

Brief Report

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Issues in Radiation Nursing Education in Japan Before and After the Fukushima Daiichi Nuclear Power Plant Accident

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Abstract

Background: The response of nurses in Japan to the Fukushima Daiichi Nuclear Power Plant accident was deemed inadequate. This study examined the issues in Japanese radiation nursing education.

Method: Anonymous, self-administered postal questionnaires were sent to managers and teachers of 1053 basic nursing educational institutions in Japan.

Results: Among the 342 institutions that completed the questionnaire, 218 (63.7%) had incorporated Radiological Nursing Education into their curriculum while 124 (36.3%) had not. Based on the time of their incorporation, they were divided into the pre-accident incorporation group and the post-accident incorporation groups. For 89 of 111 institutions (85.6%) in the former group, the main reason for the incorporation was radiotherapy care. For 11 of 26 institutions (42.3%) in the latter group, the incorporation was their response to the nuclear disaster.

Conclusion: Nursing education in Japan has been inadequate, and as such, nurses find it hard to respond to nuclear disasters. Examining the current nursing education system and building a new model based on the nuclear disaster experience are urgent issues.

Background

After the Fukushima Daiichi Nuclear Power Plant Accident in 2011, many nurses failed to deal with severe anxiety among Fukushima residents due to their insufficient knowledge of radiation and its effects.^{1,2} The insufficiency in their understanding was due to several reasons, such as the lack of radiation education in basic nursing educational institutions,³ the overloaded education curricula, and their inability to secure qualified lecturers for radiation nursing education.⁴

Some universities introduced Radiological Nursing Education (RNE) in their master's programs to meet the urgent need to develop human resources for radiation protection after the Fukushima accident.⁵ Also, the Radiological Nursing Society of Japan, established in 2012, recommended that all nursing educational institutions in Japan should include RNE in their programs.⁶ However, the RNE remains underdeveloped, and few studies have examined its content in their programs.

This study aimed at clarifying the main issues in RNE in basic nursing educational institutions in Japan. Given the number of nuclear power plants around the world, Fukushima might not be the last case of nuclear disasters. Around 160000 residents were forced to evacuate after the Fukushima accident, and many still fear the consequences of exposure to radiation. Building a comprehensive RNE system is therefore imperative, and the findings of this study could be used to construct a practical RNE curriculum for nurses in future.

Methods

Study Sample and Duration

This study targeted all 1053 basic nursing educational institutions in Japan on the 2016 list provided by the Ministry of Health, Labor and Welfare (MHLW).⁷ After identifying a manager or teacher who was in charge of radiation-related subjects in each institution (1 person per institute), an anonymous self-administered postal questionnaire was sent to them. They were then asked to fill in the questionnaire and send it back to the author upon completion. This main in-survey was conducted between September, 1 and October 15, 2016.

Survey Content

The questionnaire was developed to understand the changes in the basic nursing education before and after the Fukushima accident by referring to the questionnaire used in the previous study,⁸ which examined the curriculum content of disaster nursing training in Japan before and after the Fukushima accident. In this study, to examine whether or not RNE content was incorporated in the curriculum of the target institutions, it included questions on the types of institutions, number of students, the existence of RNE program prior to the Fukushima accident, distance from the nearest nuclear power plant, the primary reason for their incorporation of RNE into the curriculum, and finally the RNE content they had in the curriculum. Following the classification of RNE content based on the detail of each course by previous studies,^{4,9} this study classified the RNE content into 19 categories (Table 1). The target institutions were asked if they provided each category in the questionnaire.

Data Classification and Analysis

The institutions with RNE program were classified into multiple categories based on their characteristics. The first classification was by types of institutions: “Nursing training school” or “Nursing University”, and “Public” or “Private.”

“Nursing training school” included 3-year training schools that offered a diploma program under the jurisdiction of Ministry of Health, Labor and Welfare. “Nursing University” included 4-year colleges and universities, and 3-year junior colleges that were under the jurisdiction of the Ministry of Education, Culture, Sports, Science and Technology. The second classification was by distance from nuclear power stations: “Close” or “Not close.” The “Close” group included institutions located in a prefecture where there is a nuclear power plant. The third classification was by reason for incorporating RNE into the curriculum: “For radiation therapy” or “For response to nuclear disaster” (Table 2). They were further classified into 2 groups based on the timing (when they incorporated RNE into their curriculum): before or after the Fukushima accident (“Pre-accident incorporation” or “Post-accident incorporation”).

The differences between the pre- and post-accident incorporation groups were analyzed by a χ^2 test in the context of the 19 RNE categories. The significance level was set at $\leq 5\%$. SPSS v.25 (IBM, Armonk, NY, USA) was used for statistical analysis.

Results

A total of 365 out of 1053 basic nursing educational institutions in Japan returned the questionnaire (collection rate: 34.7%). Responses from 23 institutions were excluded from the analyses due to their incomplete answers. Responses from 342 institutions (32.4%) were considered valid: 282 responses were from nursing training schools (82.5%), and 60 from nursing universities (17.5%), which represented the ratio of the numbers of nursing training schools to nursing universities in Japan, that is, 791 (75.1%) and 262 (24.9%), respectively.

Characteristics of Institutions by their RNE Incorporation Status

218 of 342 respondents (63.7%) had RNE program in the curriculum, while 124 (36.3%) did not. Among these 218 institutions, 190 (87.2%) were comprised of nursing training schools, and

28 (12.8%) were universities. While the RNE incorporation rate was significantly higher among nursing training schools than nursing universities ($P < 0.001$), there was no difference by other classifications such as establishing entity, number of students, and distance from nuclear power plants.

Characteristics of Institutions by the Timing of Incorporating RNE into the Curriculum

Different characteristics between the pre- and post-accident incorporation groups included the curriculum type and the reason for the incorporation of RNE (Table 2). Of the 190 nursing training schools, 26 (13.7%), and 8 (28.6%) out of 28 universities, incorporated RNE into their curriculum after the Fukushima accident. The rate of post-accident RNE incorporation was higher among nursing universities than nursing training schools ($P < 0.05$). Moreover, 11 of the 33 institutions in the post-accident incorporation group (33.3%) answered that the reason for RNE incorporation was “For nuclear disaster response,” while only 15 out of 104 institutions (14.4%) answered that it was “For radiotherapy care.” The higher number showed that the post-accident incorporation group paid significantly more attention to nuclear disaster ($P < 0.05$).

The Difference in RNE Content by the Timing of Incorporating RNE into the Curriculum

The mean incorporation rates of the 19-course items were 60% and 65% in the pre-accident incorporation group and the post-accident incorporation group, respectively (Table 1). The course items most frequently used by the pre-accident implementation group were “Interventional radiotherapy and nursing care” (80.4%), followed by “Management of health effects” (77.2%), “Effects and side effects of radiotherapy”, and “Diagnostic radiology” (75.5%). The course items most frequently used by the post-accident implementation group were “Types and characteristics of radioactive rays,” “Management of health effects,” and “Roles of nurses” (all 82.4%). In order to examine the impact of the Fukushima accident on the nursing education in Japan, this study particularly looked into whether or not each institution incorporated the course of “Low-dose exposure and health hazard.” The incorporation rate of the following 1 item was significantly higher in the post-accident incorporation group than in the pre-accident incorporation group ($P < 0.05$): “Low-dose exposure and health hazard” (pre-accident implementation group: 40.2%; post-accident implementation group: 61.8%).

Discussion

The results of this study showed that the experience of the Fukushima nuclear accident had not been leveraged fully into Japanese nursing education. First, there were significant differences between the pre- and post-accident incorporation groups. Among the pre-accident incorporation group, the primary reason for the incorporation of RNE was “For radiotherapy” (89 of 111 institutions in the pre-incorporation group, 80.2%). This result suggested that before the Fukushima accident, not many institutions paid attention to the need for RNE in the nuclear disaster context, except some schools in Hiroshima and Nagasaki.

Among the participating institutions that did not have RNE prior to the accident, approximately 66.7% of them incorporated RNE into their curriculum after the accident. However, only 11 out of 26 institutions in the post-accident incorporation group

Table 1. Difference in RNE content by the timing of incorporating RNE in curriculum (n = 218)

Education content	Categories	Pre-accident incorporation group n = 184		Post-accident incorporation group n = 34		P
		Number	Proportion	Number	Proportion	
Interventional Radiology	Types and characteristics					
	Incorporated	136	73.9%	28	82.4%	0.29
	Not incorporated	48	26.1%	6	17.6%	
	Management of health effects					
	Incorporated	142	77.2%	28	82.4%	0.50
	Not incorporated	42	22.8%	6	17.6%	
Interventional oncology	Roles of nurses					
	Incorporated	130	70.7%	28	82.4%	0.16
	Not incorporated	54	29.3%	6	17.6%	
	Characteristics of cancer					
	Incorporated	115	62.5%	18	52.9%	0.29
	Not incorporated	69	37.5%	16	47.1%	
Interventional radiology and nursing care	Effects and side effects of radiation					
	Incorporated	139	75.5%	21	61.8%	0.09
	Not incorporated	45	24.5%	13	38.2%	
	Nursing care during treatment					
	Incorporated	132	71.7%	21	61.8%	0.24
	Not incorporated	52	28.3%	13	38.2%	
Diagnostic radiology and nursing care	Interventional radiology and nursing care					
	Incorporated	148	80.0%	23	67.6%	0.11
	Not incorporated	37	20.0%	11	32.4%	
	Radio chemotherapy					
	Incorporated	123	66.8%	23	67.6%	0.92
	Not incorporated	61	33.2%	11	32.4%	
Nuclear medicine and nursing care	Palliative medicine and terminal care					
	Incorporated	87	47.3%	20	58.8%	0.21
	Not incorporated	97	52.7%	14	41.2%	
	Diagnostic radiology					
	Incorporated	139	75.5%	25	73.5%	0.80
	Not incorporated	45	24.5%	9	26.5%	
Nuclear medicine and nursing care	Angiographic examination / interventional radiology					
	Incorporated	128	69.6%	23	67.6%	0.82
	Not incorporated	56	30.4%	11	32.4%	
	Magnetic resonance imaging examination					
	Incorporated	130	70.7%	24	70.6%	0.90
	Not incorporated	54	29.3%	10	29.4%	
Nuclear medicine and nursing care	Ultrasound sonographic examination					
	Incorporated	117	63.6%	24	70.6%	0.43
	Not incorporated	67	36.4%	10	29.4%	
	Nuclear medicine					
	Incorporated	84	45.7%	19	55.9%	0.27
	Not incorporated	100	54.3%	15	44.1%	
	Radionuclide					
	Incorporated	72	39.1%	19	55.9%	0.06
	Not incorporated	112	60.9%	15	44.1%	
	Radioactivity count and half-life					
	Incorporated	86	46.7%	19	55.9%	0.32
	Not incorporated	98	53.3%	15	44.1%	
Diagnostic scintigraphy						
Incorporated	70	38.0%	19	55.9%	0.05	
Not incorporated	114	62.0%	15	44.1%		
Diagnostic positron emission computerized tomography						
Incorporated	61	33.2%	17	50.0%	0.06	
Not incorporated	123	66.8%	17	50.0%		

(Continued)

Table 1. (Continued)

Education content	Categories	Pre-accident incorporation group n = 184		Post-accident incorporation group n = 34		P
		Number	Proportion	Number	Proportion	
Nuclear disaster and nursing care	Low-dose exposure and health hazard					
	Incorporated	74	40.2%	21	61.8%	< 0.05
	Not incorporated	110	59.8%	13	38.2%	

Abbreviation: RNE, radiation nursing education.

Table 2. Characteristics of institutions by the timing of their incorporation of RNE into curriculum

Questionnaire item	Pre-accident incorporation group n = 184		Post-accident incorporation group n = 34		P
	Number	proportion	Number	proportion	
Education curriculum					
Nursing training school	164	86.3%	26	13.7%	< 0.05
Nursing university	20	71.4%	8	28.6%	
Establishing entity					
Public	71	85.5%	12	14.5%	0.71
Private	113	83.7%	22	16.3%	
Number of Students <i>M(SD)</i>					
	52.6(28.5)		58.0(39.0)		0.07
Location of nuclear power plant					
Close	54	81.8%	12	18.2%	0.49
Not close	130	85.5%	22	14.5%	
Reason for providing RNE					
	n = 111		n = 26		
For response during radiation therapy	89	85.6%	15	14.4%	< 0.05
For response to nuclear disaster	22	66.7%	11	33.3%	

Abbreviation: RNE, radiation nursing education.

(33.3%) answered that it was “For a response to the nuclear disaster.” This result suggested that despite the high incorporation rate of “Low-dose exposure and health hazard”, after the accident, the Fukushima accident only impacted the curriculum of 11 out of 158 institutions (no incorporation and post-accident incorporation groups). Also, the low impact of the Fukushima accident reflected the “Not implemented” rate of “Low-dose exposure and health hazard” content among the post-accident incorporation group: 38.2% of institutions in this group did not provide students with the content of “Nuclear disaster and nursing care” even after the accident.

In Japan, the curriculum of nursing training schools follows the guidelines by the MHLW Regulations, and that of nursing universities follows the “Final Report on the Review of Training of Nursing Human Resources at Nursing Universities”,¹⁰ by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). However, no RNE information has been added to the MHLW regulations, and no information specific to nuclear disasters has been included in the MEXT report.

Also, issues such as overcrowded curricula, lack of instructors, and insufficient knowledge of radiation protection are possible barriers to the incorporation of RNE courses in the curriculum.^{3,4}

Limitations

The questionnaire collection rate in this study was 34.7 percent. After excluding 6.3 percent of responses from the analysis due

to incomplete answers, only 32.4 percent of responses were considered valid for analysis. This could have potentially caused a no-response bias. Also, it should be noted that the nursing training schools had a higher response rate than the nursing universities, which might have skewed the findings toward the nursing training school situation.

Conclusion

As shown in this study, the content of RNE in Japan predominantly focused on radiotherapy, despite the experience of the Fukushima nuclear disaster. Building systematic education on radiological nursing in the field of basic nursing education in Japan can enable future nurses to respond appropriately to nuclear disasters and the associated consequences. Also, building a new universal model of RNE based on lessons from the Fukushima nuclear disaster can be an important step towards building disaster preparedness and response responsibilities.

Ethical Considerations

This study was approved by the concerned ethics committee (approval number: 2776) and conducted in accordance with the principles of the Declaration of Helsinki. A letter stating that we consider submitting a returned questionnaire to be indicative of agreement with the study and voluntary participation was attached with the questionnaire. Thus, written informed consent was not necessary.

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