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The Effect of Virtual Patient Simulation on Nursing Students' Clinical Decision Making and Problem-Solving Skills

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Abstract

Background: Clinical decision making is an essential part of the nursing process adopted by nurses and nursing students as a problem-solving approach. The aim of this study was to investigate the effect of virtual patient simulation on fourth-year nursing students' clinical decision-making and problem-solving skills.

Methods: The study was designed as quasi experimental research and included 73 fourth-year nursing students. The study was conducted between December 2018 and May 2019. Sociodemographic data form, Clinical Decision-Making in Nursing Scale, and Problem-Solving Inventory were used to collect the data. After the pretest, the students undertook virtual patient simulation. Subsequently, the post-test was administered.

Results: Mean age was 22.06±0.34 years, and 93.2% of the participants were female. The mean pretest score for problem-solving skills was 110.68 ± 13.57, and the mean post-test score was 108.66 ± 18.41, and no significant difference was established between the 2 scores (P > .05). In addition, the mean pretest score for clinical decision-making skills was 153.94 ± 12.57, and the mean post-test score was 152.71 ± 13.36, and no significant difference was found between the 2 scores (P > .05).

Conclusion: The results indicated that virtual patient simulation does not affect fourth-year nursing students' clinical decision-making and problem-solving skills.

Keywords: Virtual, patient simulation, nursing students, problem solving, decision making

Introduction

Nurses routinely make and implement important decisions in clinical practice, and these decisions directly affect the quality of patient care. Clinical decision making is a systematic process involving analysis, evaluation, interpretation, and observation and is defined as choosing the most effective and appropriate solution for individuals' problems as well as their families' problems.[1]

Owing to the increasing importance of care quality and patient safety over the last years, clinical decision making has become an integral part of nursing education and has been developed through clinical practice within the scope of both undergraduate and graduate nursing education. Accordingly, with clinical practice, nursing students are aimed to acquire and develop problem-solving, critical decision-making, and communication skills and also to improve their self-confidence.[2,3]

Clinical decision making is an essential part of the nursing process that is adopted by nursing students as a problem-solving approach. Throughout the clinical practice within the scope of the nursing process, students collect and analyze data regarding the changes in patients' clinical conditions and develop their abilities in making the most appropriate clinical decisions regarding patient care by determining priorities.[1,2]

In professional nursing education, there are several difficulties in the implementation of clinical practice owing to patient safety, such as insufficiency of areas of practice and educators and students' fear of harming the patient. Therefore, nurse educators need to implement the necessary educational strategies before clinical practice to allow students to acquire sufficient professional knowledge, skills, and attitudes. In addition, while developing new generation nursing students' professional skills, nurse educators should employ new methods to increase their interest and motivation and should also encourage them to reflect their theoretical knowledge into practice.[4] In addition, they should also enrich their educational practices with various technological methods, such as games, simulations, and vid-

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eos, to prepare them for new and unpredictable clinical situations.[5] One of these technological methods is virtual patient simulation. Although there have been numerous definitions proposed for this technology, it is basically defined as a specific type of computer-based program that simulates real-life clinical scenarios. This system is an active learning strategy using a simulated patient created by a computer-based program in line with a real-life clinical scenario. The system has a wide variety of applications, ranging from simple computer-based simulations to animated virtual patients who can interact with the user and answer students' questions.[6,7] Moreover, it also provides a problem-based learning experience allowing students to improve their knowledge, skills, and clinical decision making in a safe environment.[6-10]

Medical history taking is a component of virtual patient simulation that enables students to establish a cause-and-effect relationship to contribute to the development of their problem-solving and clinical decision-making skills. In addition, because virtual patient simulation allows nursing students to practice in a safe environment, it provides every student the opportunity to practice under equal circumstances in situations they may encounter in clinical practice.[11]

To date, there have been numerous studies conducted with virtual patient simulations and nursing students. These studies have mainly focused on the effect of virtual patient simulation on student performance outcomes.[10,12] The studies have also reported that web-based simulations improve students' problem-solving skills and that students regard virtual patient cases as highly realistic and interesting and also consider them acceptable for improving their clinical skills.[13,14]

In line with these results, it is wise to consider that the use of virtual patient simulation in nursing education may enhance learning through a student-centered approach and can be effective in improving nurses' problem-solving and clinical decision-making skills.

Aim

This study was designed to investigate the effect of virtual patient simulation on nursing students' clinical decision-making and problem-solving skills.

Hypotheses

The following hypotheses were made:

1. Virtual patient simulations affect nursing students' clinical decision-making skills.

2. Virtual patient simulations affect nursing students' problem-solving skills.

Material and Methods

Research Design

This study was conducted as a quasiexperimental research with a preposttest design.

Sampling Method

The fourth-year nursing students enrolled in a nursing faculty in Ankara province, Turkey were included in the study. Sample size was estimated using the Medicres E-picos program (https://www.e-picos.com/apps/power/sscm) with a 5% significance level, 80% power, and 0.80 effect size based on the mean and standard deviations reported in previous studies.[15] The analysis indicated that the minimum sample size was 70, and a total of 73 fourth-year nursing students were included in the study.

Data Collection Tools

The study was conducted between December 2018 and May 2019 using 3 data collection tools: sociodemographic data form, the Clinical Decision-Making in Nursing Scale (CDMNS), and the Problem-Solving Inventory (PSI).

Sociodemographic Data Form: The form was developed by the researchers on the basis of literature data and consisted of 2 subsections: sociodemographic characteristics (e.g., age, gender, and permanent residential area) and attitudes toward the nursing profession (e.g., willingness in choosing the nursing profession, willingness to pursue a nursing career after graduation, and the ability to use theoretical knowledge in practice).

Clinical Decision-Making in Nursing Scale: CDMNS is a self-report scale developed in 1983 by Jenkins for nursing students in the United States and is used for assessing students' perceptions into clinical decision-making processes. The Cronbach's alpha value of the original version of CDMNS is 0.83. The scale was adapted to the Turkish language in 2015 by Durmaz Edeer and Sarıkaya.[16] The Cronbach's alpha value of the Turkish version of CDMNS is 0.78. The original CDMNS consists of 40 items divided equally into 4 subscales. Each subscale is scored 10-50, and the total score ranges between 40 and 200, and there is no cutting point. Higher scores indicate higher levels of clinical decision-making perceptions.[16] In this study, the Cronbach's alpha value was 0.83.

Problem-Solving Inventory: PSI is a self-report scale developed in 1982 by Heppner and Petersen measuring adolescents' and adults' perceptions of their problem-solving skills. The Cronbach's alpha value of the original version of PSI is 0.89.[17] The scale was adapted to the Turkish language in 1993 by Şahin et al. The Turkish version's Cronbach alpha value is 0.78. PSI consists of 35 items each scored on a 6-point Likert scale, with the total score ranging between 32 and 192. Higher scores indicate that the individuals perceive themselves as insufficient with respect to problem-solving skills.[18] In this study, the Cronbach alpha value of this scale was 0.88.

Data Collection

In the first stage, a pretest was administered to each participant, and then the scenarios selected from the virtual patient simulator were implemented. The simulation system used in the study, Body Interact, is a specific type of computer-based program involving preconfigured internationally approved clinical scenarios (https://bodyinteract.com/product/).

A virtual patient simulator resembles a large tablet computer and involves 21 internationally validated scenarios designed in line with the learning goals and outcomes of nursing education and aimed at developing students' clinical and critical-thinking skills. In this system, students are required to perform the necessary nursing interventions for the scenario applied, and all the interventions are performed virtually on the simulator. The goals and outcomes of the training are defined in the guidelines provided to the educators (https://bodyinteract.com/product/). In this study, each student initially received a 2-hour theoretical education on 5 similar scenario topics selected by the researcher. These topics were mainly concerned with nursing care in respiratory diseases, in line with the goals of the scenarios. The students then undertook virtual patient simulation designed according to these topics. Each student was asked to select 2 of 5 similar scenarios with the same difficulty by drawing lots and then to apply 2 scenarios consecutively. The reason for determining the scenarios by drawing lots was to prevent information exchange among the students. Each simulation was applied approximately for 20 minutes. Students enrolled in the elective Clinical Simulation course participated in both simulation sessions on a 1-to-1 basis during their course hours. In the literature, no detailed information was found regarding the relationship between the number of virtual patient simulation sessions and students' clinical decision-making and problem-solving skills. Accordingly, 2 scenarios were administered

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Table 1. Demographic Characteristics

Demographic variables		n	%
Gender	Male	68	93.2
	Female	5	6.8
Permanent residential area	City center	59	80.8
	Countryside	6	8.2
	Small town	8	11.0
Willingness in choosing nursing profession	Willingly	29	39.7
	Partially willingly	37	50.7
	Unwillingly	7	9.6
Willingness to pursue a nursing career after graduation	Yes	68	93.2
	No	5	6.8
Using theoretical knowledge in practice	Yes	58	79.5
	Occasionally	15	20.5
	No	-	-
Age		22.06 ± 0.34	
Total		73	100.0

Table 2. Pre and Post-test CDMNS and PSI Scores

Scale	Pretest Mean ± SD	Post-test Mean ± SD	*P* t
PSI	110.68 ± 13.57	108.66 ± 18.41	.43 .79
CDMNS	153.94 ± 12.57	152.71 ± 13.36	.58 .55
	r^2	*P*	
PSI versus CDMNS	-.36	.010*	

CDMNS: Clinical Decision-Making in Nursing Scale; PSI: Problem-Solving Inventory; SD: standard deviation; t: Paired samples t-test; r2: Spearman correlation coefficient
*P < .05

to each student owing to their limited course hours. All the scenarios were in the Turkish language. After completing both sessions for all participants, a post-test consisting of CDMNS and PSI was administered.

Ethical Issues

The study was approved by the University of Health Sciences Gülhane Training and Research Hospital Ethics Committee on December 12, 2018 (number 18/289). All the participants were informed that "they were free to participate, could leave the study for any reason, the data obtained would be used only for scientific purposes without disclosing their identities, and participation would not affect their academic scores." Subsequently, both verbal and written consent was obtained from each volunteering participant.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, version 21.00 (IBM Corp., Armonk, NY, USA).

Table 3. CDMNS Subscale Scores

Subscale	Pretest Mean ± SD	Post-test Mean ± SD	*P** t
Search for alternatives or options	40.52 ± 4.05	40.84 ± 4.53	.63 -.47
Canvassing of objectives and values	36.58 ± 3.10	36.65 ± 3.11	.89 -.13
Evaluating and revaluation of consequences	40.26 ± 5.22	39.20 ± 4.75	.22 1.21
Search for information and unbiased assimilation of new information	36.57 ± 3.01	36.00 ± 3.53	.32 .99

*Paired samples t-test; DMNS: Clinical Decision-Making in Nursing Scale; SD: standard deviation.

Frequencies (*n*), percentages (%), and mean±standard deviation were used for data definition. Normal distribution of the data was analyzed using the Kolmogorov-Smirnov test. Dependent variables were compared using a *t*-test. Correlations among scales were determined using Spearman correlation coefficient, in which correlation coefficient values (r) of 0.00-0.24 were considered weak, values of 0.25-0.49 were considered moderate, values of 0.50-0.74 were considered strong, and values of 0.75-1.00 were considered very strong. A P <.05 was considered significant.

Results

Table 1 presents the demographic and descriptive characteristics of the participants. The mean age was 22.06 ± 0.34 years, and 93.2% of the participants were female. Of all participants, 39.7% of them chose the nursing profession willingly, 50.7% of them chose it partially willingly, and 9.6% of them chose it unwillingly. In addition, 79.5% of them indicated that they could use their theoretical knowledge in practice, whereas 20.5% indicated that they could use it only occasionally.

Table 2 presents the participants' mean pre and post-test scores for problem-solving and clinical decision-making skills. Accordingly, the mean pretest score for problem-solving skills was 110.68 ± 13.57, and the mean post-test score was 108.66 ± 18.41, and no significant difference was established between the 2 scores (P > .05). In addition, the mean pretest score for clinical decision-making skills was 153.94 ± 12.57, and the mean post-test score was 152.71 ± 13.36, and no significant difference was found between the 2 scores (P > .05). On the other hand, a weak significant correlation was found between PSI and CDMNS scores (P < .01).

Table 3 presents the mean pre and post-test scores for the subscales of CDMNS. Accordingly, no significant difference was found between the pre and post-test scores for the subscales of CDMNS (P > .05).

Discussion

The results indicated that most of our participants chose the nursing profession either willingly or partially willingly and that a great majority of them indicated that they were planning to pursue a nursing career after graduation. Similarly, in 2016, Özdelikara et al.[19] examined the factors affecting the choice of nursing career among nursing students and reported that the majority of the students chose the nursing profession willingly. Meaningfully, choosing a career willingly leads to a positive perception of job satisfaction and professional relationships.[20] Moreover, pursuing a nursing career willingly will lead to higher professional

achievements and increase the quality of patient care and will also contribute to the development of the nursing profession.[20]

Most of our participants indicated that they could use their theoretical knowledge in practice. In a similar study by Uslusoy[21] in 2018, most of the students stated that virtual patient simulation enabled the theoretical knowledge to be transformed into practice. These results suggest that learning through simulation-based training and the use of theoretical knowledge in visual technologies facilitate the acquisition of nursing practice skills. Literature reviews indicate that studies conducted on virtual patient simulation among nursing students have mainly examined the knowledge and performance levels of the students.[22-23] The studies also reported that students' knowledge and performance levels were increased by the use of virtual patient simulation applications.[22-25]

In this study, the sores of the participants regarding their problem-solving and clinical decision-making skills were found to be different from those reported in the literature. Of note, the mean pre and post-test scores for problem-solving skills were 110.68 ± 13.57 and 108.66 ± 18.41, respectively, and the mean pre and post-test scores for clinical decision-making skills were 153.94 ± 12.57 and 152.71 ± 13.36, respectively. In addition, no significant difference was found between the pre and post-test scores for problem-solving and clinical decision-making skills, and also no significant difference was found between the pre and post-test scores for the subscales of CDMNS ($P > .05$) (Table 2.). Demir Barutcu[26] in 2019 and Yuksel[27] in 2015 also evaluated the problem-solving skills of fourth-year nursing students and reported the mean score for these skills as 89.77 ± 17.37 and 95.42 ± 19.87, respectively. Özden et al.[1] in 2018 reported the mean score for decision-making skills among fourth-year nursing students as 143.10±11.41, whereas Demir Barutcu[26] in 2019 reported it as 139.30±14.70. On the basis of these findings, it can be asserted that fourth-year nursing students trained through virtual patient simulation have higher problem-solving and decision-making skills than untrained students. On the other hand, Özden et al.[1] in 2018 reported that the scores for decision-making skills were similar between fourth- and second-year nursing students. The authors also noted that the high scores for decision-making skills among second-year nursing students could be attributed to the fact that caring for 1 or 2 patients could have allowed them to feel more competent.[1] These findings support the findings of our study that indicated no significant difference between the pre, and post-test mean scores for both skills.

In this study, the virtual patient simulation did not lead to a significant difference in participants' problem-solving and clinical decision-making skills. In addition, a negative weak correlation was found between the mean scores for these 2 skills. These findings implicate that nursing students with improved problem-solving skills will also have improved clinical decision-making skills. Similar outcomes were obtained in the study by Demir Barutcu[26] that was conducted among nursing students.

A previous study examined the nursing students' clinical decision-making experiences in virtual patient simulation and reported that the students became more competent in making clinical decisions, particularly in learning how to act and how to collect data.[28] In another study, nursing students stated that they expected virtual patient simulation cases to be less medical and to focus more on nursing practices. The authors also noted that although the students were able to establish the correct diagnosis and make clinical decisions, they stated that clinical decision-making processes involved a wider spectrum.[14] Clinical decision making is a complex process involving a series of decisions to achieve desired patient care outcomes in professional nursing care. Moreover, the existence of excessive information to be processed and the uncertainty of results further complicate clinical decision-making processes.[28] Accordingly, it is wise to consider that nurses' experience and intuition in addition to their field-specific knowledge play an important role in their clinical decision-making and problem-solving processes.[29]

Edelbring et al.[30] in 2011 evaluated the efficacy of virtual patient simulation among medical students and reported that the simulation allowed students to solve problems actively through its technology and learning environment. Forsberg et al.[29] in 2014 examined the efficacy of virtual patient simulation in pediatric nurses and indicated that the nurses considered that virtual patient simulation is highly applicable to nursing students in clinical decision-making processes. Clinical decision making and problem solving require combining knowledge and previous experience with the data collected regarding the clinical condition of the patient. However, these skills are high level and are difficult to acquire for nursing students.[29] The fourth-year nursing students included in the study performed clinical practice throughout the fourth year, and they performed that practice to a lesser extent in the first 3 years. During these practices, students utilize problem-solving and clinical decision-making skills numerous times and thus have the opportunity to experience these skills many times. Accordingly, we consider that the clinical practice provided throughout the fourth year of nursing education could be the reason for the absence of a significant difference between our participants' pre and post-test scores for problem-solving and clinical decision-making skills.

Limitations and Generalizability

Because the research was conducted in a single center, its findings can only be generalized to the fourth-year nursing students of the faculty where the study was conducted. Owing to the limited course hours of the students during the study period, only 2 scenarios could be evaluated for the participants.

Conclusion

The results showed that fourth-year nursing students have good problem-solving and clinical decision-making skills, and that the administration of virtual patient simulation did not have a direct effect on the improvement of these skills. Considering the importance of these skills for nursing students, we suggest that further studies with larger samples that would administer >2 scenarios in second- and third-year nursing students are needed.

Ethics Committee Approval: *Ethics committee approval was received for this study from the University of Health Sciences Gülhane Training and Research Hospital Ethics Committee (Date and number: 04.12.18-18/289).*

Informed Consent: *Both verbal and written consent was obtained from the fourth-grade nursing students who participated in the study, and the participation in the study was based on volunteering. It is explained that the data obtained will be published without the use of names for scientific purposes.*

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