Clinical and Experimental Health Sciences

High-Fidelity Environment Effect on Early Postpartum Haemorrhage Management

Merve Coşkun[1], Ergül Aslan[2], Vesile Ünver[1], Ükke Karabacak[1]

[1] Acıbadem Mehmet Ali Aydınlar University, Faculty of Health Science, Department of Nursing, İstanbul, Türkiye.
[2] Istanbul University-Cerrahpaşa,Florence Nightingale Faculty of Nursing, İstanbul , Türkiye.

Correspondence Author: Merve Coşkun
E-mail: merve.coskun@acibadem.edu.tr

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ABSTRACT

Objective: In order to compare outcomes of a simulation of early postpartum haemorrhage management through a medium-fidelity mannequin in a high-fidelity environment before clinical practicums with those after clinical practicums in nursing students.

Methods: This quasi-experimental study was performed on second-year nursing students (n=61). After the simulation, the students were asked to perform postpartum haemorrhage control in clinical practicums. Data were collected with the State-Trait Anxiety Inventory, Student Satisfaction and Self-Confidence in Learning Scale, Educational Practices Questionnaire, and Student Self-Evaluation Form.

Results: The mean satisfaction, self-confidence, and Educational Practices Questionnaire scores after the simulation were high. The mean scores for feeling competent in involution, haemorrhage control, fundus massage, perineal care, andestablishing appropriate communication with patients and their relatives were 19.18±5.70 after the simulation and 23.83±5.03 after the clinical practicums.

Conclusion: The medium-fidelity simulation in a high-fidelity environment of early postpartum haemorrhage management enhanced the students' learning satisfaction and self-confidence. This helped them to feel more competent in the clinical practicums.

Keywords: High-fidelity environment, postpartum haemorrhage, nursing student, simulation

1. INTRODUCTION

New educational techniques are needed to enable nursing students to acquire cognitive, sensorial, and psychomotor behaviour. One of these techniques is simulation used "to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real-life in a fully interactive fashion" (1). As an interactive way of learning, it can offer real-life situations in a high-fidelity learning environment. It is effective in the acquisition of cognitive, sensorial, and psychomotor knowledge and skills (2). Simulations offer learner-centred experiences and learning environments which provide support and increase confidence. They allow students to gain experience by repeating and learning from their mistakes without causing damage to individuals (3). Simulations are divided into low, medium, and high fidelity (3,4). In many cases, the fidelity is described by the sophistication of the technology of the mannequins used (4). In the low-fidelity simulation, low-fidelity mannequins (segmented clinical task trainers) are utilized to improve psychomotor skills. In the high-fidelity simulation, high and medium-fidelity mannequins and standardized patients are employed (3). The medium-fidelity mannequins can more realistically mimic reality with pulses, heart sounds, and lung sounds, but they lack the physiological display of chest rise and fall with breathing, blinking, or automated physiological responses to interventions. Most high-fidelity manikins have expanding chests that breathe and have variable heart rates and tones, measurable blood pressure, and palpable pulses (5,6). In healthcare simulation, "high fidelity" refers to the highest

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representation of reality, including mannequins as well as all details about the environment and the patient's condition (5-7). A high-fidelity environment portrays an actual setting with appropriate working equipment as in a real-life setting (4). Realism is achieved not only by choosing a simulator but also by creating a high-reality environment (e.g., wig, hospital clothing, etc.) (6). Learners need the scenario to make sense, and if it seems true to life, they are willing to accept some artificial aspects of the physical environment (8). The more realistic environment might augment learning or serve as an obstacle to attaining objectives (9). The goal of simulation in the education of nursing students is to imitate various activity areas (medium/high fidelity) in accordance with the learning objectives and to finalize the implementation of the simulation scenario in the high-fidelity environment with team participation (10,11). The evidence has shown that such simulations in nursing education have positive outcomes, primarily including self-confidence and satisfaction, improved knowledge, critical thinking, and clinical skills (12-15).

Simulation-based education is valuable in that it improves maternity nurses' knowledge, self-confidence, and clinical skills to protect women's health status from deteriorating due to postpartum haemorrhage (16).

The normal involution process in the postpartum period, physiological haemorrhage following the steps of lochia rubra, lasting for the postpartum three days, lochia alba and serosa, is expected. Postpartum haemorrhage is commonly defined as blood loss exceeding 500 ml following a vaginal birth and 1000 ml following a caesarean section (17). When diagnosed and treated early, postpartum haemorrhage becomes a preventable cause of maternal deaths. Excessive postpartum haemorrhage is a condition that must not occur. Postpartum haemorrhage accounts for 25% of maternal mortality worldwide (18,19). Early recognition and immediate intervention are of essential importance. If it occurs within the first 24 hours of labour, it is considered an early haemorrhage and if it occurs in the 24th hour-6th week after labour, it is regarded as a late haemorrhage. Bleeding that requires more than one pad per hour indicates excessive bleeding (20,21).

Using simulations in education about maternity cases allows students to encounter a higher number of real conditions and practice more in a safer environment. This interactive experience gained through simulation tools typical of maternity, helps students learn relevant practices better and improve their critical thinking skills (22). Studies including newly graduated nurses have shown that utilizing simulations in education about postpartum haemorrhage management is effective in the improvement of nurses' knowledge and practice (16,23). There have been only a few studies revealing outcomes of simulations by using a medium-fidelity mannequin before clinical practicums with those after the practicums (24,25). In addition, a high-fidelity simulation has been found to enhance nursing students' performance in postpartum haemorrhage management (26). Therefore, the main purpose of this study is to examine the results of the simulation application performed in a high-fidelity environment in the management of early postpartum haemorrhage. This study differs from other similar studies by means of its findings about the effect of simulation performed in a high-fidelity environment on clinical skills.

2. METHODS

2.1. Study Design

The study had a quasi-experimental design and was conducted between February and May in 2017.

2.2. Aim

The present study was carried out to compare outcomes of a simulation of early postpartum haemorrhage management through a medium-fidelity mannequin in a high-fidelity environment before clinical practicums with those after clinical practicums in nursing students.

2.3. Research Question

How does a simulation of postpartum haemorrhage management with a medium-fidelity mannequin in a high-fidelity environment affect self-satisfaction, self-confidence, self-evaluation, and the anxiety of students?

The PICOT format was used to summarize the research question that explores the effect of simulation (27).

(P) – Population: Second-year university students aged 18 – 24 years, studying nursing and taking the course Obstetrics and Maternal Health.

(I) – Intervention: Write a script on postpartum haemorrhage management, apply it in groups, and have students fill out the following forms. Student Satisfaction and Self-Confidence in Learning Scale, Educational Practices Questionnaire, Student Self-Evaluation Form of Clinical Practice, and State-Trait Anxiety Inventory (Figure 1).

(C) – Comparison: Comparing the students' self-evaluation scores for target skills after the simulation with those after the clinical practicums. The relation between anxiety about target skills and self-evaluation scores after the simulation and those after the clinical practicums (See Tables 3 and 4).

(O) – Outcome: Changes in students' satisfaction, self-evaluation, and anxiety related to their skills for postpartum haemorrhage management.

(T) – Time: Measurement of the outcome before simulation, after simulation, and after clinical practicums.

2.4. Participants and Setting

The study sample included 64 second-year nursing students taking the course Obstetric Nursing in the nursing department of a foundation university. Three students were

excluded from the study due to absenteeism. The study was completed on 61 students.

2.5. Data collection instruments

2.5.1. Student Satisfaction and Self-Confidence in Learning Scale

The scale was created by Jeffries and Rizzolo and composed of 13 items. It was adapted to Turkish by Unver et al. and the number of the items decreased to 12 . It is a five-point Likert scale and includes the subscales of satisfaction with current learning and self-confidence in learning. The former is composed of five items and the latter is composed of seven items. There were not any negative statements. Higher scores on the scale indicate higher satisfaction and self-confidence. Cronbach's alpha coefficients on the Student Satisfaction and Self-Confidence in Learning Scale were 0.77 and 0.85 (28). In this study Cronbach's alpha coefficients of the Student Satisfaction and Self-Confidence in Learning Scale were 0.91 and 0.92.

2.5.2. Educational Practices Questionnaire

The questionnaire was developed by Jeffries and Rizzolo and adapted to Turkish by Unver et al. . It is composed of 16 items and four subscales; namely, active learning, collaboration, diverse ways of learning, and high expectations. Active learning had ten items, collaboration had two items, diverse ways of learning had two items and high expectations had two items. The scale is divided into two sections. The first section determines whether the best simulation design elements are implemented and is called presence. The second section determines to what extent simulation design elements are important for students and is called importance. Cronbach's alpha coefficient of the Educational Practices Questionnaire was 0.91 (28). In this study Cronbach's alpha coefficient is 0.91.

2.5.3. Student Self-Evaluation Form of Clinical Practice

Student Self-Evaluation Form of Clinical Practice, which allowed the students to self-rate their performance after the simulation and the clinical practicums, was developed by the researchers. The opinions of five experts were obtained for the self-evaluation form. There were no revisions by the experts. The form was tested by conducting a pilot study with 10 students. The students involved in the pilot study were not included in the main study.

During both the simulation and the clinical practicums, the students were expected to perform three skills (i.e. 1. uterine involution; checking fundal level, vaginal tonus, vaginal bleeding and fundal massage, 2. perineal care; perineal evaluation and perineal wash and 3. establishing an appropriate communication with the women and their relatives) as required by the scenario. A visual analogue scale was used to determine how the students perceived their competencies in the abovementioned three skills. At one end of the scale is the score of zero corresponding to very incompetent and at the other end is the score of ten corresponding to very competent. The students were given the scale without numbers on it. Students marked a point indicating their perceived competency. One of the researchers measured the point with a ruler to determine its numerical value.

2.5.4. State-Trait Anxiety Inventory

Developed by Spilberger, Gorsuch, and Lushene, the inventory was adapted into Turkish by Öner and Le Compte . It includes two scales: state anxiety and trait anxiety. The total score for each scale of the inventory ranges from 20 to 80. Higher scores indicate more severe anxiety (29). Cronbach's alpha coefficient ranged from 0.83 to 0.92 for the State Anxiety Scale, and from 0.86 to 0.92 for the Trait Anxiety Scale (29). In this study Cronbach's alpha coefficient is 0.46 for the State Anxiety Scale, and from 0.61 for the Trait Anxiety Scale.

2.6. Data analysis and study process

Data analysis was performed by using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA) for Windows version 21.0. Kolmogorov–Smirnov test was utilized to determine whether the data were normally distributed. Descriptive statistics including mean and standard deviation, minimum–maximum values, frequencies, and percentages were used for the analysis. The results obtained by the descriptive statistical tests were compared by using the Pearson Correlation Test and Paired Samples t-test. $p < .05$ was considered statistically significant.

2.7. Procedure

All the students participating in the study were given a two-hour theoretical course about postpartum haemorrhage management. Thereafter, they attended eight-hour skill training in the laboratory. Students filled out the Trait Anxiety Scale after the skills training.

A scenario about postpartum haemorrhage involving the target three skills uterine involution evaluation (fundal level, vaginal tonus, vaginal bleeding, and fundal massage), perineal care (perineal evaluation, perineal wash), and feeling competent in communication with women and their relatives, was created by the researchers in light of the literature (30) (See Box 1).

After taking the theoretical course and the skill training, the students participated in the scenario. Before taking part in the scenario, the students were administered the State Anxiety Inventory.

The scenario was carried out in a "Centre of Advanced Simulation and Education". The environment in which the simulation took place was designed as a high-fidelity environment. This environment included the equipment

of a standard patient room (bed, basic medical equipment, patient monitor and alarm system, bathroom and toilet). Laerdal Nursing Anne Mannequin was given the appearance of a bleeding puerperal woman with the application of mullage (bloody pad soaked in red paint, pale skin image, weak and moaning voice on the mannequin). In the scenario, a lecturer played a role as a patient's relative among the scenario characters.The facilitator, who was a relative of the patient, had the profile of an anxious patient.

Students were expected to manage bleeding by integrating three skills in the scenario and using time management, teamwork, and communication skills. The faculty members evaluated whether the scenario was carried out correctly through the checklist containing these parameters. This checklist was prepared by the scenario developers as a guide for instructors to follow the flow of the scenario in line with the learning objectives of the scenario. It was used within the scope of the research not as a data collection tool but to manage the discussion in debrifing. As moderators, two lecturers monitored the flow of the scenario from the control room and the students' performances and took notes for the debriefing session via checklist.

Sixty-one students in the sample were divided into two stations of thirty-one and thirty students. Groups consisting of two students each were formed at these stations. The scenarios were implemented simultaneously at both stations. Students were given 10 minutes to realize the scenario. A debriefing session was held with the students who completed the scenario application. These sessions lasted 30 minutes and included eight students each. Following the debriefing, the students completed Student Satisfaction and Self-Confidence in Learning Scale, Educational Practices Questionnaire, and Student Self-Evaluation Form of Clinical Practice at face-to-face interviews. It took about ten minutes to fill in them. After the simulation, the students attended clinical practicums lasting 80 hours in total. They first implemented the three skills on the woman as required by the scenario and then filled in the Student Self-Evaluation Form of Clinical Practice and the State-Trait Anxiety Inventory.

Box 1. *The simulation scenario*

S.Y. giving a normal spontaneous birth to a healthy female infant does not receive any treatment and is followed in her postpartum period. Due to postpartum cramps, she has been given a sedative and a medication that has a hypnotic effect (5mg Zolpidem Tartrate tablet). She is accompanied by her older sister, who has high anxiety. The scenario starts with the sentence uttered excitedly by her older sister "My sister is bleeding and changes her pad more than once every hour. The scenario is directed towards achieving the following objectives:
The students will observe and evaluate women based on their information about the women.
The students determine priorities based on their evaluations of the women and then plan, implement evaluate postpartum care.
The students establish effective communication with members of the healthcare team.
The students establish therapeutic communication with the women and their families.

The steps followed in the study are presented in a flow chart in Figure 1.

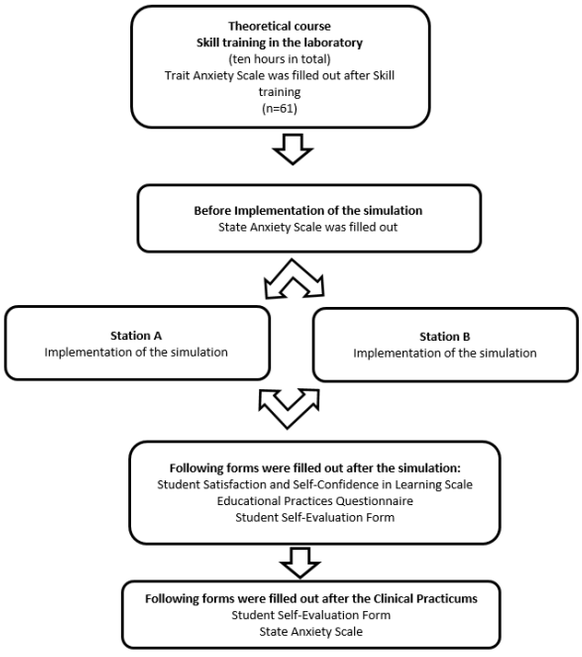

Figure 1. *Flow chart of the study*

2.8. Ethical Consideration

Approval for the study was obtained from the ethical review boards at the authors' institution (2017-3/2). The researcher gave written information to the students participating in the study and explained the purpose of the research, confidentiality of the data collected, protection of anonymity, and the right of refusal to participate. The participants were assured that their education would not be affected when they could not participate in the study or wanted to quit the study. All the participants gave written informed consent. They were informed that the training given in the scope of the course was part of a study and the evaluations would not affect the evaluation of their performance in the course. Data were gathered by the researcher who was not responsible for offering the course.

3. RESULTS

Of 61 participants, 88.7% were female and 11.3% were male. The mean age was 19.85±0.89 years in the female students (range: 18-24 years) and 19.57±0.53 years in the male students (range: 19-20 years). The mean scores for state anxiety were 38.74±4.96 before the simulation and 42.56±4.83 after the clinical practicums. The mean score for trait anxiety was 47.69±5.29.

Table 1 presents the mean scores for the subscales of Student Satisfaction and Self-Confidence in Learning Scale. The mean score was 4.20±0.64 for satisfaction and 4.14±0.53 for self-confidence in learning.

Table 1. *The Mean Scores for Student Satisfaction and Self-Confidence in Learning Scale (N=61)*

Subscales	Range	Mean±SD
Satisfaction with current learning	2-5	4.20 ± 0.64
Self-confidence in learning	3-5	4.14 ± 0.53

Table 2 shows the scores for the presence and importance sections of the Educational Practices Questionnaire and the relation between these scores. There was a significant positive relation between the presence and importance of the best simulation design elements (p<.001).

Table 2. *The Distribution of the Mean Scores for Subscales of the Educational Practices Questionnaire according to the Presence and Importance of the Best Simulation Design Elements (N=61)*

Educational Practices Questionnaire	Presence Mean±SD	Importance Mean±SD	r*	p
Active Learning	4.25±0.55	4.26±0.61	0.451	**.001**
Collaboration	4.33±0.63	4.12±0.87	0.430	**.001**
Diverse Ways of Learning	4.40±0.66	4.43±0.77	0.560	**.001**
High Expectations	4.32±0.68	4.39±0.68	0.542	**.001**
Total	4.31±0.50	4.28±0.56	0.486	**.001**
**Pearson Correlation Test*				

Table 3 demonstrates the mean scores for self-evaluation after the simulation and the clinical practicums. There was a significant difference in the score obtained after the simulation for feeling competent in uterus involution and haemorrhage control, fundamental massage and communication with women and their relatives, and in the score obtained after clinical practice (p<.001). There was not a significant difference in the scores for competence in perineal care (t:-1.55 p>.05)

Table 3. *The Comparison of the Students' Self-Evaluation Scores for Target Skills after the Simulation and the Clinical Practicums (N=61)*

Target Scores	After the Simulation Mean±SD	After the Clinical Practicums Mean±SD	t*	p
Feeling competent in uterine involution checking fundal level, vaginal tonus, vaginal bleeding, and fundal massage	5.90±2.55	7.24±2.42	**-3.95**	**.001**
Feeling competent in perineal care checking perineal evaluation and perineal wash	7.27±2.30	7.89±2.54	-1.55	.128
Feeling competent in communication with women and their relatives	6.00±2.43	8.74±1.59	**-2.05**	**.001**

** Paired Samples t-test*

Table 4 shows the relation between the self-evaluation scores and the anxiety scores after the simulation and the clinical practicums. There was a significant moderate negative relation between feeling competent in communication with the women and their relatives and state anxiety after the simulation (r: – 0.341; p<.05). However, there was not a significant relation between them after the clinical practicums (r: – 0.425; p<.01).

Table 4. *The Relation between Anxiety about Target Skills and Self-Evaluation Scores (N=61)*

Target Skills	After the simulation State anxiety r	p	Trait anxiety r	p	After the clinical practicums State anxiety r	p	Trait anxiety r	p
Feeling competent in uterine involution checking fundal level, vaginal tonus, vaginal bleeding, and fundal massage	-0.033	.801	-0.104	.423	-0.059	.679	-0.104	.423
Feeling competent in perineal care checking perineal evaluation and perineal wash	0.129	.363	-0.173	.179	-0.276	.064	0.048	.738
Feeling competent in communication with women and their relatives	**-0.341**	**.007**	**-0.425**	**.001**	-0.219	.115	**-0.425**	**.001**

r= Pearson correlation test

4. DISCUSSION

In the present study, the effects of a medium-fidelity simulation in a high-fidelity environment on outcomes of postpartum haemorrhage management practices before and after clinical practicums were examined. The students got very high scores for satisfaction with and self-confidence in learning. The mean scores, determined by a five-point Likert scale, were higher than four. Results of similar studies in the literature pointed out that simulation-based education enhanced student satisfaction and self-confidence (14,26,31,32). Hicks et al. examined knowledge, performance, and self-confidence in students receiving simulation-based education and those not getting this education. They found no difference in knowledge and performance between the students offered simulation-based education and those not

receiving this education; however, they reported that the students getting this education had higher self-confidence than those not getting this education (33). In a study by Mahfouz et al. using high-fidelity simulation techniques had significant effects on self-confidence compared to low-fidelity simulation (14). Alharbi et al., concluded that experiencing human patient simulation with nursing students can increase satisfaction and self-confidence (15).

In a study by Mert Karadas and Terzioglu using high-fidelity simulation and standardized patients, simulation practices increased students' self-confidence in the management of postpartum haemorrhage (26). Choi and Wong the more realistic environment might augment learning or serve as an obstacle to attaining objectives (9). A qualitative study performed by Kaddoura et al. stated that nursing students feel self-confident after simulation because they practice skills in an environment that is similar to clinical practice (34). In the present study, improved self-confidence and satisfaction of the students can be attributed to receiving simulation-based education in a high-fidelity environment which allowed the students to merge their theoretical knowledge and skills they acquired through the simulation.

The students got low scores for feeling competent in involution, haemorrhage control, fundal massage, and communication with women and their relatives after the simulation. Evaluation of student's performance by faculty members can cause students to experience stress. Many students have verbalized feeling uncomfortable with the fact that they are watched and evaluated by faculty on performance (35). Although simulation improves students' clinical skills, it can also induce anxiety (36). While some anxiety can help facilitate performance, too much can be debilitating (4,36). This is an expected result.

However, their self-evaluation scores significantly increased after the practicums compared to their scores after the simulation. Ha found students were satisfied with the simulation because it prepared them for future clinical practice (37). Martins and Pinho stated that students were satisfied with the simulation because they found an improvement in their collaboration and communication skills (38). Thomas and Marz emphasized that simulation-based education has a positive effect on acquiring professional nursing skills. Similar studies also showed that this type of education facilitated the acquisition of care skills, communication skills, and decision-making skills (39). Mert Karadas and Terzioglu evaluated students' communication skills during simulation practices and clinical practices and obtained similar results to the present study (26). It is obvious that simulation-based education will help students feel more competent in clinical practice.

Another striking finding of this study was that a negative relation between the students' self-rating scores for feeling competent in their communication with patients and their relatives after the simulation disappeared after the clinical practicums. This finding suggests that students' anxiety about their communication with patients and their relatives after the simulation decreased during the clinical practicums. There is evidence in the literature that severe anxiety due to insufficient experience in clinical environments has a negative effect on learning (40).

In addition to insufficient experience, there may be many factors causing stress during simulations. For example, attending a simulation for the first time, using an unfamiliar mannequin/standardized woman, and the presence of educators evaluating student performance during simulations can create stress (2). Regarding the effects of types of simulation practices, Mert Karadas and Terzioglu revealed no difference in the severity of anxiety (26). However, Horsley and Wambach reported that the presence of faculty members in the simulation laboratory caused an increase in anxiety levels but not significantly (41). In the present study, the faculty members were available in the simulation laboratory during the implementation of the scenario, but they were in the control room of the laboratory and the students were not aware of their presence. In accordance with principles of simulation practices, even if students are informed that faculty members who sit in the control room can only intervene when necessary, evaluation of student's performance by these faculty members can cause students to experience stress.

It has been emphasized in the literature that using simulations in early nursing education is useful in the reduction of anxiety in students (40,42). Simulation-based education before clinical practicums decreased anxiety (42-46) but did not increase self-confidence and satisfaction (30). This education provides students with an opportunity to gain experience in conditions they are likely to encounter in practice (42). Evidence from both the present study and the literature underlines the role of simulation-based education in terms of enabling students to prepare for clinical practices.

5. CONCLUSION

This study investigates nursing students' experiences of learning postpartum haemorrhage management in a simulation environment and then using these skills in clinical practice. Specifically, the aim of the study is to evaluate the impact of simulation on clinical practice. The use of simulations of medium – and high-fidelity environments in postpartum haemorrhage management increased the students' satisfaction and self-confidence.This caused the students to feel more competent in the clinical practicums. This means that simulation can help students enter clinical practice more prepared and confidently. Although anxiety about communication with women and their relatives was high during the implementation of the scenario, it decreased during clinical practicums. Higher levels of skill and confidence in post-simulation clinical practice helped students be better prepared for real-world applications of simulation. This can enable students to be more successful and effective in the clinical setting. The difference of this study from other studies is that it directly evaluates the effect of simulation on clinical practices and measures how this effect is reflected

in student satisfaction, self-confidence and skill levels. In addition, it is thought to contribute significantly to the literature since the focus of the study is the evaluation of a specific skill such as postpartum haemorrhage management. However, randomized, controlled studies are needed to reveal the effects of simulation-based education on clinical nursing practice.

The limitation of this study was that the sample did not include a control group and that the long-term effects of simulation-based education were not evaluated.

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Design of the study: MC, EA, VU, UK
Acquisition of data for the study: MC, EA
Analysis of data for the study: MC,VU
Interpretation of data for the study: MC, VU
Drafting the manuscript: MC, EA
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