Changes in Nurses' Radiation Risk Perception by Attending the Training Course for Radiation Emergency Medicine

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This study aims to clarify the changes in nurses' radiation risk perception after attending a training of session on radiation emergency medicine (REM training). A questionnaire survey regarding radiation was answered by 30 nurses before and after attending REM training at Hirosaki University in 2010 and 2011. The survey consisted of questions associated with radiation itself and on topics such as "risk of damage to one's health by radiation or radioactive substances" (health risk of radiation). We compared the responses between the two years (2010 and 2011). Nurses' risk perception changed after REM training in the 2011 group but no changes were observed in the 2010 group. The number of items associated with the word "radiation" increased and issue of "fear" decreased in the 2011 group, but the issue of "difficulty" increased after REM training. The severity rating of Fukushima nuclear power plant disaster was calculated as 7.9 ± 2.0, and although the study subjects considered it a severe accident, it did not affect their radiation risk perception following REM training. Perception of "difficulty" in regard to radiation increased after REM training, possibly due to the fact that the subjects had acquired a greater knowledge of radiation and its effects. It is concluded that REM training have changed the nurses' perceived radiation risk and that the occurrence of Fukushima nuclear disaster may have influenced the results.

Key words: radiation risk perception, training for radiation emergency medicine (REM training), nurse, education

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1. Introduction

The radiation has important role for treatment and diagnosis in the medical field. It is necessary for nurses to act with accurate knowledge about the radiation and radiation protection. However, there are few opportunities to learn radiation for nurses and nursing students in medical facilities in Japan[1, 2]. Systematic education about radiation exposure is needed to alleviate unnecessary anxiety[3, 4]. It is

Table 1. Contents of REM training

2010	2011
<Primary >	<Primary >
Introduction to radiation	Introduction to radiation
Biological effects of radiation	Biological effects of radiation
Radiation protection	Radiation protection
<Basic>	<Basic>
Introduction to radiation therapy	Effect of radiation on the human body
Nusing in nuclear medicine	Overview of REM
REM and nursing	Nuclear powor and radiation incidents
Property and protection of radiation	Mental health in REM
Mental health in radiation therapy	Unit of radiation
Nusing in IVR	Decontamination methods
REM system	
Mental Health in REM	
<Simulation trainig>	<Simulation trainig>
Radiation-exposed patient receiving simulationtraining	Radiation-exposed patient receiving simulationtraining

Table 2. Academic background of the subjects

	Total	sex		Academic background				Age
		Male	Female	Special school	Junior college	College	Graduate School	
2010 Group	15	2	13	11	0	2	1	39.7 ± 8.8
2011 Group	15	1	14	7	4	2	2	43.3 ± 7.0

Table 3. Background of the subjects experience with radiological medical treatment

	2010 Group	2011 Group
taking a patient to a radiation room	13	15
entered a radiation room with a patient	11	10
nursing of radiation therapy	7	9
positioning a patient for X-rays photography	13	14
nursing for X-rays photography	12	14
Radioisotope nursing	10	10
brachytherapy nursing	1	1

Table 4. Radiation workshop and REM training experience

	2010 Group	2011 Group	p-value
Specialized radiation nursing	7	6	
Radiation training session	8	4	
REM training	10	1	$P < 0.01$

Statistic analysis was assessed using chi-square test.

very important to clarify radiation risk perception for risk communication.

Radiation emergency and nuclear incident occur rarely. However, Fukushima nuclear power plant disaster occurred in March 2011. For such an incident it is essential for nurses to be prepared and trained before an emergency occurs[5]. Communicating effectively with the public for radiation emergency is a key to succeed in emergency management[5]. Especially systematic knowledge about radiation is essential for nurses who work at the time of radiation emergency.

The program of radiation emergency medicine (REM) started for nurses who were working in medical facilities in Hirosaki University Graduate School of Health Sciences in 2010. The aim of this study is to disclose whether radiation risk perception of the nurses, who learned radiation systematically, is changed by the REM training and whether unprecedented Fukushima nuclear power plant disaster affected radiation risk perception of the nurses by comparing the subjects in 2010 with those in 2011.

2. Methods

2.1. Contents of REM training for nurses

This education program started to nurses currently working in medical facilities (Table 1). The objectives of the program is to nurture nurses who have 1) the knowledge and the management abilities necessary to deal with REM, 2) the ability to liaise and cooperate with each other during an emergency and 3) the ability to take care of contaminated patients in medical care[6].

2.2. Subjects

Subjects were 30 nurses (15 each in 2010 and 2011) who have had REM training at Hirosaki University in 2010 and 2011. Training nurses were 15 each in 2010 (2010 group) and 2011 (2011 group). The survey was conducted around

the training period (Table 2-4).

2.3. Questionnaires

We asked questions about the nurses' background as well as their radiation risk perception. Work-related areas assessed included academic background, attendance at radiation workshops, REM training and experience in medical treatment. The survey consisted of 10 questions about their perception of radiation, including questions about the general risk in daily life and the risk of damage to one's health by radiation or radioactive substances. The 10 items about general risk in daily life were ranked from 1 to 10. And 10 items about health risk of radiation were evaluated on an 11-point scale from 0 to 10. Questions about risk perception were based on the study of Kanda et al.[7]. Survey questions also assessed the factors that influenced risk perception, including fear of radiation (fear), difficulty understanding radiation (difficulty), understanding the effect of radiation on the human body (understanding), and interest in radiation (interest). These items were assessed using a 4-point Likert scale ranging from no impact at all to strong impact.

2.4. Statistical analysis

All data were analyzed using SPSS 20.0 software, comparing answers among nurses in both group. The analysis was conducted using the chi-square test, one-way analysis of variance repeated analysis of variance, and Bonferroni testing for multiple comparisons. Statistical significance was defined as $P < 0.05$.

2.5. Ethical considerations

The study protocol was approved by the Committee for Medical Ethics of Hirosaki University Graduate School of Medicine, a registration number is 2010-025, and returning the questionnaire was regarded that their informed consent was obtained.

3. Results

3.1. Background of subjects

Backgrounds of subjects are shown in Table 2. Although some contents of REM training changed, they were not so different. In two groups, gender, age and academic background showed no statistically significant differences (Table 2). The subjects had experienced many situations such as "taking a patient to a radiation room", "positioning a patient for radiography" and "nursing for radiography". On the other hand, they had little experiences of brachytherapy nursing (Table 3). The 2010 group had significantly more experiences of REM training than the 2011 group (Table 4). The severity rating of Fukushima nuclear power plant disaster was 7.9 ± 2.0, and the subjects thought that the nuclear disaster was a severe accident.

3.2. Words associated with "radiation"

The results of questions associated with "radiation" were shown in Table 5. The number of the chosen words associated with "radiation" significantly increased after REM training in both the 2010 group and the 2011 group
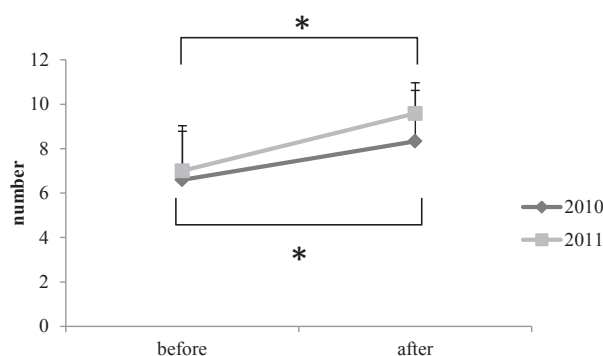

Fig. 1. Number of the word associated with "radiation"
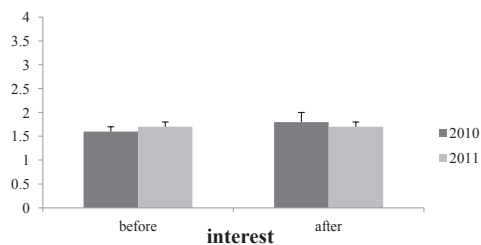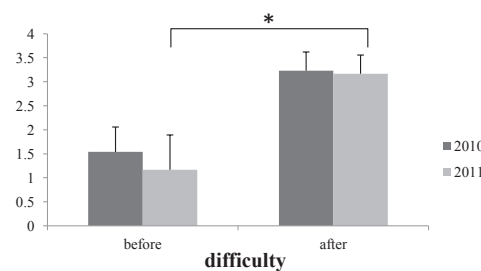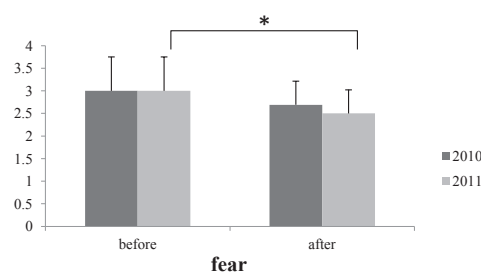Statistic analysis was assessed using repeated measure ANOVA.
*$P < 0.05$

Fig. 2. Comparison between 2010 and 2011 groups for factores influencing radiation risk perception
fear : How do you fear the radiation?
difficulty : How difficult is the knowledge of radiation?
interest : How much are you interested in radiation?
Statistic analysis were assessed using repeated measure ANOVA and Bonferroni test for multiple comparisons.
*$P < 0.05$

Table 5. Words associated with "radiation" (no limit on responses) (%)

		before	after	P-value
1. X-rays and CT photogram	2010	86.7	100.0	P <0.05
	2011	100.0	100.0	
2. Hiroshima and Nagasaki (nuclear weapo)	2010	53.3	73.3	
	2011	80.0	100.0	
3. Mr. and Madam Curie	2010	40.0	66.7	
	2011	40.0	91.7	
4. Food irradiation	2010	13.3	60.0	
	2011	26.7	75.0	
5. Chernobyl	2010	60.0	93.3	
	2011	86.7	100.0	
6. Radiation treatment	2010	86.7	93.3	
	2011	93.3	100.0	
7. Radiation Exposure	2010	86.7	100.0	
	2011	100.0	100.0	
8. Leukemia	2010	46.7	73.3	
	2011	60.0	83.3	
9. Nuclear waste	2010	53.3	66.7	
	2011	60.0	100.0	
10. Breeding (agricultural produce)	2010	6.7	26.7	
	2011	13.3	50.0	
11. Nuclear power generation	2010	40.0	73.3	
	2011	40.0	41.7	

Data analyses was done using the chi-square test.
The items of "X-ray and CT photogram" significantly higher in 2010 group after training.

Table 6. Ordering of 10 terms based on perceived risk

	2010		2011	
term	before	after	before	after
HIV (AIDS)	1	1	1	1
Hepatic fever	2	2	2	2
Smoking (sigarettes)	3	5	5	3
Surgery	4	3	4	4
O-157 (bacteria)	5	6	3	5
Riding a motorcycle	6	4	7	6
Obesty (over weight)	7	7	6	7
Antibiotics	8	10	8	8
Drinking (alcoholic bevarage)	9	9	9	9
X-rays and CT photogram	10	8	10	10

Example of question: If you think that riding a motorcycle is the most risky, please put " 1 " in the box.

(P <0.05), although there were no other significant differences between the groups (Fig. 1). The items associated with "radiation" were significantly likely to be chosen by the 2010 group after training (P <0.05), but no other items showed any significance in this group. In contrast to that 100% of the subjects of the 2010 group mentioned "X-rays and CT photogram" and "Radiation Exposure" only after REM training, 100% of the subjects of the 2011 answered these words even before REM training. The 2011 group also reported "X-rays and CT photogram", "Chernobyl", "Radiation Treatment", "Radiation Exposure" and "Nuclear waste". In the 2011 group, the associations among "Hiroshima and Nagasaki (nuclear weapons)", "Nuclear waste" and "radiation" were significantly increased after REM training. The subjects in both groups associated

a significantly greater number of the words with "radiation" after REM training than before.

3.3. The ordering of general risk in daily life

Ranking of 10 items about general risks in daily life was carried out from 1 to 10. In the ordering of 10 items about general risk in daily life, the subjects considered "X-rays and CT examination" as the lower rank. The ordering of these items did not change after REM training (Table 6).

3.4. Health risks of radiation

The survey contained questions associated with radiation itself and 10 questions about health risks of radiation. The high-risk items were "Nuclear testing", "Radon spring" and "Chest X-rays". Perception of health risks of radiation did

Table 7. Comparisons among 2010 and 2011 groups on health risk of radiation   (%)

		before	after	P-value
1. Rocks & soils	2010	6.0	4.8	$P < 0.05$
	2011	6.4	5.1	
2.Cosmic rays	2010	4.3	4.5	
	2011	5.0	4.0	$P < 0.05$
3. Radon spring	2010	7.6	7.8	
	2011	7.5	8.1	
4. Chest X-rays	2010	7.4	7.8	
	2011	7.1	8.1	
5. CT	2010	2.3	2.3	
	2011	2.7	2.1	
6. Radiation therapy	2010	5.2	5.1	
	2011	4.3	4.8	$P < 0.05$
7. Airport baggage inspection	2010	4.9	5.1	
	2011	4.5	4.8	
8. Air travel	2010	2.8	3.6	
	2011	2.8	2.6	
9. Nuclear testing	2010	7.9	7.8	
	2011	9.2	9.2	
10. Living near nuclear powor plant	2010	6.5	7.4	
	2011	5.8	6.5	

Data analyses was done using the repeated measure ANOVA.

not change after REM training. "Rocks and soil" became a significantly low item after REM training in the 2010 group ($P < 0.05$). "Cosmic rays" became significantly low items after REM training in the 2011 group ($P < 0.05$) and "Radiation Therapy" became significantly high items after REM training in the 2011 group ($P < 0.05$) (Table 7).

3.5. Radiation risk perception

Comparison of radiation risk perceptions between the two groups is shown in Figure 2. The 2011 group showed significantly lower scoring for "fear" and significantly higher scoring for "difficulty" after REM training than before (both p<0.05) .

4. Discussion

This study aimed to determine whether radiation risk perception of the nurses who had studied radiation systematically is changed after REM training, and whether the unprecedented occurrence of Fukushima nuclear power plant disaster influenced that radiation risk perception of the nurses by comparing the subjects in 2010 with those in 2011. The background of the two groups was identical apart from REM training. For nurses in the 2011 group, the accident of Fukushima nuclear plant disaster might be a trigger to attend REM training. It is essential for nurses to be prepared and trained before an emergency occurs[5], and the subjects might have thought that it was necessary some other time (Table 3-4).

Kanda et al. reported that both of nurses and general women had many concerns about radiation, affecting their radiation risk perception. However, nurses have basic knowledge and experience of radiation which enable nurses to determine their actions for radiation rationally[7]. A number of the words associated with "radiation" significantly increased after REM training. There were many items that all of the members chose in 2011 group. This suggested that the nurses who participated in REM training were highly concerned about the radiation. It is thought that the knowledge of the radiation increased because of REM training. (Table 4-6, Fig. 1).

Tomisawa et al.[8] reported that freshmen of nursing school students had greater "fear" regarding radiation than junior and senior students and this was related to the radiation risk perception according to the research on the radiation risk perception of nursing students. Our recent study[1] reported that no significant differences were observed in the degree of radiation risk perception among the freshmen of different majors. Slovic[9, 10] reported that factors contributing to risk perception included dreaded risk and unknown risk. Thus, we thought the accurate knowledge about radiation might influence the radiation risk perception and reduce "fear" after REM training. In our present study, nurses' radiation risk perceptions changed after REM training in the 2011 group although no changes were observed in the 2010 group. The number of items associated with the word "radiation" increased and the issue of "fear" decreased in the 2011 group, but the issue of "difficulty" increased after REM training. The subjects fully understood the severity of Fukushima nuclear power plant disaster. Therefore, this severe incident and the information gleaned from it may have influence them. Studying radiation and its effects through REM training may have increased the issue of "difficulty". It is important for nurses to study radiation

continuously for the protection against radiation to raise the level of protection measures against radiation and radiation accidents. Therefore, contents of REM training should be investigated and improved (Fig. 2).

5. Conclusion

It is concluded that REM training changes nurses' radiation risk perception and Fukushima nuclear disaster might affect the results.

6. Acknowledgements

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