ORIGINAL ARTICLE **Open Access**

Development and Effectiveness of an Oncology Nursing Standardized Patient Simulation Program for Nursing Students

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Purpose: Standardized patient-based simulation is known to be a useful tool in the training of nursing students; however, few studies have examined the use of this method in oncology nursing education. This study aimed to evaluate the effects of an oncology nursing simulation program that used standardized patients on knowledge, nursing performance ability, and satisfaction among nursing students. **Methods:** This study used a non-equivalent control group pretest-posttest design. The experimental group (n=25) participated in an 8-hour oncology nursing simulation program that consisted of a lecture (2 hours) and a four-session simulation program (6 hours). The control group (n=29) received case-based learning (6 hours) and a lecture (2 hours). Knowledge level was assessed with a 33-item knowledge assessment multiple-choice questionnaire. Nursing performance ability was assessed with a nursing performance ability checklist. Educational satisfaction was evaluated using the 12-item Course Satisfaction Evaluation tool. Data were collected from June to July of 2012 and were analyzed using descriptive statistics, independent t-test, and repeated measures analysis of variance. **Results:** The experimental group showed significantly higher nursing performance ability and satisfaction compared with the control group. Knowledge of oncology nursing increased in both the experimental and control groups. **Conclusion:** An oncology nursing simulation program was more effective than case-based learning in improving nursing student performance and was found to produce high satisfaction.

Key Words: Nursing education; Nursing students; Patient simulation; Personal satisfaction

INTRODUCTION

Cancer is a life-threatening disease and a primary cause of death in Korea [1]. Owing to the aging of the population and advances in diagnostic technology, the incidence rate of cancer continues to grow [2]. Oncology nursing focuses not only on pain management, but also on safety management and the side effects of chemotherapy, and emergency situations [3]. Because the most common symptom experienced among cancer patients is pain [4], it is necessary to reinforce the education on effective pain management [5] and the management of side effects [6]. Therefore, education is needed to ensure optimal professional competency in oncology nursing [7].

As an alternative to passive clinical practice education, simulation-based learning is regarded as an effective teaching and learning method that allows nursing students to experience experiential learning and to develop their own professional identities [8]. Standardized Patients (SPs) are individuals who have been trained to express specific patient characteristics [9]. Many recent studies have found SP-based training to be a useful and effective tool for improving cognitive, affective, and psychomotor domain outcomes among undergraduate nursing students [10-12]. Standardized patients have been used to train nursing students in areas such as psychiatric mental health nursing

[13,14], health assessment [15-18], hearing impairment [19], dementia care [20], women's health [21], and fundamental nursing [22,23]. However, these outcomes are mostly focused on nursing students' perceived learning or confidence and do not objectively assess clinical skills or performance. Because high-fidelity simulator-based simulation has some limitations with regard to symptom manifestation of cancer patients, SP-based simulation may be a better educational tool for the acquisition of nursing competencies among nursing students.

One study found that faculty and new graduate nurses responded positively after participating in an oncology symptom management training program that used SPs. Standardized patient-based simulation has been found to be a realistic and helpful learning strategy for acquiring knowledge and skills in evidence-based oncology symptom management [24]. In one study, health assessments for patients with skin cancer were conducted by nursing students, and the students who had received high-fidelity patient simulation training in oncology nursing showed improved confidence and problem-solving ability [25,26]. Considering the specificity of oncology nursing care and the current limitation of clinical practicum in undergraduate nursing education, there is a need for SP-based simulation education to help nursing students gain competencies by providing realistic simulated experiences. However, few studies have evaluated the effects of oncology nursing SP simulation programs. Furthermore, previous studies focused only on specific aspects of nursing care for cancer patients, and, thus, integrated nursing care simulation for cancer patients is needed. The purpose of this study was to develop an oncology nursing simulation program using SPs and to identify its effects on knowledge, nursing performance ability, and satisfaction among nursing students.

METHODS

1. Study Design

This study used a non-equivalent control group pretest-posttest design (Figure 1).

2. Participants

The minimum sample size was calculated using the G*Power 3.0.10 program (Universität Düsseldorf, Düsseldorf, Germany). At least 17 nursing students were required for each group with .25 for effect size, .05 for significance level, .80 for the power of the test using repeated measures analysis of variance. The effect size was based on a previous study [27]. The participants were junior nursing students at Chung-Ang University located in Seoul. They had received no theoretical education on oncology nursing and had no clinical practice experience in the cancer ward prior to participating in the study. Junior nursing students who satisfied the selection criteria were recruited through a notice posted on a bulletin board of Chung-Ang University. Nursing students who agreed to participate were conveniently assigned to either the experimental (n=25) or control group (n=29).

3. Measurements

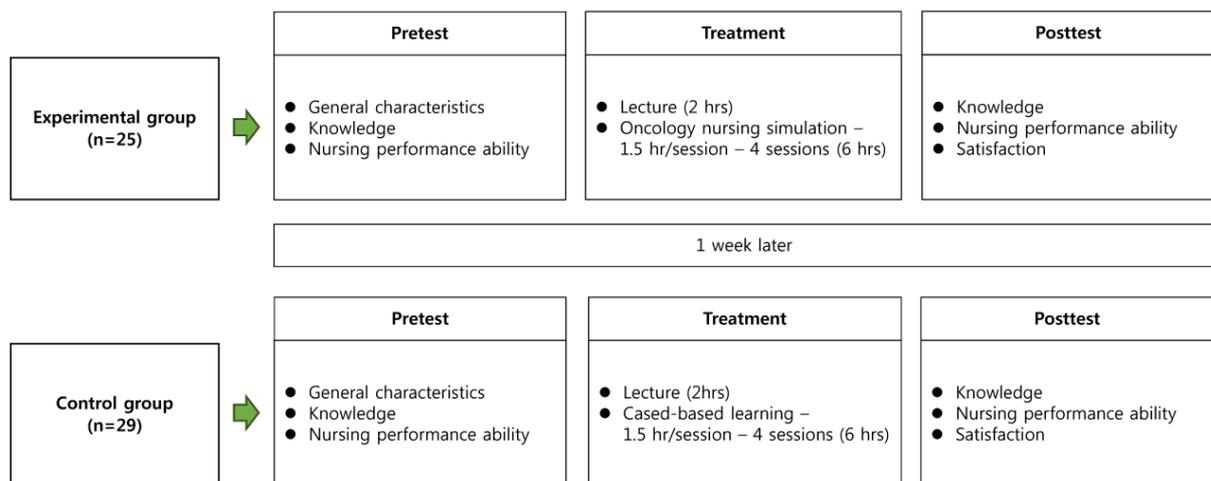This study examined three learning outcomes that are commonly measured in simulation-based educational re-

Figure 1. Research design.

search [9-12]: knowledge level, nursing performance ability, and educational satisfaction.

1) Knowledge assessment multiple-choice questionnaire

Knowledge level was assessed using a 33-item knowledge assessment multiple-choice questionnaire that was developed by the authors based on published literature [28,29]. Its validity was verified by two nursing professors and one oncology nurse. This instrument consists of a total of 33 questions on pain management in oncology nursing (11 questions), safety management in chemotherapy (9 questions), side effects management in chemotherapy (7 questions), and management of emergency situations (6 questions). One point was given for a correct answer, and 0 points were given for an incorrect answer or no answer. A higher score indicated a higher level of knowledge.

2) Nursing performance ability checklist

Nursing performance ability was assessed by a rater (researcher or instructor) using a nursing performance ability checklist that had been developed by the authors based on a literature review [30]. The researcher and instructor assessed the nursing performance ability of the students who participated in their intervention session both before and after the intervention. Rater training was conducted through pilot testing with two new graduate nurses. Two raters simultaneously assessed the performances of the two new graduate nurses in four scenarios. To secure agreement between the raters, agreement between them was assessed in the pilot test session until 100% agreement was reached. Some modifications were made as a result of the pilot test. For the simulation on the safety management rules for chemotherapy, the time to assess the participants' nursing performance exceeded the 15 minutes that was initially allotted; therefore, it was decided that some drugs (antihistamine and antiemetic) would be ready when the simulation was performed with the students. No modifications were made to the checklist.

Each rater directly assessed the performance of each student group on an SP in four simulated scenarios. Three nursing professors and seven oncology ward nurses, each with more than 5 years of work experience, verified content validity with the content validity index. The checklist consisted of items on pain management in oncology nursing (32 questions: for example: The intensity of pain is assessed using the Numeric Rating Scale.), safety management in chemotherapy (45 questions), side effects management in chemotherapy (40 questions), and management of emergency situations (30 questions). For each question, 1 point was given to a student with proper performance, and 0 points were given for improper or failed performance. A higher score indicated a higher level of nursing performance ability.

3) Course satisfaction evaluation

Educational satisfaction was evaluated using the 12-item Course Satisfaction Evaluation tool [23]. The authors had obtained permission to use the tool from its original developer. Responses on the tool were based on a 5-point Likert scale that ranged from 1 ("very unsatisfied") to 5 ("very satisfied"), and a higher score indicated a higher level of educational satisfaction. Cronbach's α was .94 in Yoo's study [23], whereas it was .89 in the present study.

4. Oncology Nursing Simulation-Based Program

1) Development of the program

In order to identify educational needs in oncology nursing, focus group interviews were conducted four times with three oncology nurse specialists, three oncology ward nurses (each with a career of more than 5 years), six head nurses in a cancer ward, and six nursing students. A self-administered questionnaire was given to 20 nursing students and 20 new graduate nurses working in a cancer ward to select priority content. Responses on the questionnaire were based on a 5-point Likert scale (1="not necessary," 5="very necessary"). The items on the questionnaire, which were based on the results of the group interviews, were on administration of chemotherapy drugs, safe handling of cytotoxic drugs, side effects and effects of cytotoxic drugs, management of emergency situations, cancer pain management, management of extravasation, case management of cancer patients, psychosocial care of patients, transfusion, and nursing records. The reason for targeting nursing students (prospective new graduate nurses) for the needs assessment survey was to identify the educational needs of new graduate nurses who lack oncology nursing competency. The nursing students were recruited from a college of nursing.

The authors developed a learning module and the simulation scenarios. The learning module was developed based on the current guidelines [28]. Then the feasibility of this learning material was verified by two nursing professors and one oncology nurse who had expertise in oncology nursing. PowerPoint slides (Microsoft Corporation, Redmond, WA, USA) were created for the 2-hour lecture. The slides were on four educational themes, which had been selected based on the results of the educational needs assessment. The themes were as follows: 1) pain management in oncology nursing, 2) safety management

in chemotherapy, 3) management of side effects in chemotherapy, and 4) management of emergency situations. The educational objectives of the program were as follows: after completion of the program, nursing students would be able to 1) assess the cancer patient's physical and psychological status, 2) perform accurate nursing interventions according to the patient's condition, and 3) communicate effectively with patients, families, and other health care professionals.

For the simulation scenarios, nursing care for patients with stomach cancer, colorectal cancer, breast cancer, and lymphoma were selected out of the top 10 most common cancers in Korea [29]. The authors selected these four cancers because it was feasible to simulate the symptoms of these cancers using SPs. Based on the actual medical record and literature [28,29], scenarios featured information on symptoms, present and past medical history, major symptoms claimed, family history, diagnostic testing, treatment, and nursing. Scenarios also reflected the four educational themes (pain management in oncology nursing, safety management in chemotherapy, management of side effects in chemotherapy, and management of emergency situations) (Table 1). The scenarios were reviewed by two

nursing professors and one oncology nurse.

The module (for the simulation-based education with four themes) was developed based on guidelines from the National League for Nursing [31]. Units of the module included progress sequence; supply; educational objectives; learning materials; matters to be attended to; an algorithm for instructors, students, and SPs; and debriefing. After the development of the module, its feasibility was verified by two nursing professors and one oncology nurse.

A script for the training of SPs for each case was composed based on the literature on the training of SPs [32]. We recruited and trained SPs who were laypersons and had previously participated in a simulation-based education program at a college of nursing. A nursing professor with more than 5 years of experience in simulation education trained the SPs. The SPs (two people for each case) were trained for 2 hours on which of the students' questions should and should not be answered and on other matters related to carrying out the scenarios.

2) Implementation of the educational program

For the experimental group, the oncology nursing simulation-based program consisted of four simulation ses-

Table 1. Overview of Scenarios for Oncology Nursing Simulation Program using a Standardized Patient

Theme	Scenario
1. Pain management in oncology nursing	Ms. Kim is a 51-year-old woman who had a breast cancer with multiple bone metastases. Pain is usually controlled by painkillers. She complained an uncontrolled pain in her anus and lower back that lasts for two days. This causes her to wake up every two hours, and the pain becomes worse when she walks for a long time or goes to the bathroom. She was admitted to the emergency room accompanied by nausea. Results of blood tests showed that leukocytes 4100/mm^3, hemoglobin 10.0 g/dL, hematocrit 38%, and platelet 150,000/mm^3. She currently suffers from cold sweating and pain and is intravenously injected with 5% D / W 1L.
	The patient is anxious by telling the nurse: "I heard that if I take a lot of narcotic pain medications, it doesn't work well later. I want to endure without taking any medications." As a nurse, assess Ms. Kim's pain and plan and perform nursing care to alleviate the symptoms.
2. Safety management in chemotherapy	Ms. Lee, a 61-year-old woman (weight: 55 kg, height: 158 cm), was diagnosed with advanced gastric cancer in March 2012 and was admitted to a cancer ward for secondary chemotherapy. The main symptoms were stomatitis, anorexia and diarrhea after the first chemotherapy.
	The patient asks the nurse: "Do I need to have chemotherapy drugs on my left arm again?" As a nurse, check the chemotherapy regimen and administer it to the patient.
3. Management of side effects in chemotherapy	Ms. Na, a 62-year-old woman, was admitted to a cancer ward for her second chemotherapy due to a non-Hodgkin's lymphoma. She complains, "I have been itching for a while now, my face is burning, my tongue is paralyzed, and it's too hard to breathe." As a nurse, assess the patient's symptoms and perform nursing cares to alleviate the symptoms.
4. Management of emergency situations	Ms. Kim, a 56-year-old woman, had breast cancer. She was admitted to a oncology ward by a wheelchair and treated well. She has general weakness, decreased muscle tone, and swelling. She complains, "I can't urinate well, it is hard to walk because of swelling, I have lost my appetite, and I sometimes feel dizzy and fall." As a nurse, assess the patient's symptoms and perform nursing cares to alleviate the symptoms.

sions (6 hours) and a lecture (2 hours). Two instructors (a researcher and an instructor) led the sessions. A total of 25 students was assigned to two teams. The researcher led one team (n=14), and the instructor led the other team (n=11). All members of the experimental group attended the lecture together. The researcher delivered the 2-hour lecture, which was on the four educational themes, using the learning module and the PowerPoint slides in a lecture room at Chung-Ang University. With regard to the duration of the simulation, a total of 6 hours was decided on (each session lasting 1.5 hours) based on the literature review, which provided information on educational simulation duration and average weighted effect size in the field of healthcare education [33]. Each simulation session consisted of case introduction, 20 minutes of demonstration, 30 minutes of task training, 15 minutes of simulation practice, and 25 minutes of debriefing. While nursing students on one team underwent task training, nursing students on the other team performed simulation practice. The nursing students performed simulation practice in pairs. The SPs provided feedback on the nursing care performed by the two nursing students. The performance of the nursing students was video recorded for the debriefing session. As recommended in the literature [34], the debriefing consisted of a 25-minute instructor-led video-assisted debriefing session was implemented in the lecture room after the completion of the simulation-based session.

The control group received case-based learning (6 hours) and a lecture (2 hours). The two instructors (the researcher and the instructor) who had led the experimental group also led the case-based learning sessions. The researcher led one team (n=15), and the instructor led the other team (n=14). The researcher delivered the same lecture to the control group as the one delivered to the experimental group. A total of four sessions was held for 1.5 hours each. The topics addressed in the sessions included nursing care for patients with stomach cancer, colorectal cancer, breast cancer, and lymphoma. Twenty-nine nursing students were divided into two teams, one a team of 15 students and the other a team of 14 students. All members of the control group attended the lecture together. Each team was then divided into three smaller groups, which were asked to discuss the same cases that had been simulated in the experimental group sessions for 40 minutes. After the small group discussion on each case, the students were asked to create a conceptual map on a whole sheet of paper depicting the name of the nursing diagnosis, assessments of nursing problems, and interventions. Then, each small group gave a 10-minute presentation. The instructors provided feedback for 30 minutes. In addition to the case-study-based training, the control group also underwent SP-based performance evaluation with four scenarios.

After the completion of data collection for both groups, an additional simulation education session on safety management in chemotherapy was provided to the nursing students in the control group. The lowest nursing performance ability scores were obtained during this session.

5. Data Collection

In accordance with the curriculum schedules of the nursing students, the intervention was applied to the experimental group first and then to the control group 1 week later. During the same period, one group performed a clinical practicum for 2 weeks, and the other group attended class lectures for 2 weeks. Intervention and data collection took place during the students' class lecture period. Therefore, there was a 1-week gap to minimize treatment diffusion between groups. To assess knowledge and nursing performance ability, both the experimental and control groups were administered a pretest before the intervention and a posttest immediately after the intervention. To assess satisfaction, both groups completed a self-administered questionnaire immediately after the intervention. Data were collected from June 18 to July 11, 2012.

6. Ethical Considerations

Ethical approval was obtained from the institutional review board of the Catholic University of Korea (No.: MC12QASI0043). Participation in the study was voluntary, and written informed consent was obtained from each participant. Confidentiality was ensured throughout the study, including during data collection and analysis. The class was not part of the regular curriculum, and student participation in the study was not reflected in their grades.

7. Data Analysis

Data were analyzed using SPSS/WIN 18.0 software (IBM Corporation, Armonk, NY, USA). For the test of homogeneity between the two groups, Fisher's exact test and independent t-test were used. The Shapiro-Wilk's test was used to test the normality of the dependent variables. All variables were found to be normally distributed. Pretest-posttest differences in knowledge and nursing performance ability were compared between the experimental and the control groups was analyzed using repeated measures analysis of variance, and differences in satisfaction were analyzed with independent t-test.

RESULTS

1. Homogeneity of General Characteristics of the Participants and Study Variables

There were no significant differences between the experimental and control groups in terms of age (t=1.58, p=.121), gender (p=.591), knowledge (t=1.39, p=.170), nursing performance ability in pain management (t=0.36, p=.723), safety management in chemotherapy (t=0.92, p=.360), side effects management in chemotherapy (t=1.08, p=.284), and management of emergency situations (t=0.32, p=.752) (Table 2).

2. Effects on Knowledge, Nursing Performance Ability, and Satisfaction

With regard to knowledge, scores of the experimental group increased from 21.08±1.41 before the program to 24.44±2.00 after the program (out of a perfect score of 33). Scores of the control group increased from 20.38±2.14 to 23.76±1.86. No interaction was found between time and group (p=.977) (Table 3).

For pain management in oncology nursing, the scores of the experimental group increased from 16.68±2.95 to 24.36±2.70 (out of a perfect score of 32), whereas the scores of the control group increased from 16.31±4.59 to 21.48±3.20. No interaction was found between time and

Table 2. Homogeneity Test for General Characteristics and Research Variables (N=54)

Variables	Categories	Exp. (n=25) n (%) or Mean±SD	Cont. (n=29) n (%) or Mean±SD	x^2 or t	p
Age (year)		21.12±1.78	22.21±3.16	1.58	.121
Gender[†]	Women	23 (92.0)	28 (96.6)		.591
	Men	2 (8.0)	1 (3.4)		
Knowledge		21.08±1.41	20.38±2.14	1.39	.170
Nursing performance ability	Pain management in oncology nursing	16.68±2.95	16.31±4.59	0.36	.723
	Safety management in chemotherapy	21.20±4.08	22.31±4.75	0.92	.360
	Side effects management in chemotherapy	24.76±3.74	23.51±4.67	1.08	.284
	Management of emergency situation	14.76±3.83	14.41±4.17	0.32	.752

Exp.=experimental group; Cont.=control group; SD=standard deviation; [†]Fisher's exact test.

Table 3. Effects of Oncology Nursing Simulation Program on Knowledge and Nursing Performance Ability (N=54)

Variables	Group	Pretest Mean±SD	Posttest Mean±SD	Sources	F	p
Knowledge	Exp. (n=25)	21.08±1.41	24.44±2.00	Group	3.15	.082
	Cont. (n=29)	20.38±2.14	23.76±1.86	Time	100.16	<.001
				Group*Time	0.00	.977
Cancer pain management	Exp. (n=25)	16.68±2.95	24.36±2.70	Group	5.14	.028
	Cont. (n=29)	16.31±4.59	21.48±3.20	Time	105.50	.001
				Group*Time	4.01	.050
Safety management in chemotherapy	Exp. (n=25)	21.20±4.08	36.72±5.38	Group	17.80	.001
	Cont. (n=29)	22.31±4.75	26.03±5.48	Time	167.90	.001
				Group*Time	63.10	.001
Side effects management in chemotherapy	Exp. (n=25)	24.76±3.74	36.52±2.83	Group	28.30	.001
	Cont. (n=29)	23.51±4.67	27.20±4.97	Time	181.40	.001
				Group*Time	49.50	.001
Management of emergency situations	Exp. (n=25)	14.76±3.83	25.16±2.99	Group	12.70	.001
	Cont. (n=29)	14.41±4.17	20.41±2.51	Time	181.60	.001
				Group*Time	13.10	.001

Exp.=experimental group; Cont.=control group; SD=standard deviation.

Table 4. Comparison of Satisfaction between Experimental and Control Groups (*N*=54)

Variables	Exp. (n=25)	Cont. (n=29)	t	p
	Mean±SD	Mean±SD		
Active participation in education	4.60±0.50	4.48±0.57	0.80	.426
Increased interest in nursing	4.64±0.49	4.55±0.57	0.61	.544
Proper educational content	4.80±0.40	4.31±0.54	3.78	<.001
Fulfillment of learning objectives	4.84±0.37	4.59±0.56	1.96	.055
Proper course materials and resources	4.44±0.65	3.97±0.62	2.72	.009
Appropriate educational time	4.80±0.40	4.28±0.52	4.11	<.001
Educational usefulness in teaching patient and family	4.72±0.54	4.45±0.57	1.79	.079
Intention of recommendation to others	4.80±0.40	4.24±0.51	4.46	<.001
Versatile and effective teaching method	4.40±0.70	4.24±0.68	0.83	.410
Acquisition of knowledge	4.80±0.40	4.31±0.60	3.53	.001
Improvement in nursing performance ability	4.92±0.27	4.69±0.47	2.22	.031
Improvement in communication ability	4.80±0.40	4.34±0.72	2.90	.006
Overall	4.71±0.30	4.37±0.37	3.71	.001

Exp.=experimental group; Cont.=control group; SD=standard deviation.

group (*p*=.050). For safety management in chemotherapy, the scores of the experimental group increased from 21.20±4.08 to 36.72±5.38 (out of a perfect score of 45). The scores of the control group increased from 22.31±4.75 to 26.03±5.48, and an interaction was found between time and group (*p*=.001). For side effects management in chemotherapy, the scores of the experimental group increased from 24.76±3.74 to 36.52±2.83 (out of a perfect score of 40), whereas the scores of the control group increased from 23.51±4.67 to 27.20±4.97. An interaction was found between time and group (*p*=.001). Finally, for the management of emergency situations, scores of the experimental group increased from 14.76±3.83 to 25.16±2.99 (out of a perfect score of 30). Scores for the control group increased from 14.41±4.17 to 20.41±2.51, and an interaction was found between time and group (*p*=.001) (Table 3).

For educational satisfaction, the experimental group showed higher overall satisfaction compared with the control group (t=3.71, *p*=.001) (Table 4).

DISCUSSION

This study aimed to develop an oncology nursing simulation program using SPs and to identify its effects on knowledge, nursing performance ability, and satisfaction among nursing students in comparison to case-based learning. Results indicated that oncology nursing simulation programs using SPs were more effective than case-based learning programs in improving nursing students' performance with higher satisfaction. However, knowledge regarding oncology nursing increased in both groups.

According to the results, both the experimental and control groups showed improvement in knowledge regarding oncology nursing; thus, there was no interaction in terms of time and group. In other words, it is known that both simulation and case-based learning effectively improve knowledge on oncology nursing. This result is similar to the outcome derived from a study that reported no knowledge score difference between SP-based learning and usual learning among nursing students [27]. In contrast to our finding, some systematic reviews of SP-based simulations reported gain in knowledge among nursing students based on improved test scores [9-12]. In comparison with other teaching methods, SP-based training resulted in higher knowledge scores compared with high-fidelity simulator group [17] or lecture-based learning [9]. In this study, lecture was provided for 2 hours and the same cases were used in both simulation and case-based learning; thus, improvement in the level of knowledge was observed in both groups.

In terms of nursing performance ability, the experimental group showed higher scores compared with the control group. Some systematic reviews identified high effect sizes in nursing performance outcomes [9-12]. Our re-

sult is similar to those of a study in which nurses in a SP-based communication skills training group showed improvement in communication in cancer pain management, compared with untrained nurses, by improving their assessment skills [35]. Previous studies have demonstrated higher nursing performance in students with SP-based training compared with those with traditional training [18,23]. Conversely, there was no significant difference in performance scores between SP-based and simulator-based learning [17]. Thus, simulation education can improve performance and help students evaluate their errors through debriefing [31]. In this study, the experimental group may have gained confidence by practicing nursing using situations found in actual clinical settings.

Educational satisfaction was higher in the experimental group than in the control group. Standardized-patient-based education has been found to induce high learning satisfaction [13,22] and positive learner perceptions [19, 24]. However, some studies did not show a statistically significant benefit of SP-based learning on perceived learning satisfaction [12,18]. Using SPs helps students to understand patients' histories and to improve in their ability to educate patients. In this study, members of the control group reported difficulty in actual nursing practice and in communication with patients. This situation may be due to lack of experience in following safety management rules for chemotherapy, practicing actual nursing techniques related to drug administration, or interacting with SPs. Student knowledge regarding cancer patients also improved through the lecture and case study. However, students who underwent simulation training showed higher satisfaction. These students were able to practice the delivery of nursing services with the SPs in an environment that reproduced actual clinical settings. Our finding supports the notion that learner satisfaction can be induced by features of SP-based learning, such as self-reflection through debriefing and active learning with realistic scenarios [13,22].

The significant finding of this study was that the performance and satisfaction of nursing students improved through the development and application of an oncology nursing simulation program using SPs. This study had some limitations. Although this study identified the effectiveness of the SP-based simulation, the results are from 2012. Therefore, revision of the educational contents is needed in order to reflect recent clinical practice guidelines in oncology nursing. Although there was a 1-week gap to minimize treatment diffusion between groups, the possibility of treatment diffusion could not be completely eliminated. The raters were not blind to the student group

assignments. Therefore, caution should be taken when generalizing the study results. Because our participants were nursing students from a college of nursing in the Republic of Korea, we cannot generalize the results to other healthcare professionals. Further study is needed to identify the effect of nurses' performance on patient outcomes after simulation-based training.

CONCLUSION

This study assessed the effects of oncology simulation-based nursing education that used SPs by developing such a program and evaluating it application in nursing students. It also provided a foundation for the use of such programs in the training of students and new graduate nurses in the future by proving their effectiveness in improving knowledge regarding oncology nursing, enhancing nursing performance ability for cancer patients, and increasing educational satisfaction. The results of this study can contribute to quality improvement in oncology nursing through the use of the program that was developed for oncology nursing in undergraduate courses and actual clinical settings.

CONFLICTS OF INTEREST
The authors declared no conflict of interest.

AUTHORSHIP
Conception and design - JKI and YYS; Data collection - JKI; Analysis and interpretation of the data - JKI, YYS and RYS; Drafting and revising the manuscript - JKI, YYS and RYS.

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