Effects of Multidrug-Resistant Organism Infection Control Simulation Program on the Infection Control Fatigue, Job Stress, and Performance of Nurses

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Abstract

Background: This study was conducted to develop a training program simulating multidrug-resistant organism infection control for nurses and to verify its effectiveness.

Method: This was a randomized, control-group, pretest-posttest design study carried out with a total of thirty-one nurses. A general lecture on theories was provided to the control group, while the developed simulation training program was implemented for the experimental group.

Result: The results showed that the experimental group who received the multidrug-resistant infection control simulation training program recorded higher infection control performance than the control group who received lecture-based training (p=.029). However, there was no statistically significant difference in infection control fatigue and job stress between the two groups.

Conclusion: It was found that the simulation training program is an effective intervention that can improve the performance of infection control. Repeated research on diverse variables is necessary in the future in order to continuously measure the effectiveness of the simulation training program.

Keywords: *MDROs, Fatigue, Job stress, Performance, Simulation training.*

Introduction

Healthcare-associated infections have steadily been on the rise due to a widespread use of invasive treatment method and an increase in multidrug-resistant organisms (MDROs)[1]. Healthcare-associated infections caused by MDROs, in particular, are known to exacerbate the medical condition of patients and even raise mortality,[2] in addition to increasing the hospitalization period and medical costs, thereby causing more financial burden on patients and their families[3].They are problematic even from the viewpoint of healthcare institutions in relation to increased costs from patient isolation, lack of space for isolation and greater workload for the medical staff to control and prevent the spread of infection[4].

Nurses taking part in the treatment of infected patients experience physical and mental burden arising from the difficulties related to wearing personal protective equipment (PPE) and managingpatients[5]. On the other hand, there are patients who believe that the medical staff is to blame for the occurrence of MDROs, which causes the relationship between such patients and the medical staff to rapidly deteriorate, and this in turn further increases mental fatigue for the medical staff[6]. When nurses nursing patients infected with MDROs the more fatigue they will experience due to increased workload such as hand hygiene and wearing PPE, and under these circumstances, they will likely have difficulty concentrating on their job and become more easily distracted, resulting in poorer job performance[7]. Therefore, in order to provide quality nursing services to patients, it is necessary to reduce the infection control fatigue experienced by nurses.

Nurses tend to experience high job stress due to the high demand for professional knowledge and skills, interpersonal conflict with patients, higher nursing quality demanded by patients, and occupational nature in

dealing with human lives[8]. Nurses who are involved in treating a patient with infectious diseases, in particular, experience emotional pain due to the idea that they themselves are responsible for the patient's infection or death and fear that they could become a medium and spread the infection to other patients[9]. The higher the job stress faced by nurses, the more difficult it is for them to provide quality nursing to patients, and it also leads to reduced productivity and work efficiency[10]. Plus,higher job stress leads to a higher chance of a burnout[8], which eventually lead to higher turnover. Therefore, it is necessary to reduce the job stress that may occur when nurses care for patients infected with MDROs.

Nurses were found to experience high stress in relation to professional expertise and PPE among other factors when nursing patients infected with MDROs. According to a study conducted by Lee[11],67.8% of nurses in small- and medium-sized hospitals have received training for MDRO infection control, while 86.1% have had experience in nursing patients with infected with MDROs. In other words, it was found that there were cases in which nurses had to care for patients infected with MDROs without having received any MDRO infection control training, and insufficient knowledge of infection control would likely have increase the level of stress they experienced. Moreover, MDRO infection control training mostly consists of lectures on theoretical knowledge, which makes it is difficult for nurses to apply the knowledge they gain in practice. Simulation training has recently been introduced in the healthcare sector, and it is known to be highly effective in allowing trainees apply the theories they have learned in lectures to clinical performance[12].

Simulation training is a method of training that helps improve the clinical competency of nurses in a safe educational environment where there is no potential harm to patients, and it is a method of training that helps cultivate comprehensive performance capacity suitable for various situations[13]. As for prior studies that examined simulation training for nurses, Lee andAhn[14] reported improved knowledge of emergency situations, clinical performance capacity, and performance confidence, and Cho et al.[1] reported that it helped enhanced the infection control performance of participating nurses.

Accordingly, this study was conducted with the aim of examining the effects of MDRO infection control training on the infection control fatigue, job stress, and performance of nurses.

Study Objectives: The purpose of this study is to determine the effects of MDRO infection control simulation training on infection control fatigue, job stress and performance of nurses. The specific objectives are as follows:

1. Verify the difference in the level of fatigue from infection control before and after MDRO infection control simulation training;
2. Verify the difference in the level of job stress from infection control before and after MDRO infection control simulation training;
3. Verify the difference in the level of infection control performance before and after MDRO infection control simulation training.

Method

Study Design: This was a randomized, control-group, pretest-posttest design study carried out with the application of an MDRO infection control simulation training program to verify its effectiveness.

Participants: The subjects in this study were nurses in a certain region who voluntarily agreed to participate in this study with an understanding of the purpose and procedure of the study. The number of samples required for the study was calculated using the G*power 3.1 program, and the number of samples required for t-test was calculated based on a significance level of .05, group number of 2, effect size of .08, and power of .80. The minimum number of samples for analysis was found to be 26 for the experimental group and 26 for the control group. Due to the outbreak of COVID-19, some of the subjects refused to participate in the study, and ultimately, there were 17 subjects in the experimental group and 14 subjects in the control group.

Measurements:

1. **Fatigue from infection control:** A total of 29 questions were asked based on a 5-point Likert scale, with the highest score indicating the highest level of fatigue. As for the reliability of the tool, Cronbach's alpha was measured to be .94.
2. **Job stress from infection control:** A total of 32 questions were asked based on a 5-point Likert scale, with the highest score indicating the highest level of job stress. Cronbach's alpha was .96.
3. **MDROinfection control performance:** A total of 16 questions were asked based on a 5-point Likert

scale, with the highest score indicating the highest level of MDRO infection control performance. Cronbach's alpha was .92.

Intervention

1. **Preliminary Survey:** Both the control group and the experimental group were asked to fill out a questionnaire on fatigue, job stress, and performance in relation to MDRO infection control without receiving any infection control training. The subjects were not given any information on whether they belonged to the control group or the experimental group.

2. **Intervention**

1. **Experimental Group:** The developed MDRO infection control simulation scenario was administered by a nurse specializing in infection control. One virtual patient, one legal guardian, and one nurse were selected, and three nurses with at least five years of experience or more at the medical institution performed the evaluation based on a checklist.

The scenario consisted of nursing activities routinely performed in the ward, such as administering medication, measuring vital signs, and emptying urine bags for MDRO patients in isolation. The checklist required the evaluators to perform evaluation on the nursing activities before entering the patient room and while in the patient room, use of PPE and hand hygiene practice when leaving the patient room, etc. After the scenario was administered, corrections were made through a 15-minute debriefing process, and manual demonstration training was conducted.

2. **Control Group:** A nurse specializing in infection control gave an hour-long lecture explaining the definition of MDRO, transmission method, and theories related to contact isolation based on a PowerPoint presentation.

3. **Follow-up Survey:** Immediately after the simulation training and lecture-based training, the same questionnaire was distributed to both the experimental group and the control group. After the final questionnaire was completed, simulation training was administered to the control group.

Statistical Analysis: The data collected were analyzed using the SPSS/WIN 21.0 program, based on the following analysis method: The test of homogeneity between the experimental group and the control group was carried out by the Chi-square test, Fisher's exact test, and Mann-Whitney U test depending on the characteristics of the variables. The hypotheses with respect to the MDRO infection control fatigue, job stress, and performance were tested using the Mann-Whitney U test.

Findings:

Characteristics of Test Subjects and Test of Homogeneity: The results of the test of homogeneity according to the general characteristics of the subjects are shown in Table 1. There were no significant differences in age, sex, affiliated department, MDRO infection control training in the past year, or prior experience in nursing an MDRO-infected patient between the control and experimental groups (Table 1). A comparison of infection control fatigue, job stress, and performance between the two groups before the simulation training program showed no significant difference between them (Table 2). As there was no significant difference between the control group and the experimental group, they were deemed homogeneous.

Table 1. General Characteristics of the Experimental and Control Groups (n=31)

Variable	Categories	Cont. (n=14)	Exp. (n=17)	U/χ^2	p
		n(%)	n(%)		
Age		31.71±10.77	34.35±7.28	-.811	.424
Sex	Male	1 (7.1)	3 (17.6)	.754	.607
	Female	13 (92.9)	14 (82.4)		
Affiliated department	Ward	9 (64.3)	10 (58.8)	.097	1.000
	Special department	5 (35.7)	7 (41.2)		

Variable	Categories	Cont. (n=14)	Exp. (n=17)	U/χ^2	p
		n(%)	n(%)		
MDRO infection control training received in the past year	Yes	3 (21.4)	8 (47.1)	2.203	.258
	No	11 (78.6)	9 (52.9)		
Prior experience in nursing an MDRO-infected patient	Yes	10 (71.4)	5 (29.4)	.003	1.000
	No	4 (28.6)	12 (70.6)		

Table 2. Test of Homogeneity Between the Experimental and Control Groups in Dependent Variables (n=31)

Variable		Cont. (n=14)	Exp. (n=17)	U	p
		M±SD	M±SD		
Infection control fatigue	Pre-test	3.37±.53	3.56±.43	116.5	.922
Infection control job stress	Pre-test	3.55±.58	3.66±.57	103.0	.544
Infection control performance	Pre-test	4.15±.44	4.42±.34	72.0	.064

Effects of MDRO Infection Control Simulation Training Program: Hypothesis 1: The hypothesis that the "experimental group receiving simulation training will experience lower infection control fatigue than the control group receiving lecture-based training" was tested, and the results showed no statistically significant difference, with the experimental group recording 3.40±.49 and the control group 3.45±.51 (U=109.5, *p*=.710). Therefore, Hypothesis 1 was not supported.

The hypothesis that the "experimental group receiving simulation training will experience lower infection control job stress than the control group receiving lecture-based training" was tested, and the results showed no statistically significant difference, with the experimental group recording 3.62±.58 and the control group 3.50±.54 (U=92.0, *p*=.297). Therefore, Hypothesis 2 was not supported.

Hypothesis 3: The hypothesis that the "experimental group receiving simulation training will exhibit better infection control performance than the control group receiving lecture-based training" was tested, and the results showed no statistically significant difference, with the experimental group recording 4.60±.32 and the control group 4.18±.54 (U=64.0, *p*=.029). Therefore, Hypothesis 3 was not supported.

Table 3. Differences between the Control and Experimental Groups in the Variables Examined After Simulation Training (n=31)

Variable	Cont. (n=14)	Exp. (n=17)	U	p
	M±SD	M±SD		
Infection control fatigue	3.45±.51	3.40±.49	109.5	.710
Infection control job stress	3.50±.54	3.62±.58	92.0	.297
Infection control performance	4.18±.54	4.60±.32	64.0	.029

Table 4. Differences in the Variables Examined before and After the MDRO Infection Control Simulation Training (n=31)

Variable	Group	Pretest	Posttest	Pre-post Difference	U	p
		M±SD	M±SD	M±SD		
Infection control fatigue	Con. (n=14)	3.37±.53	3.45±.51	.08±.22	109.5	.710
	Exp. (n=17)	3.56±.43	3.40±.49	.04±.49		

Variable	Group	Pretest	Posttest	Pre-post Difference	U	p
		M±SD	M±SD	M±SD		
Infection control job stress	Con. (n=14)	3.55±.58	3.50±.54	-.04±.30	98.5	.421
	Exp. (n=17)	3.66±.57	3.62±.58	-.04±.55		
Infection control performance	Con. (n=14)	4.15±.44	4.18±.54	.04±.38	91.0	.279
	Exp. (n=17)	4.42±.34	4.60±.32	.18±.46		

Discussion

This study was conducted with the aim of developing an MDRO infection control simulation training program and verifying its effectiveness. With homogeneous experimental and control groups, the MDRO infection control simulation training program was administered to the former. The results of verifying the MDRO infection control fatigue showed that it decreased by 0.16 points from 3.56 points to 3.40 points, on average, for the experimental group, while it increased by 0.08 points from 3.37 points to 3.45 points for the control group. However, the difference was not statistically significant. Even in the case of job stress, it decreased by 0.04 points from 3.66 points to 3.62 points, on average, for the experimental group, and it decreased by 0.05 points from 3.55 points to 3.50 points for the control group. The difference was not statistically significant. Although it is difficult to compare the changes in the levels of infection control fatigue and job stress resulting from the simulation training intervention, as there have not been prior studies examining these two variables, it is believed that it would be difficult to directly reduce infection control fatigue and job stress with short-term training. In this study, infection control fatigue and job stress were evaluated immediately after the application of the simulation training program, which is thought to be too short to truly evaluate the effectiveness of the training program on these two variables. It is predicted that it will be better to compare the changes in the infection control fatigue and stress before and after the application of the intervention program while allowing the participating nurses actually apply what they have learned in the clinical setting for some time. Thus, it is suggested that a re-evaluation be performed 4 to 8 weeks after the simulation training program intervention.

The infection control performance was verified after applying the MDRO infection control simulation training program, and the results showed it increased by 0.18 points from 4.42 points to 4.60 points for the experimental group, and it increased by 0.3 points from 4.15 to 4.18 points for the control group. The difference between the two groups was found to be statistically significant. This was similar to the findings reported by Cho et al.[1] that infection control performance was enhanced after simulation training, while there was no difference in the infection control awareness and self-efficacy. The results were similar to the findings reported by Lee and Ahn[14] in regard to their study on nurses.

Simulation training helps trainees synthesize and apply knowledge rather than simply acquiring knowledge[15]. It is believed that the subjects in this study exhibited enhanced performance by affirming and applying the knowledge they had previously learned in theoretical education on MDROs through simulation.

Based on these results, it is believed that it will be effective to use the simulation training method to improve the MDRO infection control performance of nurses. Going forward, it will be necessary to develop various scenarios and repeat this research in order to understand the effects of simulation using a control group. It will also be necessary to evaluate infection control fatigue and job stress 2 to 4 weeks after training in order to evaluate the effectiveness of the simulation training program in an ongoing manner.

Conclusion and Recommendations

In this study, a simulation training program was developed and applied, and the differences in infection control fatigue, job stress, and performance between the experimental group and the control group after the application of the MDRO infection control simulation training program were examined. The results showed that the simulation training program is an effective intervention for improving infection control performance. In order to continuously measure the effectiveness of simulation training in the future, it will be necessary to conduct this research repeatedly on various variables.

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Conflict of Interest: None

Ethical Clearance: This research has ethical clearance from the Institutional Review Board of Konyang University (KYU-2020-030-01).

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