to



**FIGURE 1.** Range of test scenario scores for graduate nurses in the three intervention groups.

the safety of the patient were awarded a higher score. When an unweighted database was used (ie, all actions awarded 1 point) the same pattern was repeated in the ANOVA results, whereby the mean score of those in the simulation group was significantly higher than those in the other two groups.

## DISCUSSION

This research suggests that educational activities that incorporate low-fidelity simulation are more effective than more traditional teaching modalities such as self-directed learning and didactic classroom education for teaching specific patient assessment skills to graduate nurses.

Previous research has highlighted how difficult the transition from student to graduate nurse can be, and these nurses often feel underprepared for real-world nursing.<sup>1-3</sup> Their competence and confidence in their clinical knowledge and skill levels may be further compromised by a prolonged period of time between the completion of their undergraduate nursing studies and the commencement of subsequent employment as a registered clinician.

Simulation can play a key role in allowing graduates the opportunity to develop their clinical reasoning and decision-making skills within a safe and comfortable environment.<sup>15-17</sup> One key advantage of low-fidelity simulation is that it is portable and can be taken directly to the learner in the clinical environment. This allows learning to be conducted and embedded within the context of the real-world setting, reducing the downtime the RN would otherwise be required to spend away from the clinical environment. Although it is important for the location to be conducive to learning, a quarantined educational activity in the workplace does eliminate the logistics of staff having to travel to another department or go offsite. It may also reduce the ongoing problem where staff often indicate they are “too busy” on the day. Easier accessibility to involvement may also generate a higher compliance in program attendance.

Importantly, this research found that there was no significant benefit in providing didactic classroom education in addition to the self-directed learning package. Those who received only the learning package (Group 1) performed at a similar level to those who participated in two scenario-based PowerPoint sessions that addressed the same two scenarios as those in the simulation group. While it was hypothesized that there would be some “value-add” to participating in these interactive PowerPoint sessions, it seems that this method of education does not necessarily result in effective knowledge transfer.

Although this research was specifically concerned with graduate nurses, there is potential for expanding low-fidelity simulation into broader educational practices, such as the “cradle to grave” approach.<sup>19</sup> Increased use of simulation in the undergraduate nursing program, both from a primary learning perspective and as an adjunct to clinical placement, needs consideration, especially in light of the increasing demand for clinical placements. Similarly, simulation may be an important adjunct in refresher and reentry programs or for upskilling international recruits who sometimes have difficulty adjusting to nursing in a different context. More com-

plicated scenarios could be developed to meet the learning needs of a more experienced nursing population, particularly those completing postgraduate and specialist courses.

There is enormous potential for incorporating low-fidelity simulation into the ongoing professional development of all nursing staff. Indeed, the use of low-fidelity simulation could be seen as an effective educational method in preparing nurses from both the “just in case” and “just in time” learning perspective. As examples, the inclusion of strategically placed scenario-driven simulation in the undergraduate curriculum could subsequently reduce the initial dependency and anxiety levels of graduates in their new roles. Furthermore, ready access to simulation activities contextualized to the clinical setting could also help both the graduate and other RNs refresh and retain knowledge and skills used intermittently, such as tracheostomy management.

## Limitations

Due to time and logistics issues, it was not possible to assess the practical skills of the graduate nurses before the research commenced. Although a written knowledge test such as the pretest used in this study is not a substitute for a practical assessment, this was considered to be the most feasible alternative. Although it is not possible to dismiss the possibility that those in the simulation group may have also performed better in a practical skills pretest before they were exposed to any education, the randomization process should ensure that the groups were evenly matched in their skill level before the additional education interventions. While the pretest results did not provide a measure of practical skill, they certainly suggested that graduate nurses across all three groups commenced with a similar level of knowledge.

Two nurse educators were required to run each scenario and given the multisite nature of this research (up to three sites simultaneously), it was not logistically possible to have the same two staff perform all 74 individual test scenarios. Similarly, given the large number of graduate nurses and the limited cohort of nurse educators involved in running the education sessions and the assessment scenarios, there were some instances where the nurse educator may not have been “blind” to the research intervention group of individual graduate nurses. It was thought that the use of a standardized checklist to objectively measure the clinical reactions of the graduate nurses would reduce the potential for subjectivity in the scoring system. The assessment scenarios were not recorded as this may have increased the anxiety levels of the graduates and impeded performance, although recordings may have been of assistance in establishing inter-rater reliability which was not examined in this study.

There were certain limitations with the manikin itself, in that it could not match all the characteristics of a real patient, such as the rise and fall of the chest and visible signs of hypoxia, but the use of other “props,” cues, and improvisations, such as chest x-rays and sputum samples, can help to establish a reasonable level of realism. Similarly, although some might suggest that those in the simulation group performed at a superior level simply because they were more familiar with the manikin itself, there were many responses on the checklist that were not directly related to the features

of the manikin. These included responses such as recognizing that the intravenous infusion was running too fast, selecting an appropriate oxygen delivery device, recognizing the need to call for medical assistance and communicating relevant details to senior nursing staff or doctors. Familiarity with the actual manikin should not enhance performance on these types of skills.

The simulation education sessions, in which the graduate nurses worked through a hands-on practical exercise, may have provided them with a more holistic view of patient assessment and improved their capacity for clinical reasoning. It is important to remember also that it is primarily the educational process, using appropriate content and context, rather than the simulator per se, that lends focus and strength to the exercise.

## CONCLUSION

Low-fidelity simulation has the potential to reduce the amount of time required for graduate nurses to become clinically proficient and work-ready in their new career. It can encourage them early in their practice to carry out systematic patient assessments and plan care using a critical thinking, clinical reasoning, and reflective approach. When considering the theory-practice dichotomy, the use of low-fidelity patient simulation within an educational framework would appear to help reduce that gap. In turn, this may facilitate an increase in graduate nurses' competence and confidence in their clinical knowledge and skills. It does not seem unreasonable to suggest that the culmination of these factors has the potential to produce safer graduate nurses.

From a broader perspective, the combination of an appropriate patient simulator and a relevant educational framework offers a significant alternative to more traditional education models in the preparation and subsequent professional support of both graduate nurses and a range of other health care craft groups. Furthermore, the use of low-fidelity patient simulation could be seen as a more affordable, high throughput, entry point, and process for learners in undergraduate, graduate, and postgraduate populations.

It could be argued too that low-fidelity simulation might help reduce the impact of the knowledge and skill decay phenomenon, and the subsequent reduction in perceptions of confidence and competence, especially among neophyte or reemerging practitioners.

Although low-fidelity simulation provides an opportunity to reinforce educational principles and clinical practices at a basic level, it also sets the stage for further, more complex learning and reflection within group dynamics using high-fidelity simulation. It could be argued that repeated exposure to learning using low-fidelity simulation can help reduce the "wow" factor often seen in first-time exposure to the high-fidelity synthetic environment. Thus the participant finds it easier to suspend reality and embrace the use of more complex simulation as a completely natural progression in their professional development.

Although existing data cannot demonstrate an unequivocal connection to improved patient outcomes, this research supports the notion that exposing various craft groups to

scenario-driven, problem-based learning using simulation will more effectively prepare them to deal with at-risk patients in a safe, confident, and competent manner. Thus patient simulation has the potential to be part of a quality strategy to positively impact on clinical risk, such as reducing adverse events, by preparing health professionals to be more alert to latent or real clinical crises.

Low-fidelity patient simulation, especially that which is occurring in the clinical setting, could be considered as a pivotal change agent, in terms of impacting on and changing the learning culture in the workplace. This opens the possibility for innovative approaches in the development and future applications of low-fidelity patient simulation, along with a fresh approach to supporting the clinician in residence.

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