Effect of simulated learning on blood pressure measurement skills


Abstract

Aim To explore whether additional teaching and simulated learning of one-hour duration could improve the blood pressure measurement skills of nursing students.

Method A post-test experimental method was used to measure the outcome of additional, targeted simulated learning of blood pressure monitoring beyond normal curriculum content in adult branch nursing students in module one of a three-year nursing programme.

Results One hour of additional teaching and simulated learning improved the ability of nursing students to measure blood pressure accurately, with a data revealing a statistical difference between experimental and control groups in the systolic and diastolic accuracy of blood pressure monitoring.

Conclusion In a changing practice environment with fewer opportunities to develop clinical skills under supervision, there is a need for nurse educators and mentors to reconsider and research further methods used for blood pressure monitoring and other skills teaching using simulation for effective learning and skills acquisition.

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Review

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WHILE THE DEVELOPMENT of clinical skills is an essential component of any nursing undergraduate programme, achieving competence has been recognised as a problem (Bloomfield et al 2010). In an attempt to address this problem and bridge the theory-practice gap, universities have developed experiential skills facilities to provide a safe environment for simulated learning, assessing clinical skills and contextualising clinical practice (Medley and Horne 2005, Van Sell et al 2006, McCallum 2007, Reilly and Spratt 2007, Starkweather and Kardong-Edgren 2008, Prescott and Garside 2009). This has proved to be a successful strategy (Ker et al 2003, Alinier et al 2004, Van Sell et al 2006, Godson et al 2007, McCaughhey and Traynor 2010).

Literature review

Bland and Ousey (2012) identified that preparing students to measure blood pressure competently is complex but essential. They stressed the need for competence in this area and contended that variation in the accuracy of measurements could lead to inappropriate decisions about treatment. Shepherd et al (2010) also expressed concern about students' ability to find the appropriate pulse and handle equipment correctly, and the lack of improvement in the manual assessment of vital signs over a period of six months in practice.

Simulation may be used to improve nursing students' learning and skills acquisition by bridging the gap between theory and practice, and by providing students with an opportunity to practise skills in a safe environment. (Prescott and Garside 2009). It can also enhance students' performance (Alinier et al 2004); allow learning in an environment that closely resembles practice; stimulate learners to think and be more inquisitive (Reilly and Spratt 2007); enable students to request demonstrations; permit skills development to be assessed in the context of a range of pathologies; and promote teamwork (Prescott and Garside 2009). In addition, McCaughhey and Traynor (2010) reported that simulators add authenticity to the learning experience.
Simulation may be used to support learning in practice while enabling students to experience and engage with clinical skills to improve confidence and competency without posing risks to patients (Wilford and Doyle 2006, Prescott and Garisde 2009, McCaughhey and Traynor 2010). It can help offset challenges to individual skills acquisition, such as the increased numbers of learners in clinical areas (Wilford and Doyle 2006) and the concomitant increased workload of mentors, which have reduced the opportunities for supervised clinical skills development in practice (Germann and Gaberson 2006, Godson et al 2007). The need to address this issue is compounded by changes in the healthcare environment, which include the increasing severity of illness and a decreasing number of qualified nurses (Bland and Ousey 2012). Simulation might also address newly qualified staff nurses’ feelings of anxiety about not being adequately prepared for the demands of clinical practice (Whitbread 2001).


Simulation is acknowledged as a valuable method of acquiring skills and of learning theory, but it is not known how much simulation is required to achieve safe and accurate practice. The difference that additional simulation training makes to skills acquisition is also unclear.

**Aim**

The aim of this small-scale study was to identify whether additional teaching and simulated learning of one-hour duration could improve the blood pressure measurement skills of nursing students.

**Method**

The hypotheses for this research was that targeted simulated learning beyond normal curriculum content would improve first-year nursing students’ accuracy when monitoring blood pressure, and that this could be detected using a post-test experimental approach. This approach involves the collection of data from participants after the intervention (Polit and Beck 2012). The blood pressure measurement skills of the students were not tested before the conventional teaching or before the additional teaching. The use of experimental and control groups in this type of study design enhances the legitimacy of any differences identified following the intervention (Moser and Kalton 1971, Oppenheim 1992).

During module one of the three-year nursing programme, all students attended a one-hour lecture on the anatomy and physiology of blood pressure and a three-hour skills session on blood pressure monitoring. All students had the opportunity to measure blood pressure manually on a simulation manikin using a sphygmomanometer and stethoscope. This teaching formed part of the normal curriculum content.

The experimental group received an additional one-hour teaching session, which included revising and reinforcing the content of the conventional lecture on the anatomy and physiology of blood pressure, and watching a DVD from the British Hypertension Society that demonstrated how to record blood pressure. Five selected systolic and diastolic sounds from the DVD were played to the students to help them identify what the sounds mean and document readings. The procedural guidelines for measuring blood pressure as described by Dougherty and Lister (2011) were emphasised.

The students were paired, recorded each other’s blood pressure, documented the readings on a vital signs chart and then moved on to work in another pair and repeat the process. As part of the additional input the experimental group also had the opportunity to measure blood pressure on a simulation arm, which had been programmed with systolic and diastolic parameters. Dual earpiece stethoscopes were used to assist students to recognise the sounds.

The study took place in the faculty of health and social care at one university in England. Ethical approval was provided by the faculty’s research ethics panel.

**Sample**

The study group comprised adult branch nursing students on module one of a three-year nursing programme. During the first week, all students were given an overview of the study and invited to participate. The 14 students who consented to participate in the study were assigned to either the experimental or control group by picking the number included on their consent form at random as per the ‘fishbowl draw’ (Kumar 1999), a form of non-probability convenience sampling.
Data collection

Before data collection, participants received an information sheet outlining what was expected of them and an individual appointment time to perform the simulated blood pressure recording. Data collection, which took place in the skills laboratory using a simulation arm with set systolic and diastolic pressures, was single-blinded because it was facilitated by a research assistant who was unaware of which group the participants were in as they were identified by random numbers only. Participants were allowed no margin of error in their manual measurement of the systolic and diastolic blood pressure. The quantitative data were recorded and analysed using Microsoft Excel and SPSS Version 16.

Results

Overall average error in blood pressure measurement was calculated to provide descriptive statistics (Figure 1 and Table 1). The data collected were applied to an Excel spreadsheet and the calculations used for the axis were average errors. Average errors for each reading (systolic and diastolic) were obtained by totalling the error for those readings of the participants that took the same length of time. This identified that the average error for an accurate systolic measurement was less when the participants took four minutes to complete the task, and that the smallest average error for an accurate diastolic measurement took three minutes (Figure 1).

The group statistical data (Table 1) for participants taught using two teaching methods (control group) showed a mean systolic difference of 11.00 and a mean diastolic difference of 4.00. The results for participants taught using three teaching methods (experimental group) were a mean systolic difference of 1.86 and a mean diastolic difference of 2.14. This indicated that there was less variability in the accuracy of systolic and diastolic measurement in the experimental group who received an additional one-hour teaching session. The time taken to complete blood pressure measurement was on average slightly less for participants who received additional teaching (3.00 minutes for participants compared to 3.29 minutes for participants in the control group).

The independent samples t-test was used because the data were normally distributed to measure whether the teaching variable revealed differences between systolic and diastolic blood pressure measurements in terms of the experimental and control groups (Table 2). A statistically significant difference (P<0.05) was found for the systolic measurement (t=2.760, P=0.017, df=12, CI=95%), indicating that some of the students were less able to identify the first phase of Korotkoff sounds (Dougherty and Lister 2011) without the additional teaching session. This phase can be defined as the first appearance of faint repetitive clear tapping sounds gradually increasing in intensity and lasting for at least two consecutive beats (National Institute for Health and Clinical Excellence (NICE) 2011), and indicates the systolic pressure. Although there were improvements in the diastolic measurement with the additional teaching session, and students were on average able to complete the measurement in a shorter time, these differences were not significant at P<0.05.

<table>
<thead>
<tr>
<th>Teaching sessions</th>
<th>No. of participants</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic difference</td>
<td>Control group</td>
<td>7</td>
<td>11.00</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>7</td>
<td>1.86</td>
</tr>
<tr>
<td>Diastolic difference</td>
<td>Control group</td>
<td>7</td>
<td>4.00</td>
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<tr>
<td></td>
<td>Experimental group</td>
<td>7</td>
<td>2.14</td>
</tr>
<tr>
<td>Minutes taken to complete blood pressure measurement</td>
<td>Control group</td>
<td>7</td>
<td>3.29</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>7</td>
<td>3.00</td>
</tr>
</tbody>
</table>
Discussion

There is a number of limitations with this study. They include broad CIs indicative of an unrepresentative convenience sample. The small sample size was compromised further by a failure to control additional extraneous variables, such as not completing the data collection before the students entered practice where they could develop their blood pressure monitoring skills, and not controlling for participants who had previously been employed as healthcare assistants. Therefore, the findings cannot be generalised to other nursing students. The additional one-hour teaching session for the experimental group included a number of research variables and it is not clear whether any one or any particular combination of lecture, revision, DVD or the simulation exercise was more influential than the others. Any or all of these could have influenced the results.

Other factors that need to be acknowledged in relation to the study findings and the literature are:

- Additional simulation, no matter how modest, would stretch resources further. This method of learning is considered costly in terms of lecturer time, particularly given that the norm is to teach small groups with a high lecturer-to-student ratio. Equipment may also be expensive (Prescott and Garside 2009).

- There are some contradictions in the findings reported in the literature. For example, Shepherd et al (2010) reported on the lack of quantitative research on simulated practice measuring actual learning and their findings that student performance was not hindered by anxiety or lack of confidence. However, Alnier et al (2004) argued that confidence is imperative in successful skills development and that structured simulation sessions aid skill integration, competence and confidence.

- The active use of simulation for teaching and learning can both engender safe and effective application of clinical skills and identify best practice (Morgan 2006).

Teaching and learning should take the form of simulation to develop evidence-based practice and provide students with experiences that enable the assimilation of knowledge for the acquisition of skills in a controlled environment. McCaughey and Traynor (2010) recognised the benefits of simulation in delivering student-centred, low-risk learning not possible in practice settings, and reported that students found it enjoyable and wanted more simulation training.

While the findings of this study concur with the literature in identifying positive outcomes from simulated learning, there is a lack of knowledge and understanding of the amount of simulation required, the optimum time for skills acquisition and the difference that modest, additional input can make to the students' performance.

This study measured changes in blood pressure measurement accuracy and revealed a statistically significant difference between the mean scores of the experimental and control groups. There was a positive correlation between accuracy of blood pressure measurement following one hour of additional teaching and simulated learning. The experimental group was more accurate in both systolic and diastolic blood pressure measurement than the control group, with potential practical significance to the patients in the care of both groups. Because the results for the diastolic readings had a high degree of accuracy in the control group, it is less likely that there would have been a significant improvement with a third teaching session. This suggests that with more research, it might be possible to identify and gain a better understanding of saturation points and optimum time frames for simulated learning for specific skills acquisition. Results also show that the average blood pressure measurement time is less following the additional teaching session.

<table>
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<th>TABLE 2</th>
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| Independent samples t-test data comparing mean scores | t-test for equality of means |
| --- | --- | --- | --- | --- | --- |
|  | t | df | Sig. (2-tailed) | Mean difference | 95% confidence interval of the difference |
|  | Lower | Upper |
| Systolic difference | 2.760 | 12 | 0.017 | 9.143 | 1.925 | 16.360 |
| Diastolic difference | 0.571 | 12 | 0.579 | 1.857 | -5.234 | 8.948 |
| Minutes taken to complete blood pressure measurement | 0.275 | 12 | 0.788 | 0.286 | -1.980 | 2.552 |
Conclusion

The results of this small-scale quantitative study have revealed that one hour of additional teaching and simulated learning improved the ability of nursing students to measure blood pressure accurately. This supports the body of literature suggesting that lecture, demonstration and simulated learning traditionally used to teach clinical skills need further consideration, as does the best way to integrate these teaching methods into the curricula, the optimum duration of simulated learning sessions and the potential value of teaching in addition to the normal curriculum.

References


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IMPLICATIONS FOR PRACTICE

- There is an increasing need for nurse educators and mentors to review and research skills teaching, and effective integration of learning and simulation for successful skills acquisition.
- The best way to teach, develop and integrate sustainable clinical skills into the undergraduate nursing curriculum remains open to debate. However, the results of this study suggest that modest, additional teaching can make a significant difference to students’ performance.
- Further research in the use of simulation in nurse education is required to identify points of saturation and optimal duration times for teaching and learning various skills for safe and effective practice.
- Research on the subjective perceptions of nursing students about skills development using simulation will provide insight into what students gain from these teaching and learning experiences and what helps to develop confidence and competence.

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