

Development of a Clinical Nursing Practice Training Simulation Program using Standardized Patient for Nursing Students Focused on Infectious Respiratory

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Abstract

This study was conducted to develop and apply clinical nursing practice training simulation program using Standardized Patient for Nursing Students focused on infectious respiratory disease. This study is descriptive methodological study. Through prior consideration of documents and educational task of infectious respiratory disease was conducted with interview of clinical specialists of infection control managers. Development of educational task for infectious respiratory disease for Nursing Students went through the content validity. Finally, 10 educational tasks are developed 'knowledge of respiratory infections disease', 'hand washing', 'put on mask', 'lead to put on mask to patients and caregiver', 'intravenous injection via 3way', 'surgical aseptic technique', 'sterilization medical instrument', 'management of contaminated linen', 'infected personnel management manual'. The infectious respiratory disease simulation program was developed based on the ADDIE model and proceeded to 4 steps of analysis, design, development, implementation. The infection control education program included lectures (20 min), skill training (20 min), simulation using standardized patient (20 min), and debriefing (40 min), The collected data were analyzed by descriptive statistics with SPSS program for version 23.0. The results of this study confirmed that the clinical nursing practice training simulation program using standardized patients was effective in infectious respiratory disease of the nursing college students in knowledge of infectious respiratory disease and clinical nursing performance. we found this practical training program for nursing college students to improve knowledge and clinical competency of infection control. we expected that this developed program could be applied to practical training for various infectious control.

Keywords: Use infectious respiratory disease(IRD), Standardized patients(SP), clinical nursing performance(CNP)

1. INTRODUCTION

Hospital is a place where various types of infectious agents exist, and in particular, not only patients and medical personnel, but also nursing assistants, administrative staff, and visitors become a source of pathogenic microorganisms and a means of transmission of infection. They have a characteristic that contaminates various parts such as hospital equipment, patients, hospital workers, and air in hospital [1]. According to the previous papers on hospital infection control, in terms of the knowledge and awareness of clinical nurses' knowledge and awareness of hospital infection control, the awareness of respiratory system infection was the highest, but the level of practice was the lowest, and it is reported that in the case of tuberculosis, the knowledges of treatment and patient care are in high level, while the knowledges regarding the characteristics of

Manuscript received: October 29, 2021 / revised: November 12, 2021 / accepted: December 1, 2021

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Mycobacterium tuberculosis, incubation period, and infection prevention methods are low [2]. In the case of MERS, which is a representative IRD, the level of the clinical nurses' knowledge of respiratory system hospital infection management was low in transmission prevention methods and wearing personal protective equipment [3]. Specifically, transmission route, incubation period, undressing order of individual protection equipment, the use of the isolated room, and the instructions to release the containment was measured low. It is reported that, in the emergency room, where patients are cared for without prior information, the performance of wearing a gown to prevent contamination from respiratory secretions was the lowest, and protective equipment to prevent infectious aerosols caused by coughing or breathing was not worn [4]. It is the process of establishing a government level infection response procedure due to the recent spread of a new infectious respiratory disease just like *MERS* and *COVID 19*. Due to the nature of new respiratory infectious disease, it is important to management relationship between pre hospital and in hospital clinical performance. In particular, it can be seen that additional education is needed due to the level of knowledge on the characteristics of the causative bacteria of respiratory diseases, the incubation period, and the infection route.

Nursing students are more likely to be exposed to in-hospital infections because they have frequent direct contact with patients during clinical practice education, such as interviewing patients and measuring vital signs. However, in the case of nursing students, education on hospital infection is provided at school, so it is necessary to develop education that reflects the clinical situation of hospital infection [5]. Simulation practice education in current nursing education is proven to be an effective learning method that can acquire learning contents and critical thinking skills and increase CNP without fear of harming actual patients in a safe practice environment [6], and CNP can be improved by repeated practice and learning in a safe environment. Therefore, this study intends to develop a SBLM for hospital infection control using SP to develop nursing education for IRD patients with high educational requirements for hospital infection control. We aim to narrow the gap between theoretical education and clinical practice by collecting expert opinions of infection management fields.

2. METHOD

2.1 Design

This study is descriptive research to develop a simulation-based learning module(SBLM) for nursing students with an IRD by reflecting the opinions of clinical experts in charge of hospital infection control.

2.2 Definition

Simulation-based learning module(SBLM): In a simulated environment similar to a clinical field, using equipment such as Human Patient Simulator (HPS), multimedia equipment, and patient models, learner can communicate with the subject in a realistic and safe situation to solve health and nursing problems, improve the learner's CNP, coping skills by training and evaluating with this integrated education [7]. In this study, it refers to a SBLM for infection control developed for nursing students to improve their practical ability to manage hospital infections when nursing patients with IRD using SP.

Clinical nursing performance(CNP): Clinical nursing performance refers to the ability to function competently in the nursing field and demonstrate appropriate knowledge, judgment and skills. In this study, It means the value measured with 20 items of nursing performance evaluation based on nursing for patients with respiratory disease.

2.3 Subject and data collection

In February 2019, three clinical experts were selected from nurses with clinical experience of more than 20 years and currently performing hospital infection control tasks at general hospitals located in Gyeonggi, Daejeon, and Gumi regions. The necessity, purpose, and method of this study were explained, and an interview was conducted on the educational contents of nursing of fever patients with IRD who visited the emergency medical center, the situation of hospital infection, and the topic of hospital infection control required for education of nursing students. The learning topic was derived by collecting opinions from clinical experts and modifying the learning task based on the prior literature review and infection control standardism. From February to March 2019, an initial draft of a SBLM for hospital infection control developed based on 10 learning topics was verified through e-mail to the expert group composed of two nursing college professors, five hospital nurses with more than 5 years of clinical experience, and one respiratory clinic specialist. Preliminary lecture materials, case-based team learning materials and scenarios for operating the developed learning module, simulation guides for leaders and students, and evaluation tools were developed. As a verification of the developed SBLM, in April 2019, a nurse with 6 years of clinical experience participated as a SP for 5 of 4th grade students of the College of Nursing, and the SBLM was modified and supplemented.

2.4 Data analysis method

The collected data were analyzed as follows. The general characteristics of the subjects were analyzed as real numbers and percentages, mean and standard deviation, and arithmetic calculation was used for expert content validity index (CVI).

2.5 Research process

This study developed the SBLM in four stages of analysis, design development of the subjects were analyzed as real numbers and percentages, mean and standard deviation, and arithmetic calculation was used for expert content validity index(CVI).

- 1) In order to develop the learning task areas of the SBLM for nursing education for IRD patients, 10 learning task areas were derived through literature review and standard guidelines for hospital infection control.
- 2) The construct validity of the derived learning task area was verified through interviews with three clinical experts who perform hospital infection control tasks.
- 3) The simulation scenario and learning module for nursing contagious respiratory system patients were prepared by reflecting the literature review and opinions of clinical experts. The core skill, 'Intravenous Nursing Core Skills' suggested by the Korea Institute of Nursing Education and Evaluation, was added, and the learning goals and learning contents were written in connection with the learning outcomes.
- 4) As the learning operation method, the pre-simulation stage, the simulation stage, and the post-simulation stage were designed, and learning materials and educational media for each stage, practice guidelines and evaluation tools were selected.
- 5) For the learning operation method designed in three stages, the CVI was conducted by an expert group consisting of two nursing professors, five nurses with more than five years of clinical experience, and one respiratory internal medicine specialist, and selected items with a CVI score of 0.8 or higher, and was completed after collecting other opinions.
- 5) A nurse with 6 years of clinical experience who received SP education was selected as a SP, and with one simulation operator from the Department of Nursing at G University, the narration practice and situation of the SP were simulated in advance. The performance of SP was supplemented with the advice of a Korean theater art therapy expert.

- 6) As a verification stage of the developed learning module, a pilot operation was conducted for SP and 5 of 4th grade students from the G city-based university nursing department, and the required time and detailed progress were corrected and supplemented. The final learning module was developed by pre-and post-measurement of respiratory infection knowledge and CNP.

Learning module development	Analysis	Learning task analysis	Literature review: Validation of the learning topic Implementation of the validity of the study topic composition through interviews with clinical experts
		Learner Analysis	For 4th grade students who have completed more than 2 semesters of clinical practice
		Learning environment analysis	Structure and arrangement of lecture rooms and simulation labs, equipment and educational materials
	Design	Learning Goal Setting	Korean Nursing Association Adult Nursing Learning Goals Learning outcomes presented by the Korea Institute of Nursing Education and Evaluation
		Learning operation method design	Pre-simulation - Module 1: IRD Characteristics (PPT) - Case-based team learning (group activities and reports) Simulation stage - Module 2: Simulation learning using SP Post-simulation steps - Module 3: Debriefing (Reflection Journal)
		Selection of evaluation tool	Knowledge: IRD Patient Nursing Knowledge Skill: CNP Attitude: attendance, attire, and participation in learning
	Development	Learning material development	Lecture materials, case-based team learning materials Scenarios, Simulation Guide for Leaders and Students
		CVI verification	Expert CVI verification of learning module
	Verification	SP Education	Preliminary simulation of narration acting practice and situations in clinical practice education Expert acting guidance
		Trial operation and evaluation	Preliminary implementation for 5 of 4th graders in the Department of Nursing
		Development of final learning module	Modification and improvement of the developed SBLM

Figure 1. Module development flow for simulation practice learning

3. RESULTS

3.1 Development of learning task based on previous researches

In order to derive the learning task area of the SBLM for hospital infection control for nursing IRD patients, Respiratory diseases and hospital infection control literature were summarized at Table. 1. In summary, there are knowledge of respiratory system diseases, hand washing, mask wearing, patient and guardian mask wearing training, core nursing skills for intravenous administration, surgical aseptic operation in case of invasive treatment, disinfection of medical instruments used after treatment and disposal of consumables, linen treatment with patient secretions or vomit, isolation and parental control to prevent the spread of infection, and isolation and reporting methods for medical personnel exposed to infection.

3.2 Interview with clinical infection control nurses

The 10 derived learning task areas were interviewed with 3 clinical experts of over 20 years of clinical experience in infection control, and construct validity was conducted. The three clinical experts had 20-24 years of clinical experience in nursing, currently in charge of infection control. In the process of collecting opinions from clinical experts and constructing validity, 6 items were revised, and the results are as follows Table 2. Respiratory infection knowledge was revised to 'Contagious respiratory disease knowledge', and the opinion was suggested that '3-WAY using Side Shooting intravenous drug administration' is more appropriate for the core intravenous injection technique rather than intravenous injection for actual nursing students. The arterial blood gas analysis test, which is most frequently performed, was modified to hemostasis and nursing at the arterial puncture site, rather than the examination and nursing for various invasive treatments performed in emergency medical centers. The learning task was modified from the patient's used linen treatment to the 'infectious linen treatment' stained with the patient's feces or vomit. In the area of parental control, hospitalization is often done at emergency medical centers. Especially for patients with IRD, hospital infection control must be performed during transfer, it has been modified as a learning task for 'transfer of ward handover during transfer, infection control during transfer, education and nursing instructions for transfer personnel and nursing assistants'. In the case of exposure to infection among various medical staff of emergency medical centers, it was revised in the opinion that the quarantine and self-quarantine period of the staff, how to prevent transmission, education on disease and symptom education, etc. should be conducted, and a learning topic to report this was necessary. In addition, there was an opinion that learning should be done on how to deal with a patient's blood spilled on the floor of the hospital room, accurate information reporting to the doctor, carrying out medical instructions, and the duties of an infection control nurse. There were, however, other opinions that the level of learning is too high for nursing students.

3.3 Learner analysis

In the case of 5 of 4th grade nursing students participating in the operation stage of this study, they completed theoretical education in basic nursing, adult nursing, child nursing, women's nursing, and community nursing as well as adult nursing practice, community nursing practice, child nursing practice women nursing practice etc. The average age of the five subjects was 23.7 years (± 2.74), all female, and as for the distribution of grades, two students (40%) had a score of 4.0 or higher on a 4.5-point scale, two students (40%) had a score of 3.5 or higher, and one person (20%) had a score of less than 3.5.

3.4 Learning environment analysis

In order to analyze the learning environment, the structure and layout of the practice room of the Nursing

Department Simulation Center located in G city is checked, and the classroom, simulation laboratory, and debriefing room are equipped for case-oriented team-based learning and simulation practice using SP. Educational equipment such as beam project, video playback equipment, sound equipment, and recording equipment were checked.

Table 1. literature review on hospital infection control in nursing IRD patients

Researcher	I.Y. Kim	M.G. Cho etc.	WHO	Y.J Ji	
Subject	nurse	Emergency Medical Center Patient		nurse	Learning task initial draft
Yr. study	2013	2018	2014	2018	
Contents	standard caution				
Disease characteristics		Characteristics of disease air caution droplet caution contact caution		Characteristics of disease infection route incubation period diagnosis and treatment	Knowledge of IRD
Hand sanitizer	traditional hand hygiene	hand washing and hand sanitizer	Washing hands		Washing hands
Protective equipment	personal protective equipment	Wearing a mask	Wear personal protective equipment		Wearing a mask
Propagation path	respiratory etiquette		infection through clothing of medical personnel		Patient and caregiver wear a mask
Safe distance	patient placement				
Nursing	safe injection				core skills
Aseptic technique	Infection control during lumbar puncture				In the case of invasive treatment aseptic technique
Medical waste disposal	Therapeutic instruments and articles		Decontamination and cleaning, disinfection and sterilization of instruments		Disinfection of use medical instruments waste disposal
Linen care	linen care		Cleanliness in hospital	hospital environment	used linen treatment
Environmental management	environmental management		environmental management		
Propagation control		Visitor Restrictions			parental control
Administrative guidelines	employee safety			Infection control guidelines	Handling and reporting of medical personnel exposed to infection

3.5 Presenting of learning objective and CNP outcome

Table 3 show setting the learning goals of the SBLM, the contents of IRD patient nursing and medical infection control textbooks were reviewed. In this study, the learning goal of nursing for patients with IRD was set as ‘to be able to assess the health status of patients with IRD and perform effective nursing’.

Table 2. Construct validity of learning task

Learning task (draft)	Modification	Modified study assignments
Respiratory system infection knowledge		IRD Characteristics and Knowledge
Washing hands		Washing hands
Wearing a mask		Wearing a mask
Patient and caregiver wearing masks		Patient and caregiver wearing masks
Intravenous Injection Core Techniques		Side Shooting Intravenous Administration Nursing
Invasive treatment aseptic technique		ABGA Examination Nursing
Handling of medical devices and supplies		Disinfection and disposal of used medical instruments and tools
Treatment of used patient linen		Infectious linen treatment
Parental control		Infection control during transfer, training of nursing assistants
Reporting and handling of medical personnel exposed to infection		and nursing instructions Reporting and handling of medical personnel exposed to infection

Table 3. Learning objective for IRD nursing practice

Korea Institute of Nursing Education and Evaluation performance outcomes	Learning goal	Detailed learning goals
PO1. Nursing skills based on various knowledge of culture, major knowledge is integrated and applied to practice. PO6. Apply a nursing process based on critical thinking and practice clinical reasoning	Medical-related infection control	The concept of medical-related infections Mechanisms and pathways of medical-related infections Monitoring system for medical-related infections Role of infection control nurse
	Respiratory dysfunction patient management	Structure and function of the respiratory system Causes and Symptoms Related to Respiratory Health Problems Health status of respiratory patients Interpretation of test results for respiratory patients Nursing goals and intervention plans for respiratory patients Intervention and evaluation of respiratory health problems

3.6 Design of learning operation system

The learning operation method was designed in three stages according to the design of the simulation curriculum [9]. In the pre-simulation stage, module 1. lecture and case-based team learning were designed, and the learning material consisted of a 30-minute lecture on microbiological knowledge, pathophysiology, and disease characteristics of tuberculosis, influenza, and meningococcal diseases. In the case-based team learning, a team was formed and the contents and questions learned through the simulation cases of the above three IRD were composed to be applied to the presentation by the team and nursing. In modul 2, SBLM for hospital infection control using SP, after collecting the opinions of clinical experts and constructing validity of the

scenario, nurse administration, nursing intervention, ward transfer and infection control were included. Scenarios include handing over and checking additional patient information, wearing a patient mask, instructing medical staff and members of emergency medical centers to wear masks, reporting focused on patient symptoms and performing medical instructions, administering medication, and disinfecting medical instruments after invasive treatment such as arterial blood gas testing. Scenarios also include separation treatment, treatment of patient's vomit and linen treatment, handing over to the ward for all patients, infection education and nursing instructions for nursing assistants, and reporting and procedures for staff exposed to infection. In module 3, after watching a demonstration video as a debriefing process to help students reflect, feedback from the instructor, and cooperation and roles among team members are discussed.

3.7 Development of teaching material

Scenario outline, situation introduction and guidance for students, scenario introduction and training script for SP, and demonstration scenario script were prepared as learning materials for the nursing simulation of IRD patients using SP, and practice guidelines and evaluation tools were developed. To evaluate the achievement of learning goals, knowledge measurement of IRD and CNP were selected as evaluation tools. IRD - related knowledge measurement was developed by Kim Jung-kyung (2018) with 20 questions [10]. The CNP evaluation was selected as 10 questions based on nursing for patients with IRD and 10 self-assessment tools that students can evaluate themselves.

3.8 CVI of clinical nursing practice training simulation program

In order to confirm the suitability of the SBLM, CVI was verified by e-mail to 8 experts. CVI was made on a 5-point scale, and an average of 0.8 or higher was adopted. As an expert group, it consisted of two professors of nursing college with experience in conducting simulation education, five nurses with more than 5 years of clinical experience in the emergency room and general ward, and one surgeon of respiratory medicine at E university hospital. The average age was 42.5 years old (± 10.75). The gender was 1 male and 7 females. Table 4 shows the CVI result of experts.

3.9 Verification stage

SP Education: In order to help SP play the role of patients with respiratory system, the process and education were conducted based on the scenario for SP. Actual narration acting practice and situation for the SP's role were simulated under the guidance of a theater expert.

Trial operation and evaluation: For the pilot operation of the SBLM for hospital infection control nursing for IRD patients using SP, the pilot operation was conducted after obtaining the consent of one SP and five fourth-grade nursing students. In this stage, the appropriateness of the flow of the scenario, the operation time of each stage of the simulation, the appropriateness of the educational operation, the learning materials to be provided to the students, the simulation environment and preparation materials, and the practice movement were comprehensively evaluated. The time required for takeover was longer than expected, and it was decided to additionally learn to take over focused information in Module 1. Pre-learning. The procedure for intravenous administration and nursing was different from the actual hospital clinical practice field of the students, so the procedure was modified with the advice of a clinical expert. The practice environment was improved by additionally installing a medical waste treatment place and disposal container in the process of organizing items and treating medical devices after invasive treatment. The shortcomings in the on-site quarantine and reporting process of medical personnel who came in contact with patients with IRD were decided to

additionally learn the role of infection control nurses in the pre-learning. In addition to the SP who took on the role of a respiratory patient, the role of a doctor performing invasive treatment was additionally needed, so the simulation operator was to participate in additional modification. As an additional requirement of students who participated in the pilot operation, it is not related to this scenario, but there is an educational requirement to perform actual respiratory patient nursing after wearing protective gear in the negative pressure ward, so it was added to the contents of the previous lecture.

Evaluation and measurement results of education subjects before and after education: The knowledge level before and after education was measured using the knowledge measurement tool related to IRD developed by Kim Jung-kyung (2018). The level of knowledge of the five subjects was measured as 11.8 points before training and 15.4 points after training out of a total of 20 points. TheCNP of IRD nursing was 13.4 out of 20 points before training and 17.6 points after training. Although it is difficult to discuss statistically with 5 participants, it was found that the score increased after training.

Table 4. Result of CVI

Content	CVI	Expert opinion
Learning task	1.00	
Learner	1.00	
Learning environment	1.00	
Learning outcomes	1.00	
Learning objectives	1.00	
Learning operation method module 1	1.00	
Learning operation method module 2	1.00	
Learning operation method module 3	0.87	Lack of time for many learning tasks
Evaluation tool	0.87	Student self-assessment is not appropriate as an evaluation tool, it has been deleted
Guidebook	1.00	

4. DISCUSSION

This study was attempted to be used as basic data for nursing education for IRD patients by developing and verifying a SBLM for hospital infection control using SP that reflected the opinions of clinical experts in order to improve nursing students' ability to manage hospital infections. Infection is a case in which the symptoms are not accurate or in the latent state at the time of admission to the hospital, and the nurse collects and analyzes information. A quick judgment is important, and a disease can occur due to exposure to pathogenic microorganisms during hospitalization or within 30 days after discharge from a non-infectious patient, or disease can occur due to endogenous microorganisms that the patient already has due to reduced immunity. In this study, based on the patient information obtained during the handover process, additional information is used to determine whether the patient is contagious, and while performing hospital infection control measures,

learning tasks were dealt with the infection control which controls not only nurse herself, but also patients and their guardians, emergency medical center workers, and nursing assistants. In most nursing department curriculum, infection control is covered as a part of the curriculum, but the subjects focusing on safety and infection control are insufficient. In order to improve nursing students' attitudes, knowledge, and performance confidence in hospital infection control, it is important to develop an infection control education program for nursing students in the undergraduate course. Simulation-based hospital infection control education that can acquire clinical practice competency in undergraduate course education is important [11]. In this study, the opinions of clinical experts were collected based on the standardism of clinical cases so that they could experience learning in an integrated domain through simulation-based education to strengthen the competency integration ability of nursing students in a simulation environment. It is in line with previous studies that provide well-designed simulation education to motivate and immerse students in learning and enhance their performance in competency development [12]. Simulation practice education using SP can experience verbal and non-verbal communication that can be experienced with real patients in situations similar to clinical situations, and provides opportunities to understand and solve various problems. In this study, SP education was provided for nurses with 6 years of clinical experience, and through the acting guidance training course, clinical adaptation and reflexes to problems that could be faced in the clinic were increased. In this study, the IRD patient situation with fever, which is easily encountered in clinical situations, was set. The simulation operation time of this study is 20 minutes, which satisfies the appropriate simulation operation time standard of 15-20 minutes. As the number of students participating in the simulation education decreases, individual learning opportunities increase and the learning effect increases. Therefore, in this study, a handover process was added by setting the shift situation of the morning nurse and afternoon nurse. A study task, consisted of 5 people, was added to identify, report, and take action by afternoon nurse in which the morning nurse was exposed to infection while performing IRD patient nursing. Based on the research result that it is recommended that the debriefing time be at least twice the simulation operation time [13], twice the operation time of SBLM developed in this study was allocated for debriefing and self-reflection. Sufficient time is provided for students to recall and provide mutual feedback.

5. CONCLUSION

The simulation-based hospital infection control education program using SP in this study was developed to improve the practical ability of infection control by applying the CNP frequently experienced by nursing students in clinical practice to SP in a safe simulation environment. In addition, the field suitability was improved by reflecting the opinions and advice of clinical experts in infection control, and the competence of SP has a great influence on practice. Thus, it was developed to enhance the effectiveness of education through acting guidance and narration advice along with education of normal SP.

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