Factors Influencing Disaster Nursing Competency of Nursing Students[*]

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Ⅰ. INTRODUCTION

The term disaster refers to an event that can cause damage to facilities, serious economic loss, casualties, human health hazards, and deterioration of community health service conditions (American Medical Association, 2012). In recent years, such disasters have been occurring frequently and have gradually shown large-scale, long-term, and intensive trends. A total of 40.7% of the natural disasters in 2013 occurred in Asia, and the area has been severely affected by economic loss and casualties (Guha-Sapir, Hoyois, & Below, 2015). South Korea has also suffered catastrophic disasters, namely the sinking of the Jindo passenger ship [Sewol Ferry] in 2014, the Middle East respiratory syndrome outbreak in 2015, and the 5.8-magnitude earthquake that occurred in Gyeongju in 2016. Natural disasters can cause both tremendous human and material damage and the infrastructure of the country may be seriously damaged and the safety of the people may be threatened. Comprehensive disaster management is required to establish and implement countermeasures for these disasters (Jung & Yang, 2019).

Disaster nursing involves the systematic use of specialized knowledge and skills to reduce the risk to a person's life and health due to disasters (Jennings-Sanders, Frish, & Wing, 2005). When a disaster occurs, the demand for medical care for patients increases, as does the need for a nursing workforce. Nurses play a very important role in disasters as early responders, disaster triage and first aid providers, and mental health counselors (Cusack, Arbon, & Ranse, 2010). In disaster

nursing, nursing care is provided to patients by systematically using professional knowledge and skills to reduce the threat to life and health risks caused by a disaster (Jennings-Sanders, Frish, & Wing, 2005). However, the disaster area is a completely different environment from the clinical department; care is provided in a harsh situation with few resources and compromised facilities. Therefore, it is necessary to strengthen disaster response capability through systematic education and training. It is crucial that nursing students be able to act as a substitute workforce in a disaster and to serve as disaster nurses after graduation.

The term competence refers to a combination of cognition, attitudes, and skills that can be improved through education and training (Parry, 1996). Disaster nursing competency refers to the ability to provide nursing care effectively to disaster victims using the necessary knowledge and skills (World Health Organization and International Council for Nurses, 2009). The World Health Organization and the International Council for Nurses developed a framework of disaster nursing competencies that presents each nursing activity according to the stage of the disaster, with the goal of improving nurses' overall capacities in this area (World Health Organization and International Council for Nurses, 2009).

According to rational emotive behavior therapy, cognition affects emotion and behavior, emotion affects thinking and behavior, and cognition plays a central role. It is also assumed that human behavioral changes result from cognitive change or restructuring (Park, 2007). This implies that an educational approach based on personal and psychological factors, which can be controlled and controlled by individuals, is effective for enhancing disaster nursing capacity in the clinical field. Therefore, in order to improve disaster nursing competency, disaster nursing education programs at universities should include disaster nursing knowledge and disaster preparedness attitudes, which are cognitive and emotional factors. International organizations such as the World Health Organization and the International Council for Nurses have suggested that undergraduate nursing school graduates are not adequately prepared for disaster relief activities and emphasize that disaster nursing should be included in the nursing education curriculum.

In recent years, disaster management plans and simulation training have been developed, based on the standards of the Korea Institute for Healthcare Accreditation, and large hospitals are now required to conduct periodic disaster drills (Korea Institute for Healthcare Accreditation, 2014). In addition, the Ministry of Health and Welfare has been promoting disaster preparedness through the publication of the Disaster Emergency Medical Emergency Response Manual, which outlines the structure and activities of the disaster medical assistance team (Ministry of Health and Welfare, 2016).

In a previous study on disaster nursing knowledge and disaster preparedness attitudes, it was found that emergency room nurses were more aware of the need for disaster management and more positive about participation in education and training than nurses in other wards (Nilsson, et al., 2016). A study on medical personnel found that the majority of respondents were positive about disaster management, recognizing their ability to identify disaster management plans for their institutions (Naser & Saleem, 2018). However, nursing students' knowledge and skills

specifically in disaster nursing, understanding of the nurses role during disasters, and knowledge of disaster preparedness were found to be inadequate. They also lack experience in disaster drills, and their level of competency varies by level of academic training (Cusack, Arbon, & Ranse, 2010; Jennings-Sanders, Frish, & Wing, 2005).

Despite extensive need and demand, existing education programs in South Korea do not meet the needs of nursing students with regard to disaster nursing training, and there are very few studies that have examined the ability to respond to a disaster among nursing students (Lee, 2014). Only the degree of attitudes or awareness of disaster has been confirmed, and few studies have investigated the effects of disaster nursing knowledge and disaster preparedness attitudes on disaster nursing competency. Therefore, this study aimed to provide basic data for the development of disaster nursing education programs by analyzing disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency among nursing students, who should play an important role in disaster response and management.

Ⅱ. METHODS

1. Aims

This study aimed to examine the relationships among disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency and to analyze the factors influencing disaster nursing competency among nursing students.

2. Design

This was a cross-sectional descriptive study that used data from a structured questionnaire to assess the relationships among disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency among nursing students.

3. Participants

Using convenience sampling, nursing students of 3 universities in G City and J Province were invited to complete the survey. Sample size was estimated based upon estimated power and effect size and recruitment feasibility. To verify the statistical power of our sample size, we used G*Power software version 3.1.2 (Faul, Erdfelder, Buchner, & Lang, 2009). The sample size required for the multiple regression analysis was 274 according to the following parameters: the number of independent variables = 14, power = 95%, and effect size = 0.15. After considering an estimated response rate of 80%, surveys were sent to a total of 330 nursing students, and 306 responded.

4. Data collection

Of the 330 nursing students invited to participate in the survey, 306 completed the questionnaire (response rate of 92.7%), and their data were used in the analysis. Before distributing the questionnaire, the research team described the study's purpose and provided instructions on how to complete the questionnaire and consent forms. The survey was conducted in May and June of 2019.

5. Measures

1) Participant characteristics

The questionnaire included 14 items on participant characteristics that were disaster-related. The participant characteristics examined in the study were gender, year level, religion, disaster experience, disaster education experience, disaster training experience, first-aid training experience, disaster nursing education needs, disaster area experience, medical service experience, disaster severity awareness, and importance of disaster education.

2) Disaster nursing knowledge

Disaster nursing knowledge was measured using the same methods as those used by Park and Kim (2017). The scale used consisted of 10 true or false questions on the disaster management system, triage, first aid for trauma, personal protective equipment, toxins and pollutants removal, and nerve agents. Each response was scored as 1 (correct) or 0 (incorrect). The total scores ranged from 0 to 10. Higher scores indicate higher levels of disaster nursing knowledge. The Kuder-Richardson Formula-20 (KR-20) in this study was 0.66 and 0.66 in Park and Kim's (2017) study. KR-20 is a type of reliability used when there are correct and incorrect answers.

3) Disaster preparedness attitudes

Disaster preparedness attitudes were measured using the same methods as those used by Park and Kim (2017). There were 11 item on disaster management, disaster preparedness plan and personnel in disaster management. Participants were asked to indicate the extent of their agreement with each statement on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for each item. Cronbach's α was 0.77 in this study and 0.76 in Park and Kim's (2017) study.

4) Disaster nursing competency

Disaster nursing competency was measured using the same methods as those developed by Noh (2010) and modified by Ahn and Kim (2013). A questionnaire consisting of 15 items was used. Participants were asked to indicate the extent of their agreement with each statement on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for each item. Cronbach's α was 0.95 in this study and 0.90 in Ahn and Kim's (2013) study.

5) Ethical considerations

The institutional review boards of institutions that the authors belonged to approved this study (IRB NO. 201901-SB-003). The research team conducted the study in accordance with the Declaration of Helsinki. Informed and signed consent forms were obtained from all participants after the purpose, and procedure of the study had been explained and after they had been told that participation was voluntary and that their demographic information would be confidential. Participants were reminded that they could cease participation at any time during the study if they felt uncomfortable with the process.

6) Data analysis

The data were analyzed using SPSS WIN 24.0 (IBM, Armonk, NY, USA). The research team completed a descriptive analysis of participant general characteristics using means and standard deviations. Disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency were described using means and standard deviations, and the reliability of the research tools was verified with Cronbach α coefficients. Differences in disaster nursing competency according to participant

general characteristics were analyzed using independent t-tests and one way analyses of variance. Scheffe post hoc tests were performed to identify differences in disaster nursing competency by participant characteristics. Pearson correlation coefficients were generated to identify correlations among disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency.

A multiple regression analysis was performed to identify the predictors of disaster nursing competency.

Ⅲ. RESULTS

1. General characteristics of participants

The general characteristics of the 306 nursing students are summarized in Table 1. Most were female (85.9%), 114 (37.3%) were in their second year of nursing school, and 203 (66.3%) did not have a religion. 186 (60.8%) did not have disaster experience, 227 (74.2%) had disaster education experience, and 177 (57.8%) had disaster training experience. The majority of the participants (78.8%) had first-aid training experience, and 299 (97.7%) reported needing disaster education. Two hundred seventy-two (88.9%) did not have disaster area experience, and 211 (69%) did not have medical service experience. Of all the participants, 5.2% reported low awareness of disaster severity, 13.4% moderate awareness, and 81.4% high awareness. For the importance of disaster education, 10.5% reported having moderate awareness, 36.3% reported having high awareness, and 53.3% reported having very high awareness.

A comparison of nursing students' disaster nursing competency by general characteristics is provided in Table 1. There were statistically significant differences in disaster nursing competency according to year level (F=13.64, $p<.001$), disaster training experience (t=2.01, $p=.045$), first-aid training experience (t=3.10, $p=.002$), disaster area experience (t=2.03, $p=.044$), medical service experience (t=3.27, $p=.001$), and disaster severity awareness (F=3.92, $p=.021$).

2. Level of nursing students' disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency

The mean scores of nursing students' disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency are summarized in Table 2. The mean score of disaster nursing knowledge was 5.44 (SD=1.68). The mean score of disaster preparedness attitudes was 4.29 (SD=0.46). The mean score of disaster nursing competency was 2.84 (SD=0.78).

3. The relationships among nursing students' disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency

The relationships among nursing students' disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency are presented in Table 3. The variable that significantly related to disaster nursing competency was disaster nursing knowledge (r=.23, $p<.001$). Disaster nursing knowledge positively related to disaster preparedness attitudes (r=.11, $p=.048$).

Table 1. General Characteristics of Participants in Disaster Nursing Competence　　　　　(N=306)

Characteristics	Category	n(%)	Mean(SD)	t/F	p (Scheffé)
Gender	Male	43(14.1)	2.93(0.87)	0.79	.432
	Female	263(85.9)	2.82(0.77)		
Year level	2nd[a]	114(37.3)	2.59(0.73)	13.64	<.001 a,b<c
	3rd[b]	92(30.0)	2.84(0.79)		
	4th[c]	100(32.7)	3.13(0.74)		
Religion	Yes	103(33.7)	2.87(0.78)	0.44	.661
	No	203(66.3)	2.82(0.79)		
Disaster experience	Yes	120(39.2)	2.91(0.76)	1.29	.200
	No	186(60.8)	2.79(0.80)		
Disaster education experience	Yes	227(74.2)	2.89(0.78)	1.81	.071
	No	79(25.8)	2.70(0.78)		
Disaster training experience	Yes	177(57.8)	2.91(0.80)	2.01	.045
	No	129(42.2)	2.73(0.76)		
First aid training experience	Yes	241(78.8)	2.91(0.77)	3.10	.002
	No	65(21.2)	2.57(0.78)		
Disaster nursing education needs	Yes	299(97.7)	2.84(0.79)	0.20	.845
	No	7(2.3)	2.78(0.79)		
Disaster area experience	Yes	34(11.1)	3.09(0.75)	2.03	.044
	No	272(88.9)	2.81(0.78)		
Medical service experience	Yes	95(31.0)	3.05(0.83)	3.27	.001
	No	211(69.0)	2.74(0.74)		
Disaster severity awareness	Low	16(5.2)	2.45(0.91)	3.92	.021
	Moderate	41(13.4)	2.65(0.60)		
	High	249(81.4)	2.90(0.79)		
Importance of disaster education	Moderate	32(10.5)	2.79(0.75)	0.23	.798
	High	111(36.3)	2.81(0.68)		
	Very high	163(53.2)	2.87(0.78)		

Table 2. Level of Disaster Nursing Knowledge, Disaster Preparedness Attitudes and Disaster Nursing Competency　　　　　(N=306)

Variables	Mean(SD)	Min	Max	Item Range
Disaster nursing knowledge	5.44(1.68)	0.00	9.00	0-10
Disaster preparedness attitudes	4.29(0.46)	2.91	5.00	1-5
Disaster nursing competency	2.84(0.78)	2.49	4.64	1-5

Table 3. Correlations among Disaster Nursing Knowledge, Disaster Preparedness Attitudes and Disaster Nursing Competency　　　　　(N=306)

Variables	Disaster nursing knowledge	Disaster preparedness attitudes	Disaster nursing competency
	r(p)	r(p)	r(p)
Disaster nursing knowledge	1		
Disaster preparedness attitudes	.11(.048)	1	
Disaster nursing competency	.23(<.001)	.01(.934)	1

4. Regression analysis predicting disaster nursing competency

Table 4 presents the predictors of disaster nursing competency found by the multiple regression analysis. All conditions for regression analysis were satisfied: tolerance and the variance inflation factor statistics were computed to determine the extent of multicollinearity among the independent variables. The hypothetical result of the multiple regression analysis was satisfied by a Durbin-Watson statistic result of 1.957, and a variance inflation factor of 1.08 to 1.54, which confirmed that multicollinearity was not a problem in the model.

The multiple regression analysis used to identify the influencing factors of the participants' disaster nursing competency showed that some of the general characteristics, disaster nursing knowledge, and disaster preparedness attitudes of the participant had a significant effect on disaster nursing competency ($F=6.53$, $p<0.001$) (Table 4). To identify the factors that influenced disaster nursing competency, a multiple regression analysis was conducted that included disaster nursing knowledge, disaster preparedness attitudes, year level, disaster training experience, first-aid training experience, disaster area experience, medical service experience, and disaster severity awareness. The multiple regression analysis revealed that about 17% of the variation in the participants' disaster nursing competency was explained by second-year student level ($\beta=-.26$, $p<.001$), third-year student level ($\beta=-.13$, $p=.046$), disaster nursing knowledge ($\beta=.14$, $p=.011$), disaster severity awareness ($\beta=.15$, $p=.007$).

Ⅳ. DISCUSSION

The purpose of this study was to provide basic data for the development of disaster nursing education programs by analyzing the factors influencing disaster nursing competency among nursing students. In this study, disaster nursing knowledge level was slightly lower than the results for nurses using the same tools (Park, & Kim, 2017), and are similar to those for nursing students using the same tools (Cho, 2018). In this study, the disaster nursing knowledge tool was developed for nurses; therefore, a simple comparison was difficult. However, nursing students' knowledge level of disaster nursing was moderate at 10 points. Previous studies have suggested that in order to improve students' knowledge of disasters, education strategies that include realistic depictions of disaster situations are necessary (Kang & Piao, 2014; Lee, 2014; Park, & Kim, 2017). Harkrider et al. (2012) reported that case based learning can effectively improve knowledge. Aluisio et al. (2016) showed that nursing trainees' knowledge improved through case based simulation training in disaster preparedness education. Taken together, these two studies suggest that the acquisition of disaster nursing knowledge can be enhanced through the process of solving case problems. Disaster education programs that employ case-based learning will allow nursing students to have indirect experience of disasters and effectively improving their disaster nursing knowledge.

In the present study, nursing students' disaster preparedness attitudes were very positive (4.29±0.46 out of 5 points). Park and Kim (2017) found similar results in their study, which used the same tools for nurses. Jennings-Sanders, Frisch, and Wing (2005) found that their educational needs should be considered in order to better understand the

disaster situation. In a study by Kang, Uhm, and Nam (2012), the demand for disaster nursing education of nursing college students was high, but the curriculum of the university did not fulfill this demand. Woo, Yoo, and Park (2015) reported that nursing students in South Korea have primarily low levels of disaster preparedness. The recent and rather frequent disasters have been a major challenge for nurses; therefore, the preparation of disaster nursing personnel to take charge during disasters is necessary (Ann, Keum, & Choi, 2011).

Nurses must accurately understand their own roles; be able to adapt their knowledge, skills, and abilities to the disaster situation; and be able to inform other disaster responders of what they can do to help. Competencies such as these are critical for effective and efficient disaster relief activities as they could promote smooth coordination among health-care professionals. Alim, Kawabata, and Nakazawa (2015) reported that virtual training methods were effective in improving disaster preparedness attitudes in nursing students, and Jose and Dufrane (2013) found similar results for high

fidelity simulators and virtual simulations. Therefore, it is essential to develop curriculum-based, hands-on training in order to improve nursing students' disaster preparedness attitudes. Disaster nursing education programs using technology such as smartphone applications and virtual reality programs that can be easily accessed are considered to be effective in improving disaster nursing competency among nursing students.

In the present study, the degree of disaster nursing competency of nursing students was 2.84 ± 0.70 out of 5 points. These results were higher than those of Chan et al. (2010) for Hong Kong nursing students, and were similar to those of Ahn and Kim (2013) using the same tools for domestic nursing students. The items with the highest nursing competency scores were "I know general coping strategies in the event of disaster" and "I know about the roles of medical staff in the event of disaster." These results are likely due to the fact that the students learned about first aid through clinical practice experience, including emergency nursing or emergency room training, even if they had not taken a disaster nursing course.

Table 4. Factors Influencing Disaster Nursing Competency (N=306)

Variable	B	SE	β	t	p
(Constant)	2.789	0.45		6.24	<.001
Disaster preparedness attitudes	−0.09	0.10	−.05	−0.92	.360
Disaster nursing knowledge	0.07	0.03	.14	2.56	.011
Grade (2nd)[*]	−0.42	0.11	−.26	−3.94	<.001
Grade (3rd)[*]	−0.22	0.11	−.13	−2.01	.046
Disaster training experience (No)[*]	−0.11	0.09	−.07	−1.25	.211
First aid training experience (No)[*]	−0.13	0.11	−.07	−1.19	.237
Disaster area experience (No)[*]	−0.18	0.14	−.07	−1.28	.202
Medical service experience (No)[*]	−0.15	0.10	−.09	−1.55	.121
Disaster severity awareness	0.22	0.08	.15	2.73	.007
R^2=.17, Adj. R^2=.14, F=6.53, p<.001					

[*]Dummy variable; Variables included in stepwise method: grade, disaster training experience, first aid training experience, disaster area experience, medical service experience, disaster severity awareness

The items with the lowest nursing competency scores were "I know the procedure of documenting the contents of the provision of nursing care in case of disaster," and "I know the procedure of delivering the information of the client in case of a disaster to other medical staff and related persons." The results of previous studies and the present study provide evidence of the importance of knowledge, skills, thinking ability, and interpersonal abilities in problem-solving and critical thinking in disaster nursing. More emphasis should be placed on disaster nursing education to promote familiarity with the disaster preparedness plan of the institution and community (Nakajima, Owatari, & Okumura, 2013).

Disaster nursing competency according to general characteristics was significantly different by year level, first-aid training experience, disaster training experience, disaster area experience, medical service experience, and disaster severity awareness. In other words, there was higher disaster nursing competency among fourth-year students compared with second- and third-year students. The results of the present study were similar to those of Kim (2015), who showed high levels of disaster nursing knowledge and disaster nursing skill scores in students who took emergency and disaster nursing coursework. Systematic disaster education is essential for nursing students, who will play an important role in disaster response and management.

In terms of the correlation of variables, disaster nursing knowledge showed a statistically significant positive correlation with disaster preparedness attitudes and disaster nursing competency. This is consistent with the findings of previous studies that showed a link between higher disaster nursing competency and higher knowledge of disaster nursing (Ahn & Kim, 2013; Kim, 2015; Noh, 2010). Therefore, it is necessary to develop and apply various methods such as audiovisual materials and simulation exercises to enhance the linkage between disaster nursing knowledge and disaster nursing competency.

In the present study, factors affecting disaster nursing competency were identified as disaster training experience, first-aid training experience, disaster area experience, medical service experience, disaster severity awareness. These variables explained 17% of the variance in disaster nursing competency. In the study by Kim (2015), disaster education experience and disaster readiness were presented as factors influencing disaster nursing performance ability.

It is necessary to develop a disaster education program specifically for nursing students. An education program using different practical case scenarios may maximize the effects of learning (Lee, 2014). Lee (2014) showed that disaster-related nursing competency was high in individuals who had completed courses or other training on disaster-related subjects. In particular, practical training in disaster nursing education is important because disaster nursing performance is higher in individuals who have received practical training compared with those who have not.

Case-based small group learning is a teaching- learning strategy that is known to improve the effectiveness of education by stimulating learner participation in learning activities, rather than relying on one way communication from education providers (Aluisio et al., 2016). The method is known to be effective in enhancing learners' knowledge, attitude, and performance by inducing their active participation in learning (Aluisio et al.,

2016).

The findings of the present study and previous studies emphasize the need to develop a standardized disaster nursing education program to foster nursing students' ability to perform disaster nursing (Park, & Kim, 2017). It is necessary to develop a standardized disaster nursing education program that utilizes teaching methods such as case-based learning that reflects disaster-related experiences.

1. Limitations

This study had some limitations. First, the data were collected from self-administered questionnaires, which might have created limitations. Second, this study was cross-sectional, and causal relationships could not be inferred. We suggest conducting longitudinal and follow-up studies on nursing students in different grades, genders, and regions to investigate the correlations among disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency. In addition, there were limitations to the validity and reliability of the tools used in this study.

Ⅴ. CONCLUSION

This study investigated the relationships among nursing students' disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency. And analyzed the factors influencing disaster nursing competency. Results indicate a need to improve nursing students' disaster nursing knowledge, and highlight the importance of positive experiences on disaster nursing. Based on this study, it is necessary to develop disaster nursing education programs that employ various methods, such as

case-based learning and mock-situation training, that can offer realistic depictions of disaster situations in order to nurture nursing students' ability to perform disaster nursing. These efforts may increase nursing students' care abilities and interest regarding disaster nursing competency.

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ABSTRACT

Factors Influencing Disaster Nursing Competency of Nursing Students[*]

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Purpose: This study examined the relationships among disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency among nursing students by identifying the predictors of disaster nursing competency. **Methods:** The study participants were 306 nursing students in the nursing departments of 3 universities located in G City and J Province. The data was analyzed using descriptive statistics, t-test, analysis of variance, the Pearson correlation coefficient, and multiple regression analysis. **Results:** The participants' scores for disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency were 5.41±1.68, 4.29±0.46, and 2.84±0.78, respectively. Disaster nursing knowledge, disaster preparedness attitudes, and disaster nursing competency exhibited positive correlations. The factors influencing disaster nursing competency among nursing students included disaster nursing knowledge, disaster preparedness attitudes, year level, disaster training experience, first-aid training experience, disaster area experience, medical service experience, and disaster severity awareness. These variables explained 17% of the variance in disaster nursing competency. **Conclusion:** Disaster nursing knowledge and disaster preparedness attitudes was positively related to disaster nursing competency. The findings of this study indicate that it is important to develop and apply education programs aimed at increasing disaster nursing knowledge and enhancing disaster preparedness attitudes among nursing students to improve nursing students' disaster nursing competency.

Key words : Disaster, Knowledge, Attitudes, Competence