RESEARCH ARTICLE

CYPRUS
JOURNAL OF MEDICAL SCIENCES

DOI: 10.4274/cjms.2022.2022-12
Cyprus J Med Sci 2023;8(4):271-275

The Effects of Manikin-Based and Standardized-Patient Simulation on Clinical Outcomes: A Randomized Prospective Study

Yasemin Uslu[1], Meryem Yavuz Van Giersbergen[2]

[1]Department of Surgical Nursing, İstanbul University Faculty of Nursing, İstanbul, Türkiye
[2]Department of Surgical Nursing, Ege University Faculty of Nursing, İzmir, Türkiye

Abstract

BACKGROUND/AIMS: Simulation-based learning improves performance in the clinical learning environment. The aim of this study was to determine the effects of manikin-based and standardized-patient (SP) simulation modalities on clinical outcomes applied in stoma care in nursing students.

MATERIAL AND METHODS: A prospective randomized study was conducted consisting of two phases. In the first phase, simulation modalities on the knowledge and skill levels of 64 nursing students were investigated. In the second phase, the skill levels were observed in a clinical learning environment. Data were collected by using the Stoma Skill Form, Stoma Knowledge Form and Simulation-based Learning Evaluation Scale.

RESULTS: The students' knowledge levels were significantly higher after the SP modality than after the manikin-based modality (p=0.012). However, no significant differences were observed between the skill levels of the groups except in regards to communication, which was higher after the SP modality.

CONCLUSION: The findings of this study indicate that both of the simulation modalities helped the students gain competencies and prepare for clinical environments, and both led to equal skill levels in such environments.

Keywords: Clinical outcome, clinical skill, simulation modality, stoma care, nursing education

INTRODUCTION

Simulation is a learning method in which real experiences are recreated in completely interactive ways.[1,2] There are different types of simulation as part of simulation activities, such as task-trainer, manikin-based, standardized-patient (SP), and computer-based simulation modalities. An SP modality uses a person who has been carefully coached to simulate an actual patient in a real health care situation. The SP interacts with students in experiential education and assessment contexts.[3,4] In contrast, a manikin-based modality uses a manikin which represents a patient using heart and lung sounds, palpable pulses, voice interactions, and other human capabilities which can be controlled by a simulationist using computers and software.[4]

Simulation-based experience is considered one of the best methods for teaching nursing skills.[5] However, while the development of psychomotor skills is a core learning goal in nursing education, there is limited empirical evidence in the extant nursing literature which supports simulation's efficacy at teaching such skills.[6] Furthermore, there have been limited studies on the different simulation modalities used in nursing education, including their specific efficacies in regards

To cite this article: Uslu Y, Yavuz Van Giersbergen M. The Effects of Manikin-Based and Standardized-Patient Simulation on Clinical Outcomes: A Randomized Prospective Study. Cyprus J Med Sci 2023;8(4):271-275

ORCID IDs of the authors: Y.U. 0000-0001-5727-3753; M.Y.V.G. 0000-0002-8661-0066.

Address for Correspondence: Yasemin Uslu
E-mail: yaseminuslu86@gmail.com
ORCID ID: orcid.org/0000-0001-5727-3753

Received: 30.03.2022
Accepted: 30.07.2022

to the development of skills and the results of clinical practice outcomes.[6,7] Specifically, it is recommended that the knowledge and psychomotor skills gained in simulation environments be evaluated in clinical environments and in relation to clinical practice outcomes.[8,9]

This study aimed to address these research gaps by investigating the effects of manikin-based and SP simulation modalities on the knowledge and psychomotor skills of nursing students. The main aim of this study was to determine which of the two simulation modalities was more effective in helping the students develop their clinical stoma care skills.

MATERIAL AND METHODS

Study Design

This study was carried out as a randomized prospective study. Data were collected between October, 2016 and February, 2017 in İstanbul, Türkiye. This study was approved by Acıbadem University and Acıbadem Healthcare Organizations Medical Research Ethics Committee (ATADEK) (approval number: 2016-14/13, date: 25/08/2016). All students and patients participating in the study were informed and written informed consent was obtained.

Setting and Participants

The initial study population was 67 second-year undergraduate students. Students who had previous experience with stoma care were excluded. After this criterion was applied, the sample size for this research was 64 students. The data was collected simultaneously during surgical practice.

The students were divided into two groups using the simple random method and the program Random Allocation Software (version 2.0.0). One group learned using a manikin-based simulation modality and the other group learned using an SP simulation modality.

Procedure

The study then consisted of two stages. The study flow chart is given in Figure 1.

Scenario Procedures

The two different modalities were used to study the students' stoma knowledge and skill levels; this step was carried out in the university's simulation laboratory.

An artificial stoma and a defecation moulage were applied to each modality to increase the simulations' levels of fidelity. The scenarios were designed to last for ten minutes for each student.

The participants' levels of knowledge were measured before the scenario was implemented (with a pre-test) and shortly after the scenario debriefing (with a post-test). The scenario content included caring for a patient who had a stoma due to colon cancer.

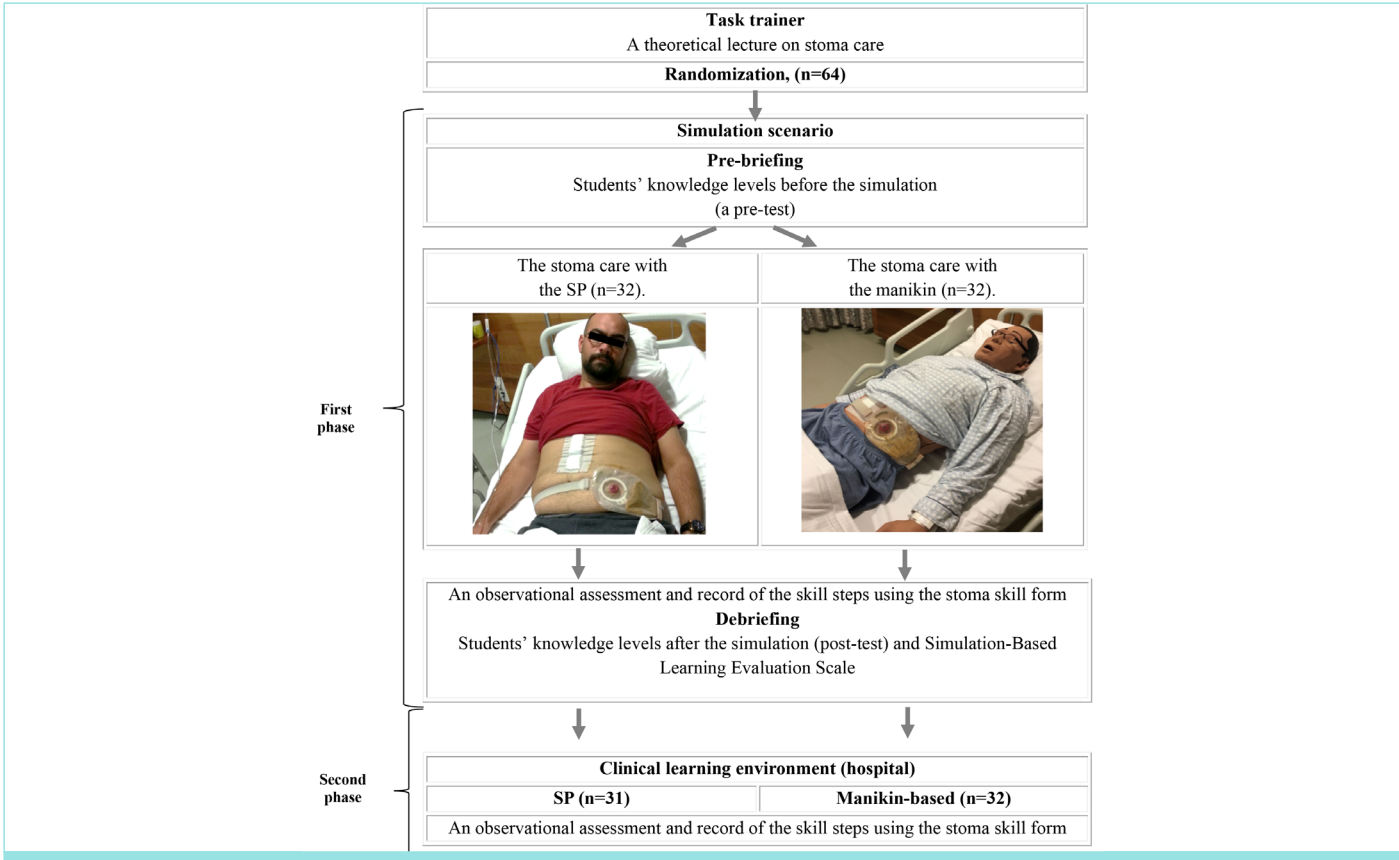

Figure 1. Study flow chart.

SP: Standardized-patient.

One independent observer (nursing instructor in the simulation and ostomy nurse in the hospital) and one investigator evaluated each student's skills in performing the stoma care steps. Each student was evaluated from an observation room, which provided the ability to view the student from all angles with a One-Way mirror and cameras.

Clinical Procedures

The subjects' skill levels in regards to caring for patients with stomas were investigated in clinical-learning environments at four university hospitals. The students were divided randomly among the hospitals, then each stoma care skill was examined in the patient room. This was carried out by the academic researcher and ostomy nurses at the hospitals.

The care was performed on patients who had received postoperative colostomies and had no complications which prevented the care procedures from being carried out. In total, each student performed stoma care 63 times across the 61 patients. The first stoma care application by each student was observed.

Measures

Stoma Knowledge Form

This evaluation was developed in accordance with the extant literature on stoma care; it consisted of 30 items related to stoma care. There were 17 correct statements and 13 incorrect statements regarding this topic. The students select "true," "false," or "no idea" for each item. Correct answers were given one point and incorrect answers were given zero points; the possible total scores ranged from 0 to 30.

Stoma Skill Form

This form was used to examine 26 items and was developed based on the extant literature; it assessed the steps necessary for proper stoma care. For each student, the steps involved in stoma skills were assessed as insufficient (zero), i.e., incorrect or skipped; partially sufficient (one), i.e., applied correctly and on time but ineffective for easily passing between skill steps; and sufficient (two), i.e., applied correctly and on time and effective for easily passing between skill steps. A final score was obtained by summing up the scores for the 26 skill steps; the possible total scores ranged from 0 to 52.

Simulation-Based Learning Evaluation Scale

This scale was developed by Hung et al.[10], and the validity and reliability of a Turkish version of the test were evaluated by Uslu and Yavuz van Giersbergen[11]. This scale has five subscales and 37 items. Responses are scored using a five-point Likert scale ranging from one (*strongly disagree*) to five (*strongly agree*), and the total scores can range between 37 and 185 points. The basic competencies which a nurse should have are examined: namely, *the nursing process*, *patient safety*, *professional knowledge*, *communication*, and *attitude of reflection*.

Statistical Analysis

The software Number Cruncher Statistical Systems (NCSS) was used for statistical analyses (the 2007 version by NCSS, LLC in Kaysville, Utah, the United States of America). Student's t-test was used for two-group comparisons of variables with normal distributions, and the paired sample *t*-test was used for intragroup comparisons. Statistical significance was accepted as $p<0.05$.

RESULTS

The first phase included 64 nursing students; 86% (n=55) were female and their mean age was 20.18±1.43 years. The second phase included 63 students as one student left the study.

As mentioned earlier, 61 patients were treated by the students during phase two. The patients mean age was 56.7 years and 61% (n=37) were male. Colon cancer was the underlying reason for the stoma placement in 93.4% (n=57) of the patients.

It was determined that the knowledge levels of both groups increased after the simulation scenarios (p=0.267). The knowledge levels were significantly higher for the SP group after the training in the first phase, as shown in Table 1 (p=0.012).

The stoma skill form scores are shown in Table 1. No significant differences were found between the overall scores of the groups for scenario implementations (p>0.05) and clinical practice (p>0.05). However, for both groups, there was a significant increase in the students' stoma skill scores during clinical practice (p≤0.001 for both groups).

Table 1. The stoma knowledge and skill levels of the students

Stoma knowledge level (min.: 0, max.: 30)	**Simulation modality**		
	SP, (n=32)	**Manikin-based, (n=32)**	**p[a]**
	Mean ± SD	**Mean ± SD**	
Pre-test	24.81±2.22	24.06±2.80	0.240
Post-test	26.34±1.41	25.13±2.25	0.012*
Difference	1.53±1.74	1.06±1.61	0.267
p[b]	<0.001**	0.001**	
Stoma skill level (min.: 0, max.: 52)	**SP, (n=31)**	**Manikin-based, (n=32)**	
	Mean ± SD	**Mean ± SD**	
During scenario implementation	24.06±5.05	22.00±5.91	0.136
During clinical practice	32.13±6.07	31.23±6.14	0.563
Difference	8.06±6.78	9.23±7.34	0.513
p[b]	<0.001**	<0.001**	

[a]: Independent samples t-test; [b]: Paired t-test; *p<0.05; **p<0.01, min.: Minimum, max.: Maximum, SD: Standard deviation, SP: Standardized-patient.

The scores obtained by both groups using the Simulation-Based Learning Evaluation Scale were not statistically significantly different for the categories of *nursing process*, *patient safety*, *professional knowledge*, or *attitude* (p>0.05). However, the scores obtained by the SP students were significantly higher for the category of *communication* (p=0.048) (Table 2).

Table 2. The students' simulation-based learning evaluation scale scores by subscale

		Simulation modality		
		SP, (n=32)	Manikin-based, (n=32)	p
Nursing process	Min.-max.	31-45 (36)	27-45 (36.5)	t=0.313
	Mean ± SD	36.91±4.32	36.56±4.47	0.756[c]
Patient safety	Min.-max.	32-40 (38,5)	29-40 (39)	Z=-0.082
	Mean ± SD	37.34±2.70	37.00±3.43	0.935[d]
Professional knowledge	Min.-max.	22-33 (26)	17-35 (26)	t=1.117
	Mean ± SD	26.63±3.01	25.63±4.07	0.268[c]
Communication	Min.-max.	21-35 (30.5)	21-35 (28)	t=2.022
	Mean ± SD	30.06±3.68	28.34±3.10	0.048*[,c]
Attitude of reflection	Min.-max.	20-30 (26,5)	20-30 (26)	t=-0.043
	Mean ± SD	26.28±2.79	26.31±3.01	0.966[c]

[c]: Student's t-test; [d]: Mann-Whitney U test, *p<0.05, min.: Minimum, max.: Maximum, SD: Standard deviation, SP: Standardized-patient.

DISCUSSION

In this study, the knowledge and skills of the students were evaluated separately and objectively using two simulation modalities: manikin-based and SP-based. Some studies have reported that simulation-based learning can increase the knowledge capacities of students,[12,13] whereas others have indicated that it cannot.[14] Hegland et al.[15] noted a need for highly standardized random controlled studies to address this issue. This study provided research to address this gap and suggested that such simulations do indeed improve the knowledge of students.

However, it was found that the post-training knowledge scores were significantly higher for the SP group than for the manikin-based group; therefore, the training which used the SP simulation modality was more effective. This finding is supported by research conducted by Tuzer et al.[16]. This study's results indicated that the more realistic the simulations are, the more effective they are in facilitating the acquisition and reinforcement of knowledge.

Moreover, the SP group had higher *communication* scores on the Simulation-Based Learning Evaluation Scale than the other group. SP modality increases the communication skills of students and contributes to patient safety, both during patient care and during patient discharge.[17] It is recommended to help students develop not only their psychomotor skills but also their communication skills.[18]

However, no significant differences were found between the two modalities with regards to the stoma skill scores of the students, and this finding is supported by research conducted by Tuzer et al.[16]. Some studies have reported that manikin-based simulations lead to better skill outcomes than SP simulations as the use of real people in simulations can increase stress and thus affect the performance of students.[19]

Realistic simulations can lead to improved skills and clinical performance.[20] The experience students gain in simulation-based training promotes the achievement of learning outcomes throughout clinical practice.[21]

Indeed, the present study found that the skill scores of all the students increased significantly after they had received training, regardless of the simulation method they used, although their communications skills increased more with SP training than with manikin-based training.

Study Limitations

Our study had some limitations. Firstly, its sample size was small and it recruited from only one nursing school, which limits the generalizability of our results. Secondly, the stoma skills and knowledge forms were prepared by the researcher and so are not valid reliable tools. Although there are limitations of this study, this research provides a basis for future research. It is an important preliminary step in proving clinical outcomes of simulation-based learning.

CONCLUSION

While SP and manikin-based modalities can increase post-training knowledge and stoma care skill levels equally, the SP method can lead to significantly higher communication skills than the manikin-based method. The recreation of a near-actual environment during ssimulation experiences can prepare students for clinical environments and help them gain competencies.

MAIN POINTS

- Simulation-based learning methods aid the development of cognitive and psychomotor skills.
- Simulation-based learning improves performance in the clinical learning environment.
- The SP method can lead to significantly higher communication skills than the manikin-based method.
- The modality appropriate to the learning objectives should be selected during simulations.

ETHICS

Ethics Committee Approval: This study was approved by by Acıbadem University and Acıbadem Healthcare Organizations Medical Research Ethics Committee (ATADEK) (approval number: 2016-14/13, date: 25/08/2016).

Informed Consent: All students and patients participating in the study were informed and written informed consent was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: Y.U., M.Y.V.G., Concept: Y.U., M.Y.V.G., Design: Y.U., M.Y.V.G., Supervision: Y.U., M.Y.V.G., Data Collection and/or Processing: Y.U., M.Y.V.G., Analysis and/or Interpretation: Y.U., M.Y.V.G., Literature Search Y.U., M.Y.V.G., Writing: Y.U., M.Y.V.G., Critical Review: Y.U., M.Y.V.G.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study had received no financial support.

REFERENCES

1. Gaba DM. The future vision of simulation in healthcare. Simulation in Healthcare. Simul Healthc. 2007; 2(2): 126-35.
2. Lebdai S, Mauget M, Cousseau P, Granry JC, Martin L. Improving Academic Performance in Medical Students Using Immersive Virtual Patient Simulation: A Randomized Controlled Trial. J Surg Educ. 2021;7 8(2): 478-84.
3. Lewis KL, Bohnert CA, Gammon WL, Hölzer H, Lyman L, Smith Cet al. The Association of Standardized Patient Educators (ASPE) Standards of Best Practice (SOBP). Adv Simul. 2017; 2: 10.
4. Lioce L, Lopreiato J, Downing D, Chang TP, Robertson JM, Anderson M, Diaz DA, Spain AE. (Ed.), The Terminology and Concepts Working Group. Healthcare Simulation Dictionary-Second Edition. Rockville, MD: Agency for Healthcare Research and Quality. AHRQ Publication; September 2020.
5. Bowen-Withington J, Zambas S, Macdiarmid R, Cook C, Neville S. Integration of high-fidelity simulation into undergraduate nursing education in Aotearoa New Zealand and Australia: An integrative literature review. Nursing Praxis in Aotearoa New Zealand. 2020; 36(3): 37-50.
6. Johnson CE, Kimble LP, Gunby SS, Davis AH. Using Deliberate Practice and Simulation for Psychomotor Skill Competency Acquisition and Retention: A Mixed-Methods Study. Nurse Educ. 2020; 45(3): 150-4.
7. Aldridge MD, Hummel F. Nursing Students' Perceptions of Skills Learning: A Phenomenological Study. Nurse Educ. 2019; 44(3): 170-4.
8. Cowperthwait A. NLN/Jeffries Simulation Framework for Simulated Participant Methodology. Clinical Simulation in Nursing. 2020; 42(C): 12-21.
9. Klenke-Borgmann L, Cantrell MA, Mariani B. Nurse Educators' Guide to Clinical Judgment: A Review of Conceptualization, Measurement, and Development. Nurs Educ Perspect. 2020; 41(4): 215-21.
10. Hung C, Liu H, Lin C, Lee B. Development and validation of the simulation-based learning evaluation scale. Nurse Educ Today. 2016; 40: 72-7.
11. Uslu Y, Yavuz van Giersbergen M. Simulation-Based Learning Evaluation Scale: Turkish Validity and Reliability Study. Journal of Education and Research in Nursing. 2020; 17(Suppl1): 53-61.
12. Curl ED, Smith S, Chisholm L, McGee LA, Das K. Effectiveness of Integrated Simulation and Clinical Experiences Compared to Traditional Clinical Experiences for Nursing Students. Nurs Educ Perspect. 2016; 37(2): 72-7.
13. Warren J, Luctkar-Flude M, Godfrey C, Lukewich J. Review: A systematic review of the effectiveness of simulation-based education on satisfaction and learning outcomes in nurse practitioner programs. Nurse EducToday. 2016; 46: 99-108.
14. Beal M, Kinnear J, Anderson C, Martin T, Wamboldt R, Hooper L. The Effectiveness of Medical Simulation in Teaching Medical Students Critical Care Medicine: A Systematic Review and Meta-Analysis. Simul Healthc. 2017; 12(2): 104-16.
15. Hegland P, Aarlie H, Strømme H, Jamtvedt G. Simulation-based training for nurses; systematic review and meta-analysis. Nurse Educ Today. 2017; 54: 6-20.
16. Tuzer H, Dinc L, Elcin M. The effects of using high-fidelity simulators and standardized patients on the thorax, lung, and cardiac examination skills of undergraduate nursing students. Nurse Educ Today. 2016; 45: 120-5.
17. MacLean S, Kelly M, Geddes F, Della P. Use of Simulated Patients to Develop Communication Skills in Nursing Education: An Integrative Review. Nurse Educ Today. 2017; 48: 90-8.
18. Cason M, Atz T, Horton L. New Nursing Graduates' Self-Efficacy Ratings and Urinary Catheterization Skills in a High-Fidelity Simulation Scenario. Clinical Simulation in Nursing. 2017; 13(2): 71-7.
19. Luctkar-Flude M, Wilson-Keates B, Larocque M. Evaluating High-fidelity Human Simulators and Standardized Patients in an Undergraduate Nursing Health Assessment Course. Nurse Educ Today. 2012; 32(4): 448-52.
20. Vincent M, Sheriff S, Mellott S. The efficacy of high-fidelity simulation on psychomotor clinical performance improvement of undergraduate nursing students. Comput Inform Nurs. 2015; 33(2): 78-84.
21. Hustad J, Johannesen B, Fossum M, Hovland OJ. Nursing students' transfer of learning outcomes from simulation-based training to clinical practice: a focus-group study. BMC Nurs. 2019; 18: 53.