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Note

A Case-Study of the Effects of Teaching Radiation Risk Communication to Local Government Officials

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The purpose of this case-study is to consider the effect of radiation risk communication educational programs. This program was developed to conduct research in an interactive format by incorporating exercises and group work. The program used a three-part series, with one session of 110 minutes per month. The subject was local government officials (n = 9), and an anonymous questionnaire was conducted before and after the lesson, and focused on participants' perceptions of radiation and the tools utilized in information gathering. As a result, after implementing this program for the target audience, their image of radiation changed in four categories. This is thought to indicate that participants started with a somewhat negative evaluation of radiation, which then might have changed to a more neutral evaluation following the program. In terms of the tools that can be used to collect information about radiation, there was increased such as the Internet, SNS, TV, radio, and newspapers, it was inferred that they might have helped develop an increased awareness of information related to radiation.

Based on the data, the practices used in this educational program might be an effective means of organizing education in the field of radiation risk communication.

Key words: radiation risk communication, educational program, educational evaluation

1. Introduction

The incident that occurred at the Fukushima Daiichi Nuclear Power Plant, following the 2011 Tōhoku earthquake and tsunami, scattered radioactive substances over a wide area, which led to severe pollution in the surrounding environment[1)]. As a result, many residents living in the area were forced to evacuate[2)].

In response to this situation, the government has been committed to on-going decontamination work in affected areas—other than the areas to which residents are unable to return—and promoting radiation risk communication so that evacuated residents could return to their homes in an expeditious manner. Explanations of radiation have previously been conducted using advanced expertise and esoteric terminology, making it difficult for the general population to obtain a sufficient understanding of the

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Table 1. Overview of radiation risk communication education program

	Contents	Class form	Time	Number of teachers
First Session	Basic Knowledge of Radiation	lecture	50-minutes	1
	Radiation Characteristics Experiment	exercises	60-minutes	5
Second Session	Basic Knowledge of Education and Exercises	lecture/exercises	60-minutes	4
	Basic Knowledge of Radiation Risk Communication	lecture	50-minutes	1
Third Session	Radiation Risk Communication Exercises	exercises	110-minutes	4

situation. In the aftermath of the 2011 Tōhoku earthquake and tsunami, however, it became necessary to explain radiation in a way that was easy to understand. To this end, the Ministry of the Environment began training human resources – such as healthcare workers, welfare services personnel, and educators – to implement risk communication related to the health effects of radiation[3]. Furthermore, the Reconstruction Agency created a policy package regarding radiation risk communication for those returning to the area; by providing accurate and easily understandable information, as well as counselors, they have been organizing assistance for residents[4].

Furthermore, there are several studies that describe the need for an education curriculum on radiation for students and citizens[5], and reports that clarify the influence of insufficient risk communication on women who gave birth after the nuclear disaster in March 2011[6]. Therefore, the need for radiation risk communication education is increasing.

Hirosaki University also conducts training from the perspective of developing human resources who can lead practice radiation risk communication education in the Advanced Human Resources Development Project for Radiation Emergency Medicine (REM)[7].

With this background, the researchers developed and conducted an educational program for radiation risk communication in an interactive format, by incorporating exercises and group work. This study aims to consider the effects of teaching the educational program for radiation risk communication.

2. Methods

2.1. Subjects

The researchers explained the intention of this study to the local government in Prefecture A, which is involved in a nuclear energy related facility.

An educational program for radiation risk communication (henceforth "this program") was implemented with the cooperation of 11 participants from 10 departments. Of the 10 participants who attended the sessions on two or more occasions, there were nine participants selected as subjects for cooperation in the research. The group comprised 8 men and 1 woman, 8 of whom were in their 20s with the remaining person in his/her 30s.

2.2. The Radiation Risk Communication Education Program

This program was developed for the purpose of providing an opportunity for those involved to think about radiation risk communication, and to examine its necessity. The program used a three-part series, with one session of 110 minutes per month. Nurses, radiologists, and occupational therapists with training in radiation and risk communication, as well as seven university faculty members licensed as clinical laboratory technicians, all took part in the operation of the program (Table 1). The content of each session is discussed in detail below.

First Session: Basic Knowledge of Radiation (50-minutes lecture) and Radiation Characteristics Experiment (60-minutes exercises)

Having been provided with basic information, such as radiation types, half-life, and units, participants were taught about the three principles of radiation safety and its effects on the human body through a PowerPoint presentation.

Next, the participants were divided into two groups, and carried out exercises related to radiation safety using a characteristic experiment set for radiation (Iki Sangyo Inc: 1-121-545 DX-SET). The lecture was led by a teacher who was a licensed radiologist, and four faculty members joined the exercises in support.

Second Session: Basic Knowledge of Education and Exercises (60-minutes); Basic Knowledge of Radiation Risk Communication (50-minutes)

A lecture was delivered on the requirements for establishing communication, as well as the verbal and nonverbal messages that constitute communication. Afterwards, participants were grouped into pairs, and they performed communication exercises in order to experience the various errors that can occur due to one-way communication. Then, a lecture was delivered on the importance of two-way messages in radiation risk communication, with a focus on those cases where agreement was not established among evacuated residents regarding radiation after the accident at Fukushima Daiichi nuclear accident. The lecture was led by a teacher with a nursing qualification, in charge of psychiatric nursing, and three faculty members provided support during the exercises.

Third Session: Radiation Risk Communication Exercises

In the first half of the session, participants were divided

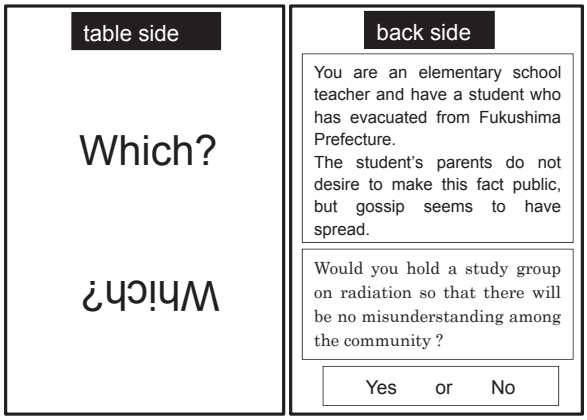

Fig. 1. Example of the card.

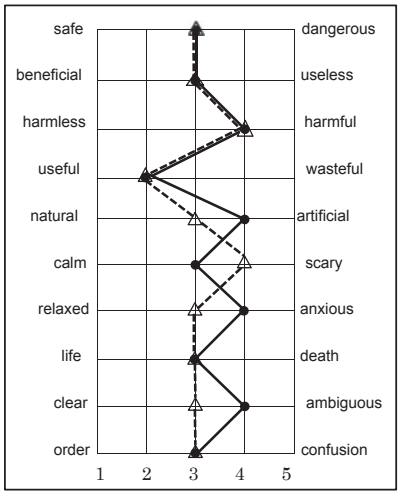

Fig. 2. Changes in the program before and after images of radiation (comparison of median) (n = 9) ●:before △:after

into two groups and carried out exercises using cards. On the back of these 18 cards, the following details were provided: the status of the person who makes possible judgment calls, such as a father or mother; the occupation, such as teacher or government employee; and imaginary conditions that might occur involving radiation substances. The participants were asked to take decisions on the stipulated conditions by indicating "yes" or "no," and providing an explanation before taking the next card. This exercise was designed by the researcher of this study with reference to the disaster prevention game developed by Yamori, *et al*[8]. One example is as follows: "You are an elementary school teacher and have a student who has evacuated from Fukushima Prefecture. The student's parents do not desire to make this fact public, but gossip seems to have spread. Would you hold a study group on radiation so that there will be no misunderstandings among the community ?" (Fig. 1) The person leading the lecture was a teacher in charge of psychiatric nursing, and three faculty members provided support. During the final thirty minutes of the session, groups discussed what they had learned from these exercises and presented the results of their discussed to everyone.

This program took place from X month to X+2 month in 2015.

2.3. The Questionnaires

An anonymous questionnaire was conducted before and after the lesson, and focused on participants' perceptions of radiation and the tools utilized in information gathering. The results of these questionnaires were then analyzed. The contents of the questionnaires are explained in three parts.

First, we asked questions using phrases related to radiation and compiled answers using an SD (Semantic Differential method) scale. We examined phrases organized into 10 itemized pairs: "safe/dangerous," "beneficial/useless," "harmless/harmful," "useful/wasteful," "natural/artificial," "calm/scary," "relaxed/anxious," "life/death," "clear/ambiguous," "order/confusion." These items were measured on a scale ranging from 1 point (a positive image) to 5 points (a negative image). Next, participants were asked to choose from three responses—"yes," "a little," or "none at all"—to express their level of knowledge of radiation. Participants were also asked to choose all applicable answers across 18 choices (e.g., Internet, Television, newspapers, etc.) related to tools used to collect information on radiation. Additionally, participants were allowed to select all applicable answers across 13 options regarding reasons for learning about radiation, such as "because I live in an area where there is a nuclear power plant" or "because it is being talked about in the media."

2.4. Ethical considerations

With regards to ethical considerations, participants were required to sign to confirm that they were cooperating in the research freely; it was also explained that this would not affect their performance evaluations. And this study was conducted with the approval of the Ethics Committee of the Hirosaki University Graduate School of Health Sciences (2015-015).

3. Results

After attending the education program, the median values of subjects' image of radiation changed: from 4 to 3 points in the "natural/artificial" category; from 3 to 4 points in "calm/scary"; from 4 to 3 points in "relaxed/anxious"; and from 4 to 3 points in "clear/ambiguous." (Fig. 2) Furthermore, when comparing using the Wilcoxon signed-rank test, there was no significant difference observed ($P < 0.05$).

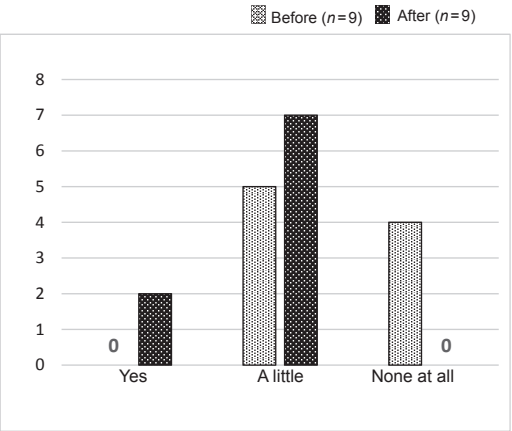

Fig. 3. Changes of self-evaluation about radiation

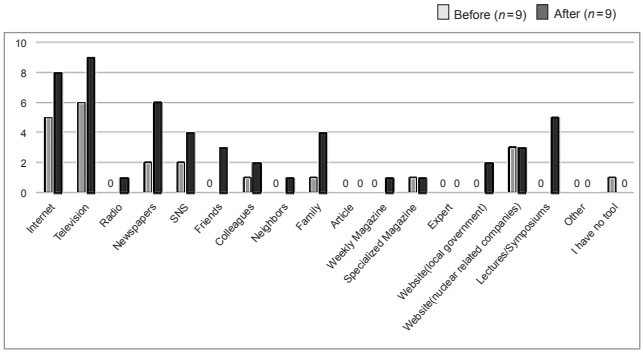

Fig. 4. Changes of the tools used to gather information about radiation.

Table 2. Participants' reasons for learning about radiation

Reason	Before	After
① Because I live in an area where a nuclear power plant is located.	7	6
② Because I'm anxious about what is going on in Fukushima Prefecture.	0	3
③ Because I have family members who receive treatment and examinations.	0	0
④ Because it was talked about in the media.	0	4
⑤ Because the topic is brought up among family members or friends.	0	0
⑥ Because I'm anxious about health effects.	0	4
⑦ It felt personally relevant.	3	5
⑧ Because it's harmful substances.	0	1
⑨ Because, I'm anxious about contamination of food.	0	1
⑩ Because I am interested in the effects of radiation hormesis.	0	0
⑪ Because it makes me think of the atomic bombs dropped on Hiroshima and Nagasaki.	1	1
⑫ Because I want to use it in the event of a disaster or accident.	0	3
⑬ The others	0	0

$n=9$

In terms of the extent of the participants' radiation knowledge, as reflected by their subjective assessment, there were no "yes" responses, five responses of "a little," and four of "none at all" before attending the education program. After attending the program, two subjects responded with "yes," seven with "a little," and no subject responded with "none at all." (Fig. 3)

Concerning the tools used to gather information about radiation, prior to attending the education program, 8 items were referred to, including Internet, TV, newspapers, and SNS. After attending, the number of tools used increased to 14, including lectures/symposiums, friends, radio, and neighbors (Fig. 4).

Participants' reasons for learning about radiation before attending the program included the following 3 reasons: "because I live in an area where a nuclear power plant is located," "it felt personally relevant," and "because it makes me think of the atomic bombs dropped on Hiroshima and Nagasaki." After the lectures, however, the number reasons given increased to seven, including "because I'm anxious about health effects," "because it was talked about in the media," "because I'm anxious about what is going on in Fukushima Prefecture." (Table 2)

4. Discussion

After implementing this program for the target audience, their image of radiation was revealed in four categories. The median value became 3 (from the previous 4) in three areas: "natural/artificial," "relaxed/anxious," and "clear/ambiguous." This is thought to indicate that participants started with a somewhat negative evaluation of radiation, which then might have turned into a more neutral evaluation following the program. Additionally, the median value of 3 remained as 3 in the categories of "safe/dangerous," "beneficial/useless," "life/death," and "order/confusion," showing that participants' neutral evaluation did not change in these areas. Additionally, the median value of 3 remained as 3 in the categories of "safe/dangerous," "beneficial/useless," "life/death," and "order/confusion," showing that participants' neutral evaluation did not change in these areas. From these

results, it can be seen that those attending this program maintained a neutral evaluation of radiation and improved their biased image of radiation.

On the other hand, after attending the program the median value of the "calm/scary" category became 4 (from the previous 3), suggesting a slight increase towards a negative evaluation – this result was thought to be quite interesting. The view that "a proper fear of radiation" is required, based on accurate information and knowledge, has been suggested by a number of different media sources. It is thought that meticulous attention is required so that attending this program will not lead to "an excessive fear of radiation."

With regard to the subjective assessment on the knowledge of radiation, before participating, no one responded positively ("yes"); participants either responded that they had "a little" knowledge or "none at all." After attending the program, the number of subjects who answered "yes" increased to 2 and no one responded with "none at all."

We continued to implement lectures and exercises on basic radiation knowledge using the most fundamental content; this seems to have an influence on the participants' subjective assessment.

In terms of the tools that can be used to collect information about radiation, there was a suggestion that the participants might have learned how to collect information on their own – since subjects had never participated in such lectures or symposia before the program, their participation had thus increased. With an increased use of tools to collect information, such as the Internet, SNS, TV, radio, and newspapers, it was inferred that participants had an increased tendency to collect information related to radiation using familiar media resources. Additionally, subjects' knowledge of how to gather radiation information from family, friends, neighbors, colleagues, and the local government also increased, as did their ability to discuss topics related to radiation with others, suggesting that they might have had more opportunities to do so.

Based on the data, it was inferred that the practices used in this educational program seem to be an effective means of introducing education in the field of radiation risk communication.

Study limitations

This study has limitations, including the fact that it was conducted with only one local government in one prefecture, with few subjects and multiple departments participating in the study, and the gender ratio was not balanced. There is also a possibility that the results of this study might not be applicable to the areas that have suffered a serious impact from the Fukushima Daiichi nuclear accident.

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Conflict of Interest Disclosure

The authors declare that they have no conflict of interest.

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