Original article

Factors influencing disaster nursing core competencies of emergency nurses

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ABSTRACT

Background: Emergency nurses are expected to provide required nursing services by using their professional expertise to reduce the risk posed by disasters. Thus, emergency nurses' disaster nursing core competencies are essential for coping with disasters. The purpose of the study reported here was to identify factors influencing the disaster nursing core competencies of emergency nurses.
Methods: A survey was conducted among 231 emergency nurses working in 12 hospitals in South Korea. Data were collected on disaster-related experience, attitude, knowledge, and disaster nursing core competencies by means of a questionnaire.
Results: In multiple regression analysis, disaster-related experience exerted the strongest influence on disaster nursing core competencies, followed by disaster-related knowledge. The explanatory power of these factors was 25.6%, which was statistically significant ($F = 12.189, p < 0.001$).
Conclusions: These findings indicate that the disaster nursing core competencies of emergency nurses could be improved through education and training programs that enhance their disaster preparedness. The nursing profession needs to participate actively in the development of disaster nursing education and training programs.

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1. Introduction

The frequency of disasters and the severity of the resulting damage are gradually increasing in contemporary society. Along with damage caused by natural disasters, such as earthquakes, floods, and typhoons, the amount of damage caused by man-made incidents resulting from the development of human civilization is also increasing markedly (Giarratano, Savage, Barcelona-deMendoza, & Harville, 2014).

The Great East Japan Earthquake in March 2011 was one of the worst natural disasters in this century, and the cost of its damage is estimated to be about 235 billion dollars, which is 60% of the total damage caused by natural disasters throughout the world since 1994 (Kim, 2011; Zhang, 2011). Meanwhile, in Korea, 295 lives were lost and nine people remained missing following the sinking of the Sewol Ferry in 2014, which is remembered as one of the worst man-made calamities ever in the country (The Korea Herald, 2015).

The range of recent disasters worldwide has led to change in disaster policies, raising the need to improve nurses' competencies in disaster response (Loke & Fung, 2014; Yamamoto, 2013). For example, the 9/11 terrorist attack in the U.S. triggered discussions on roles and situations for coping with mass disasters, and there has been recognition of the need to educate and train health care workers, including nurses, in preparation

against mass attacks (Gebbie & Qureshi, 2002; Williams, Nocera, & Casteel, 2008; Wisniewski, Dennik-Champion, & Peltier, 2004). When a disaster occurs, nurses should be able to assess and meet patients' care needs and to utilize available resources in collaboration with other professionals. Accordingly, they should be equipped with knowledge and abilities to keep themselves safe from disasters, and they need to develop disaster nursing core competencies to carry out nursing activities during and after a disaster (Gebbie & Qureshi, 2002). With this urge to develop a set of core competencies for disaster nursing, the International Council of Nursing (ICN) launched a framework of disaster nursing competencies in 2009 World Health Organization and International Council of Nurses (WHO & ICN, 2009). The framework consists of four areas corresponding to the four stages of a disaster (prevention, preparedness, response, and recovery states) and a total of 130 items by which nurses play numerous and multiple vital roles in disaster care and management (WHO & ICN, 2009).

Nurses' disaster core competencies may vary according to their discretionary judgment, personal and family safety, and clinical competency, as well as the situation (Gebbie & Qureshi, 2002; Klein, 2006; Rolls & Thompson, 2007). Moreover, belief that they are thoroughly prepared for disaster situations has been found to increases nurses' confidence in disaster response (Chapman & Arbon, 2008). To acquire disaster core competencies, nurses need knowledge and skills related to disasters and an attitude of disaster preparedness (Fatma, 2014). According to previous studies (Ahn & Kim, 2013; Baack & Alfred, 2013), nurses' disaster

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core competencies are significantly correlated with disaster-related experience, and knowledge.

However, despite previous research and efforts to improve disaster nursing core competencies through education, many studies have reported that most nurses remain inadequately prepared for disaster and lack confidence in their abilities to respond to disaster (Baack & Alfred, 2013; Fung, Lai, & Loke, 2009; Fung, Loke, & Lai, 2008; Loke & Fung, 2014; Whetzel, Walker-Cillo, Chan, & Trivett, 2013). This suggests that education and training in disaster nursing remain insufficient. Therefore, it is essential to identify the factors that influence disaster nursing core competencies so that effective nurses' education and training programs about disaster may be developed and provided in more efficient ways to prepare nurses for disaster. In particular, as the ED is the first place where patients are admitted, examined, and treated in a disaster, factors affecting the core competencies of emergency nurses providing nursing services to such patients using their professional expertise to reduce the risk posed to life and health in this context may be informative (Hammond, Arbon, & Gebbie, 2011; Whetzel et al., 2013). Therefore, this study aimed to enhance understanding of emergency nurses' disaster core competencies.

2. Methods

2.1. Design and participants

This descriptive cross-sectional study aimed to identify factors influencing emergency nurses' disaster core competencies. A self-report questionnaire survey was conducted among emergency nurses working at hospitals with 200 or more beds in Seoul, Gyeonggi-do, Busan, and Incheon in Korea from April to May 2015. When estimated using G*Power 3.1 with a significance level of 0.05, power of 0.80, and effect size of 0.15, the minimum sample size required was 150 (Faul, Erdfelder, Lang, & Buchner, 2007). In consideration of potential dropouts, this study sampled 235 emergency nurses.

3. Measures

3.1. Participants' general characteristics

Demographic information (sex, age, length of work experience in total and as an emergency nurse, current position, education level, and salary) and hospital information (grade of ED and number of beds) were gathered using a self-report questionnaire.

3.2. Disaster-related experience

This was measured using the Nurses' Experiences of Disaster scale developed and tested for nurses by Nho (2010). This scale consists of seven yes/no questions related to various disaster experiences: four questions on disaster education/training, two on field of disaster recovery, and one on disaster nursing. The content validity of this dichotomous scale was rated (1: "Not relevant"; 4: "Very relevant") by a professor of nursing and an ED head nurse in this study. The content validity index (calculated as the ratio of the number of items assigned 3 or 4 points to the total number of items assessed by two experts) of the scale was 0.90. One point was assigned for an item if an individual had experienced that item and 0 if an individual had not experienced that item. Therefore, the total score ranged from 0 to 7. A high score indicates considerable disaster-related experience. The Kuder-Richardson 20 (KR 20) coefficient (a measure of reliability) of this scale was 0.765 in a preliminary survey among 12 emergency nurses, and 0.840 in this study.

3.3. Disaster-related attitude

This was measured using the Attitudes toward Disaster Management scale developed and tested for health care workers by Moabi

(2008), which contains 11 items related to the attitudes toward disaster preparedness. This scale includes five items related to the need for disaster preparedness in a hospital, and six items related to disaster management. The scale was translated into Korean and verified by back-translation for use in this study. The translated tool consists of 11 items and its content validity was rated by a professor of nursing and an ED head nurse in this study. The content validity index (CVI) of the scale according to the two experts was 0.82.

The original scale contained agree/disagree dichotomous questions, but this study required participants to indicate their degree of agreement with each item on a 4-point Likert scale ranging from "not at all" (1) to "absolutely yes" (4). The total score ranged from 11 to 44. A high score indicated that the respondent had insight into disaster management. Cronbach's α of this scale was 0.764 in a preliminary survey among 12 emergency nurses, and 0.756 in this study.

3.4. Disaster-related knowledge

This was measured using the Nurses' Knowledge about Disaster scale developed by the authors based on a review of previous studies. This scale consists of 10 yes/no items, namely two about the relevant hospital disaster command system, two about severity classification in disasters, two about emergency care for major traumas, two about detoxification and decontamination, and one each about personal protective equipment and nerve agents. The contents of this dichotomous scale were verified by a nursing college professor, a professor in emergency medicine, and an emergency nurse practitioner with over 10 years' ED experience. The CVI was assessed by three experts; two items that scored 1 or 2 points in this assessment were revised, and the CVI of the final assessment was 0.85. One point was assigned for a correct answer, and 0 for an incorrect answer or an answer of "don't know." The total score ranged from 0 to 10 and was converted to a percentage correct (%). A high score indicates a high level of disaster-related knowledge. The KR 20 coefficient of the 10-item scale was 0.684 in a preliminary survey among 12 emergency nurses, and 0.765 in this study.

3.5. Disaster nursing core competencies

These competencies were measured using the Disaster Nursing Core Competencies scale developed and tested for nurses by Nho (2010). This scale consists of 15 items based on the ICN Framework of Disaster Nursing Competencies (WHO & ICN, 2009) and the Emergency Preparedness Information Questionnaire (Gilmore, Schwan, & McLaughlin, 2007) the latter of which contains 44 items developed by the Nurse Association of Wisconsin. The Nho (2010) questionnaire is comprised of items measuring nurses' competencies, rather than those of emergency nurses specifically. Therefore, several words were modified by the authors to relate to emergency nurses. The content validity of the scale was rated by a professor of nursing and an ED head nurse; CVI was 0.90.

This scale requires indications of degree of agreement with given statements on a 5-point Likert scale, with responses ranging from "not at all" (1) to "absolutely yes" (5). A high score indicates a high level of disaster nursing core competencies. Cronbach's α of the scale was 0.94 in Noh's study (2010) and 0.936 in this study.

4. Data collection

Prior to data collection, ethical approval was obtained from the Institutional Review Board of our institution (IRB No.: 1044396-201501-HR-005-01). After obtaining IRB approval, twelve general hospitals were selected through convenience sampling for data collection. Then, the author requested the cooperation of the nursing department by telephone, explained the purpose of the study to the ED head nurse, and obtained her consent. The author explained the research purpose to potential participants, and clarified that the data collected would not be used for any purpose other than the research. Informed consent

was obtained from individual participants. Participants were informed at the beginning of the questionnaire that they could withdraw from the survey at any time without giving a reason and without being penalized. Questionnaires were then distributed among 235 nurses who agreed to participate in the study. Nurses who completed the questionnaire received a gift. Of the 235 questionnaires completed, four were excluded due to incomplete responses. Thus, the data from 231 questionnaires were analyzed.

5. Data analysis

Data were analyzed using SPSS Win 20.0. The Kolmogorov-Smirnov test statistic was non-significant ($p > 0.005$), showing that the variables were normally distributed. Thus, parametric statistics were used to analyze the data.

First, the data on participants' general characteristics, disaster-related experience, attitude, knowledge, and disaster nursing core competencies were summarized using frequencies, percentages, means, and standard deviations. Second, differences in competencies by general characteristics were tested through an independent *t*-test and a one-way ANOVA. Furthermore, Pearson's correlation analysis was used to examine the relationship between the competencies and participant characteristics that were continuous variables (age, work experience, number of beds, disaster-related experience, attitude, and knowledge). Finally, factors influencing the competencies were identified through multiple linear regression analysis using the enter method.

6. Results

6.1. Participant characteristics and differences in disaster nursing core competencies

The participants' average age was 28.41 years, average work experience in an ED was 4.47 years, and 68.4% of the participants worked in regional emergency medical centers. Disaster nursing core competencies significantly differed by job position ($p = 0.002$) and salary grade ($p = 0.002$; Table 1).

6.2. Characteristics of disaster nursing core competencies and main variables

The mean score for the disaster nursing core competencies scale was 3.05 out of 5. The remaining mean scores were 3.37 out of 7 on disaster-related experiences, 3.29 out of 4 on attitude, and 62.5 out of 100 on disaster-related knowledge (Table 2).

Table 2
Characteristics of disaster nursing core competencies and main variables ($N = 231$).

Variable	M ± SD
Disaster nursing core competencies	3.05 ± 0.58
Disaster-related experience	3.37 ± 1.36
Disaster-related attitude	3.29 ± 0.36
Disaster-related knowledge	62.5 ± 17.2

M ± SD, Mean ± Standard deviation.

6.3. Correlation between disaster nursing core competencies and study variables

The main variables that positively correlated with disaster nursing core competencies were age, total work experience, and ED work experience ($p < 0.001$), as well as disaster-related experience and knowledge ($p < 0.001$; Table 3).

6.4. Factors influencing disaster nursing core competencies

The results of linear multiple regression analysis, which included variables that were significant in the univariate analysis (see Tables 1 and 3), are shown in Table 4. In the test for autocorrelation errors to ensure that the conditions for regression analysis were met, the Durbin-Watson statistic was 1.947. In the test for multicollinearity, tolerance was 0.279–0.995, which is higher than 0.1, and the variance inflation factor was 1.049–3.580, which is lower than the reference level 10. Thus, these regression diagnostics indicate that the analysis met the required statistical assumptions, i.e., there was no auto-correlation or multicollinearity. Disaster-related experience ($\beta = 0.355$, $p < 0.001$) exerted the strongest influence on disaster nursing core competencies, followed by disaster-related knowledge ($\beta = 0.187$, $p = 0.003$). These variables together explained 25.6% of the variance in disaster nursing core competencies (Table 4).

7. Discussion

Because disaster victims visit the ED first, emergency nurses' disaster nursing core competencies are extremely important. In this study, the participants' mean score was 3.05 out of 5 on the measure of these competencies. In a previous study of Park and Lee (2015) that used the same tool, the reported mean was 3.45. This may be due to the timing of Park and Lee's study (2015), as they collected data at a hospital just after the tragic sinking of the Sewol Ferry in Korea. At that time, the Center for Disaster Relief Training and Research was opened in Korea, and began to conduct workshops on local hospitals' preparation for disasters, as

Table 1
Participant characteristics and differences in disaster nursing core competencies ($N = 231$).

Variable		n (%)	M ± SD	t or F
Age (years)			28.41 ± 5.25 (range 22–49)	
Sex	Female	206 (89.2)	3.04 ± 0.57	0.997
	Male	25 (10.8)	3.16 ± 0.68	
Total work experience (years)			5.82 ± 5.06	(Range 0.08–28.08)
ED work experience (years)			4.47 ± 3.87	(Range 0.08–20.00)
Position	Staff nurse	198 (85.7)	3.00 ± 0.56	−3.119*
	Charge nurse and above	33 (14.3)	3.35 ± 0.61	
Education level	Associate degree	198 (85.7)	2.97 ± 0.54	−1.834
	Bachelor and master's degree	33 (14.3)	3.11 ± 0.60	
Salary ($USD)	<2500	156 (67.5)	2.97 ± 0.52	−3.195*
	≥2500	75 (32.5)	3.22 ± 0.65	
Grade of ER	Regional emergency medical center	158 (68.4)	3.09 ± 0.56	2.622
	Emergency medical center	48 (20.8)	3.08 ± 0.63	
	Local emergency medical facilities	25 (10.8)	2.81 ± 0.53	
Hospital size (beds)			795.28 ± 440.53 (range 200–1860)	

M ± SD, Mean ± Standard deviation.

* $p < 0.01$.

Table 3
Pearson's correlation coefficients between study variables ($N = 231$).

Variables	1	2	3	4	5	6	7	8
1. Disaster nursing core competencies	1							
2. Disaster-related experience	0.426***	1						
3. Disaster-related knowledge	0.338***	0.238***	1					
4. Disaster-related attitude	0.460	0.106	0.134*	1				
5. Total work experience	0.279***	0.118	−0.031	0.107	1			
6. ED work experience	0.296***	0.163*	0.278***	0.035	0.769***	1		
7. Age	0.254***	0.122	0.241***	0.147*	0.931***	0.695***	1	
8. Hospital size (beds)	0.129	0.080	−0.031	0.095	−0.191**	−0.073	−0.182**	1

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

well as simulation education on disaster medicine and procedures. Thus, the level of disaster nursing core competencies may have been temporarily increased at the time of the Park and Lee's study (2015). The present results suggest, however, that nurses need continuous education and training to maintain these competencies. No standardized tool exists by which to measure emergency nurses' core disaster-related competencies. Thus, the present research utilized tools developed within other Korean study. This highlights the need to develop such standardized tools in future research.

The present results also show that disaster nursing core competencies differed in accordance with position and wage, among the participants' general characteristics. Specifically, competencies were higher among those in higher positions and those earning higher wages. In addition, these competencies showed a significant positive correlation with age and clinical experience. This is probably because greater work experience is related to the development of nurses' job competency (O'Leary, 2012).

Disaster-related experience and knowledge also showed a significant positive correlation with these competencies. In contrast, disaster-related experience did not correlate with these competencies in Nho's study (2010), but did so in Park and Lee's sudy (2015). These two studies differed in that their participants were floor nurses and emergency nurses, respectively. In sum, education regarding and experience in disaster nursing should be provided to improve emergency nurses' disaster core competencies.

To identify factors influencing emergency nurses' disaster core competencies, this study performed multiple regression using variables that were significant in the univariate analyses. Disaster-related experience and knowledge predicted disaster nursing core competencies when other variables were controlled for, together explaining 25.6% of the variance in these competencies. This suggests that disaster nursing core competencies are not enhanced proportionally to work experience or position; rather, disaster-related experience and education are essential for disaster nursing core competencies. A number of academic societies have been established and nursing care provision systems

developed for post-disaster response around the globe, especially as natural and man-made disasters have increased in recent times (Yamamoto, 2013). This has also encouraged the development of disaster nursing educational programs and curricula in public health (Loke & Fung, 2014). Nevertheless, recent studies (Baack & Alfred, 2013; Loke & Fung, 2014; Whetzel et al., 2013; Yan, Turale, Stone, & Petrini, 2015) have still reported inadequate disaster nursing competencies and insufficient disaster nursing training. With only two institutions specialized in disaster management education, Korea is relatively poor in terms of resources for training disaster nursing specialists. Accordingly, because most nurses may lack disaster-related experience, regular education and training on disasters is essential for them to accumulate such experience and to gain insight into the reality of disaster response.

In this study, emergency nurses' disaster-related experience and knowledge were found to influence the disaster core competencies. Since the ICN launched its Framework of Disaster Nursing Competencies in 2009, nurses' competencies in this area have been highlighted regarding disaster preparedness. For instance, a previous study (Baack & Alfred, 2013) on the preparedness and perceived competence in managing disasters comprising 620 nurses in Texas found that most nurses was not confident in their ability to respond to disasters. Korea has recently experienced a number of disasters, including not only the tragic sinking of the Sewol Ferry (a man-made disaster) but also natural disasters, such as the Middle East respiratory syndrome that threatens the state and the people. Medical institutions play core roles in responding to casualties in the event of a disaster. Education and training regarding disasters helps nurses make practical estimations of how a disaster situation is progressing. It also provides them with opportunities to prepare for similar situations in the future (Hammond et al., 2011; Whetzel et al., 2013). Disaster nursing core competencies are essential for emergency nurses, who have to provide urgent nursing services to a large number of patients in the event of a disaster. However, although a range of disaster-related studies have been conducted among nurses, very little research exists regarding emergency nurses' disaster-related competencies. The findings of this study provide useful basic information showing the necessity of regular disaster-related education and training programs for emergency nurses so that they can cope with disaster situations effectively and carry out their roles confidently.

Following the recent spate of natural and human-generated disasters, the Korean government expanded the related budgets by up to 50% compared to the previous year in order to stimulate disaster-related medicine and to improve sentinel hospitals' coping abilities (Ministry of Health and Welfare, 2016). In response to this trend, the nursing profession needs to participate actively in the development of disaster nursing education and training programs and to initiate the training of disaster nursing specialists.

Table 4
Factors influencing disaster nursing core competencies as shown by linear regression analysis ($N = 231$).

Variables	B	SD	β	t
Constant	2.166	0.426		5.085***
Disaster-related experience	0.150	0.025	0.355	5.978***
Disaster-related knowledge	0.063	0.021	0.187	3.047**
Age	−0.007	0.017	−0.062	−0.390
ED work experience	0.001	0.001	0.107	0.537
Total work experience	0.001	0.002	0.134	0.715
Position (staff nurse)[a]	0.007	0.135	0.004	0.054
Salary (≥ 2500 $)[a]	0.058	0.085	0.047	0.684
	F = 12.189***			
	Adj. R^2 = 0.256			

[a] Dummy coded ** $p < 0.01$ *** $p < 0.001$.

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