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## Awareness of Necessity for Radiation Risk Communication among Municipalities Adjacent to Nuclear Power Plants in Japan

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This paper reports results obtained from a questionnaire survey conducted to understand the awareness of radiation risk communication among municipalities adjacent to nuclear power plants. A total of 532 questionnaires were sent by post to the following organizations: 105 local government offices, 66 public health centers or departments, and 151 visiting nursing stations. All these organizations were within 30 km from nuclear power plants across Japan. We analyzed 154 completed surveys from the following respondents: 108 municipal employees, 33 home visiting nurses, and 13 public health nurses. The findings of this study suggest that local municipalities adjacent to nuclear power plants are aware of the necessity to communicate the risk of radiation; however, it has not been sufficiently practiced due to a lack of confidence in basic knowledge of the risk. It is also suggested that there is no consensus on who should take the initiative to communicate the risk. This is because there are differing interests between the nuclear power companies and the municipalities that did or did not invite nuclear plants to their locale. These findings clearly show there is a strong demand to acquire knowledge about risk communication.

*Key words:* risk communication, radiation risk, local municipal employee, public health nurse, home visiting nurse

### 1. Introduction

Accidents caused by the Great East Japan Earthquake at the Fukushima Daiichi Nuclear Power Plant are still affecting local communities. More than 170,000

people are being forced to live in areas inside or outside Fukushima Prefecture as evacuees<sup>1)</sup> because they are living in areas designated as “difficult-to-return zone,” “restricted residence area,” or “zone in preparation for the lifting of the evacuation order.” Immediately after the accidents, only insufficient information about the radiation risks were provided for the residents around the nuclear power plants. This brought attention to the need for adopting radiation risk communication measures to provide accurate knowledge and information about

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radiation risks<sup>2–5</sup>). With the recommendation for local municipalities to develop measures that can be put in effect in nuclear accident emergencies, we surmise that currently, local municipalities have addressed the issues involving radiation risk communication to residents.

This paper reports results obtained from a survey conducted to assess the awareness of risk communication for local municipalities near nuclear power plants.

## 2. Purpose

The purpose of this study is to investigate the awareness of radiation risk communication among local municipalities near nuclear power plants.

## 3. Methods

### 3.1. Survey subjects

Based on local government websites, we selected government offices, public health centers, and visiting nursing stations that were within 30 km of nuclear power plants across Japan. A total of 532 questionnaires were sent by post to the following organizations: 105 local government offices, 66 public health centers or departments, and 151 visiting nursing stations. Since we did not know which or how many local governments departments had jurisdiction over nuclear power plants, we sent three questionnaires to each local government. This allowed for up to three departments of local governments to respond if more than one department had jurisdiction over the plant. For public health centers and visiting nurse stations, only one questionnaire was sent to each facility.

### 3.2. Survey methods

Questionnaires were distributed to prospective participants by mail. When completed, surveys could either be returned to us by mail. The survey was conducted between August and September 2015. The submission of the completed questionnaire was regarded as consent to participate in the survey. The study was conducted with the approval of the Ethics Committee of the Hirosaki University Graduate School of Health Sciences (2015-004).

The section regarding demographic variables collected data on gender, age, distance between work place and nuclear power plant, and job position when completing the questionnaire. Other sections of the questionnaire were comprised of questions about the awareness of radiation risk, of risk communication in general, and of radiation risk communication. Participants were asked about their knowledge, understanding of the necessity; desire to participate in lectures; medium used to collect information; knowledge necessary for radiation risk

communication; and difficulties of risk communication. Respondents were also asked about who should be responsible for risk communication.

As the idea of risk communication has not been generally recognized, the instructions accompanying the questionnaire explained that “risk communication includes activities to ensure that personnel involved understand the risks correctly; respect ideas about the risks held by individuals or groups; and provide objective information about what the risks involved are, not just by explaining the safety of events that impose risks on society.” Further, we explained that we assumed that the communication of risk could be routinely discussed, not just in terms of crisis management, and that these communications be made by local municipalities and specialists but not by authorities specializing in risks.

### 3.3. Analytical methods

Based on the basic data: age, job position, and distance to a nuclear power plant as independent variables, data were analyzed to establish differences in awareness by the Kruskal–Wallis test using SPSS Version 20.0. The significance level was set as  $P < 0.05$ .

## 4. Results and Discussion

### 4.1. Demographics of the participants

Of the 532 surveys sent, 167 (31.4%) were returned, and analyzed 154 of these, excluding 13 in which responses to the demographic questions were not provided. Of the 315 sent to local government offices, 108 (34.3%) were returned and analyzed. Of the 151 sent to visiting nursing stations, 33 (21.9%) were analyzed, and 13 (19.7%) of the 66 sent to public health centers and departments were analyzed.

There were 106 male (68.4%) and 48 female (31.2%) respondents. The majority of the respondents were 40 to 49 years of age ( $n = 65$ , 42.2%) or 50 to 59 ( $n = 49$ , 31.8%). The numbers of municipal employees, home visiting nurses, and public health nurses were 108 (70.1%), 33 (21.4%), and 13 (8.4%), respectively.

The distance from the place of work to a nuclear power plant was classified into the following four: within 10 km ( $n = 26$ , 16.9%), over 10 to 20 km ( $n = 41$ , 26.6%), over 20 to 30 km ( $n = 57$ , 37.0%), and over 30 to 50 km ( $n = 30$ , 19.5%). (Table 1) The two prefectures with the greatest number of completed surveys were Sizuoka ( $n = 24$ , 15.6%) and Ibaraki ( $n = 20$ , 13.0%).

### 4.2. Risk communication

About one-third of the participants, 54 (35.1%) knew of the idea of risk communication. However, the number of participants who had knowledge about the risk communication remained at only 11 (7.1%). For

**Table 1.** Demographics of the participants

Demographic		Number of people ( <i>n</i> = 154)	%
Gender	male	106	68.8
	female	48	31.2
Age	20 to 29 years old	14	9.1
	30 to 39 years old	24	15.6
	40 to 49 years old	65	42.2
	50 to 59 years old	49	31.8
	over 60 years old	2	1.3
Job position	municipal employees	108	70.1
	public health nurses	13	8.4
	home visiting nurses	33	21.4
Distance between work place and nuclear power plant	within 10 km	26	16.9
	over 10 to 20 km	41	26.6
	over 20 to 30 km	57	37.0
	over 30 to 50 km	30	19.5

**Table 2.** Awareness of risk communication according to job position

	Mean Rank					
	Risk Communication ( <i>n</i> = 154)			Risk of Radiation ( <i>n</i> = 154)		
	Know	knowledge	Experience	Awareness	knowledge	Municipal Employees should have Knowledge
Municipal Employees ( <i>n</i> = 108)	73.08	70.26	69.42	73.49	69.49	81.43
Public Health Nurses ( <i>n</i> = 13)	60.77	81.81	87.62	63.12	77.92	68.85
Home Visiting Nurses ( <i>n</i> = 33)	98.56	99.5	97.41	96.3	101.24	68.06
<i>P</i> -value	0.002**	0.0001***	0.002**	0.009**	0.001**	0.047*

Kruskal-Wallis test, \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ , The result (mean rank) shows that high one is low awareness.

the opportunity to communicate risks, 88 (57.1%) had knowledge of such opportunities, but only 13 (20.1%) had actually experienced such an opportunity. The number of participants who indicated a wish to participate in lecture meetings of risk communication was 61 (39.6%).

By job position, the frequency of participants who knew of the idea of risk communication was significantly high among public health nurses, followed by municipal employees, and by home visiting nurses ( $P = 0.002$ ). The frequency of participants with “knowledge” and “experience” of risk communication was high among both public health nurses and municipal employees; however, it was low among home visiting nurses ( $P = 0.0001$ ,  $P = 0.002$ ) (Table 2). Public health nurses had a higher awareness in both “knowledge” and “experience”; there were no statistically significant differences in other

demographic data.

The fact that public health nurses and municipal employees have opportunities to implement risk communication not limited to radiation may have contributed to the high awareness of the necessity for risk communication.<sup>6,7)</sup>

#### 4.3. Radiation risks

Sixty-eight participants (44.2%) were aware of radiation risks, 73 (47.4%) showed a wish to participate in lecture meetings, and 27 (17.5%) had basic knowledge about radiation.

By job position, the percentage of participants who were aware of radiation risks was significantly high among public health nurses, followed by municipal employees, and home visiting nurses ( $P = 0.009$ ). For basic

**Table 3.** Medium used to collect information about radiation risks

Medium	Number of People	% (n = 154)
newspapers	116	75.3
lecture meetings	59	38.3
home page of nuclear power plant	54	35.1
explanation by the local government	49	31.8
environmental radiation dose monitors	45	29.2
website of radiation agencies	40	26.0
TV programs	36	23.4
magazine	21	13.6
journal of radiation	18	11.7
research paper	6	3.9
total	444	

radiation knowledge, this was significantly high among municipal employees, followed by public health nurses, and home visiting nurses ( $P = 0.001$ ), who reported the lowest awareness.

It was suggested that the interest in radiation risk of the visiting nurses was slightly low. However, home visiting nurses are in charge of populations vulnerable to disasters including the elderly and people requiring nursing care. Therefore, they feel a need to acquire basic knowledge because of the necessity to make decisions on risks in disasters and as they need to explain the details to populations vulnerable to disasters.

As per the distance to a nuclear power plant, the basic knowledge of radiation was high in the group within 10 km, followed by those at over 10 to 20 km, over 20 to 30 km, and over 30 to 50 km. There is an inverse relationship between distance and knowledge. ( $P = 0.026$ ). There were no statistically significant differences in regarding age.

The most frequently used medium to collect information about radiation risks was newspapers ( $n = 116$ , 75.3%), followed by lecture meetings ( $n = 59$ , 38.3%), and the websites of nuclear power plants ( $n = 54$ , 35.1%) (here, multiple answers were allowed for the question) (Table 3).

#### 4.4. Radiation risk communication

The number of participants who were aware of the necessity of radiation risk communication was 112 (72.7%). By job positions, the frequency of participants who thought “municipal employees should have knowledge” was high among home visiting nurses, followed by municipal employees, and public health nurses ( $P = 0.047$ ). The reasons for difficulties in practice (multiple answers) include lack of knowledge about radiation ( $n = 66$ , 42.9%), lack of knowledge about communication ( $n = 54$ , 35.1%), and lack of knowledge about risk awareness ( $n = 43$ , 27.9%). The top three frequently reported occupations in charge of communication of radiation risks

**Table 4.** Knowledge necessary for radiation risk communication

Knowledge	Number of People	% (n = 154)
basic knowledge about radiation	140	90.9
risks of radiation	138	89.6
influence of radiation on health	137	89.0
basic knowledge about radio protective	129	83.8
knowledge of communication	91	59.1
legal system	82	53.2
risk perception	80	51.9
disaster prevention measures	77	50.0
basic skills of communication	65	42.2
concept of risk communication	62	40.3
harmful rumors	60	39.0
ethical consideration	56	36.4
total	1,117	

(multiple answers) were municipal employees ( $n = 122$ , 79.2%), medical doctors ( $n = 107$ , 69.5%), and employees of nuclear power plants ( $n = 107$ , 69.5%). The top three frequently reported types of knowledge necessary for radiation risk communication (multiple answers) were basic knowledge about radiation ( $n = 140$ , 90.9%), risks of radiation ( $n = 138$ , 89.6%) and the influence of radiation on health ( $n = 137$ , 89.0%) (Table 4).

The findings of this study suggest that local municipalities near nuclear power plants are aware of the necessity of risk communication of radiation; however, it has not been sufficiently practiced due to a lack of confidence in basic knowledge. It is also suggested that there is no consensus on which organization or who should take the initiative in the risk communication. These findings clearly show there is a strong demand to acquire knowledge about risk communication. Further studies are needed to address measures to propagate radiation risk communication at the community level throughout the nation.

## 5. Conclusions

The local municipalities near nuclear power plants are aware of the necessity of communication about radiation risks. Therefore, measures should be taken to ensure that radiation risks are communicated at the community level throughout the area around the nuclear power plant.

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### Conflict of Interest Disclosure

The authors declare that they have no conflict of interest.

### References

1. Reconstruction Agency [Internet]. Tokyo: The number of refugees of the whole country [updated; 2016 Jan 29; cited 2016 Feb 26]. Available from: <http://www.reconstruction.go.jp/topics/main-cat2/>.
2. Nishizawa M. Risk communication, Tokyo: Energy Forum Shinsyo; 2013. p. 21–37.
3. Sekizawa J and Nakamura Y. Evaluation and Communication of Radionuclide Contamination in Foods after the Fukushima Daiichi Nuclear Power Plant Accident. Japanese Journal of risk analysis. 2011 Mar;21(3): 203–8.
4. Ban N. Issues Radiation Risk, Cleanup and Return of Evacuees. Japanese Journal of risk analysis. 2011;21(3):165–8.
5. Kai M. Lessons Learnt from the Fukushima Accident: What is a Key Issue on Radiation Risk and Its Management? Japanese Journal of Risk Analysis. 2014;24(3):169–73.
6. Goto A, Rudd ER, Lai YA, Yoshida K, Suzuki Y, Halstead DD, et al.: Leveraging public health nurses for disaster risk communication in Fukushima City: BMC Health Ser Res. 2014;14:129–37.
7. Konishi E, Nagai T, Kobayashi M, Mitsumori Y, Ono W, Asahara K & Porter SE: Post-Fukushima radiation education for public health nursing students: a case study. Int Nurs Rev. 2016;63(2):292–9.