

Increased Radiation Dose Issues in Tokatsu Area in Chiba Prefecture, Japan

– How the Situation and Measures were Explained to the Local Residents –

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After the accident at the Fukushima Dai-ichi nuclear power plant, the environmental radiation dose in some areas in Tokatsu in Chiba prefecture increased due to the released radioactive nuclides contamination. The ambient dose equivalent in the area was low (about 1 microSv/h or less) so that any damage to the residents' health was not expected. The main concern of the local governments was how to explain the current situation to the residents to relieve their anxiety and to prevent a panic reaction. Explanation to the residents was given in two different types of meetings: one was a large-sized seminar-style meeting (more than 100 residents) and the other was a small-sized group consultation meeting (up to 10 residents). Although both of the meetings had merits and demerits, the relationship of trust between the residents and the specialists was established more easily and the anxiety of the residents was decreased more effectively in the small-sized group consultation meetings than in the large-sized seminar-style meetings.

Key words: Fukushima Dai-ichi nuclear disaster, ambient dose equivalent, radiation exposure, safety, explanation

1. Introduction

A large amount of radioactive nuclides were released into the environment by the accident of Fukushima Dai-ichi nuclear power plant after the Great East Japan Earthquake on March 11, 2011. Emitted radio-nuclides were spread

widely to the area of Eastern Japan and heterogeneously fell on the ground, producing radioactive "hot spots" in which ambient dose equivalent was significantly higher than that in the surrounding areas (Fig. 1).

Radiation doses in Tokatsu areas in Chiba prefecture (0.09-0.49 microSv/h at 1 m above the ground according to the measurement by Chiba prefecture on May 31 and June 1) were higher than that in neighboring Tokyo (less than 0.1 microSv/h at 1 m above the ground). This was probably due to the increased deposit of radioactive cesium¹³⁷. The Tokatsu cities were broadcasted to be "hot spots" and the local residents in these cities soon knew this fact and many

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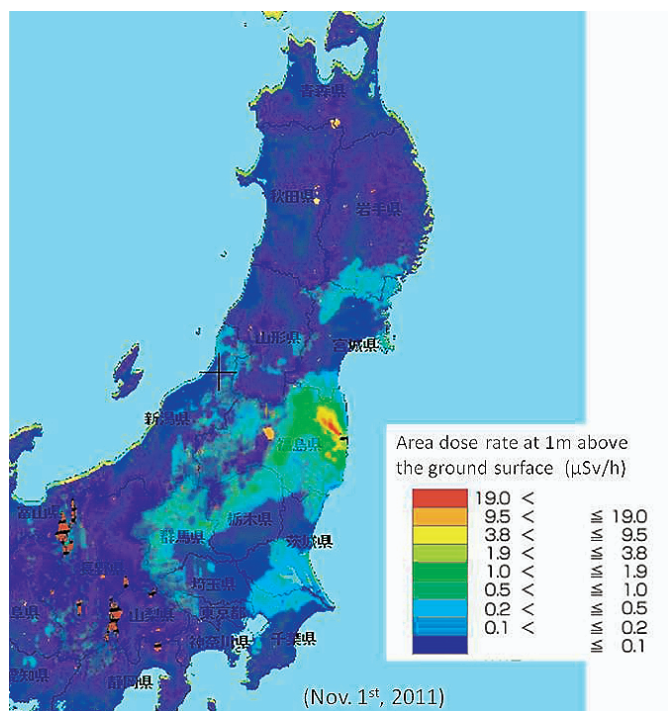


Fig. 1. The map that shows ambient dose equivalent rate at 1m above the ground surface in East Japan.

residents became seriously anxious.

To cope with this problem, 6 cities in the Tokatsu area (Matsudo, Noda, Kashiwa, Nagareyama, Abiko and Kamagaya) established a conference and measured the radiation doses in the cities. The ambient dose equivalent actually measured was less than 1 microSv/h (at 1 m above the ground) and it was unlikely to affect the health of the local residents in the 6 cities. Thus, the main roles of the conference were to relieve the anxiety of the residents and to prevent panic reactions. The experts of radiation science and radiation biology discussed the methods of how to explain the health damage from the current radiation dose and how to decontaminate the radioactivity in the Tokatsu cities at the conference²⁾.

And, they held two different sized meetings with the residents to explain the health effects and decontamination protocols. In this manuscript, we report on our experience of the meetings that were held in Kashiwa and Nagareyama cities and discuss the achievements and problems of these meetings depending on our impressions.

2. The situation and measures

The 6 cities in Tokatsu area (Matsudo, Noda, Kashiwa, Nagareyama, Abiko and Kamagaya) established a conference on radiation countermeasures in June 2011 and the activity started according to the guidelines provided in ICRP publication 111³⁾ and so on.



Fig. 2. A seminar-style meeting to explain decontamination plans.

First, radiation doses in these areas were measured. The ambient dose equivalent was almost always lower than 1 microSv/h except in special environments such as rain gutters or areas under eaves. The amount of radionuclide contamination in food and drinking water was also measured. All of these results were also lower than the standard values determined by the Japanese government so that the effective dose per year would not exceed 1 mSv.

The measured values of the radiation doses indicated that the residents in the 6 cities did not have to evacuate immediately and furthermore did not have to worry about the health effects under the current conditions²⁾. Based on these facts, local governments of the Tokatsu cities gave the highest priority to developing measures to prevent a panic reaction of the residents and to relieve their anxiety.

3. The meetings to explain the effects of low-dose radiation exposure on residents' health and the decontamination protocols

In Kashiwa and Nagareyama cities, small and large sized meetings were held with residents to explain the health effects due to radiation exposure and the protocols to decontaminate the areas. The large-sized meetings were held seminar-style and the small-sized meetings were held as group consultation meetings with the parents of kindergarten children and the specialists in radiation science and radiation biology.

The meetings to explain the protocols and the methods of decontamination were often held as large-sized seminar-style meetings, in which a large number of the residents (more than 100 people) gathered in a seminar hall (Fig. 2). To explain the protocols and the methods of decontamination to the residents, the large-sized meetings were more effective and suitable than the small-sized meeting. In the seminar-style meetings, the audience comprised the residents living in the same part of the city and thus the explanation and instruction could be performed at the same. As for the age of attendees, 40% were in their sixties and 38% were



Fig. 3. A small-group consultation meeting held at a nursery school.

in their forties. As for their gender, 59% were male and 41% were female. Many of attendees in their sixties were anxious for health issues of their grandchildren. Attendees in their forties were often interested in the measures of decontamination.

In contrast, the group-consultation meetings were held in kindergartens and nursery schools in the cities and were intended to explain the health effects of radiation exposure to parents of young children and infants. Parents of young children often had high anxiety about radiation exposure and living in the “hot spots”. These meetings were designed so that small numbers of participants were able to talk with the specialists in a face-to-face manner and to ask questions and have their questions answered (Fig. 3).

It was difficult to compare the usefulness of the different sized meetings because of their different aims and targets. In the seminar-style meetings, it was difficult for the audience to interrupt the lecturer’s talk and to ask questions at an appropriate time. Thus, the lecturer often finished speaking but the audience was left with unanswered questions. This resulted in some audience members remaining frustrated and anxious. In some meetings, opinions of some of the attendees misled the arguments and increased the anxiety of the audience, and the result was a loss of confidence in the lecturer. For example, in one meeting, an attendee claimed that a foreign researcher reported that the effects of natural radionuclides such as ^{40}K on human bodies are quite different from those of artificial ones such as ^{137}Cs . Of course, this information was incorrect because both ^{40}K and ^{137}Cs emit gamma and beta rays and these rays damage DNA similarly by indirect reactions. However, many attendees were disturbed because people are more sensitive to bad news than good news. The role of the chairperson is important in such a situation. He/she must dauntlessly wind up a confusing questioning and ask a

specialist to express correct interpretations.

Some audience members carried their laptops in to the lecture hall and they transmitted the situation of the meeting via Twitter®, but the contents of the message were often different from the original ideas of the lecturer and depended on the understanding of the person transmitting.

In contrast, in the small group consultation meetings, the audience was able to ask their own questions of the specialists and obtain the information that they needed. When the specialist’s explanation did not satisfy the attendee, the attendee could repeat her/his questions and ask the specialist for further explanation until she/he was satisfied. In the small-sized meeting, the specialists also benefitted. They could easily check whether the audience correctly understood their explanation or not. As a result, both the specialist and the audience were able to build a relationship of trust easily and almost all of the attendees were satisfied. The only drawback of the small-sized meeting was that the small number (up to 10 people per one specialist per hour) of attendees and the local governments meant that many meetings had to be held to satisfy the anxiety of the residents.

The representative questions in both types of meetings were summarized in Table 1. In small-sized consultation meetings, attendees asked specialists about more detailed questions, compared to large-sized seminar-style meetings.

4. The questionnaire survey to evaluate the usefulness of small group meetings.

The small group consultation meetings were held at 20 facilities in Kashiwa city and 12 in Nagareyama city. Questionnaire surveys to evaluate the usefulness of the small group consultation meetings were distributed in these 20 facilities and the contents of these surveys and the results are presented in Table 2 and Table 3. Almost all facilities judged that the small consultation meeting was very helpful in decreasing the anxiety of parents of small children. It is noteworthy, however, that even in the small-group meetings, the specialists could not diminish all of the anxiety of the parents.

5. Discussion

Many researchers have investigated the effects of radiation exposure on human beings precisely at the molecular mechanism⁴⁾. Long term follow-up epidemiological studies about A-bomb survivors at Hiroshima and Nagasaki and victims of the Chernobyl nuclear disaster have also revealed that no obvious health damage appeared among them unless they received radiation exposure more than 100mSv within a short period^{5,6)}. Some specialists reported that the situation would be similar in the current nuclear power plant accident⁷⁾. In the Tokatsu area, the radiation doses were lower than 1 microSv/h at places where small children

Table 1. Representative questions in two types of meetings**Large-sized seminar style meetings**

Q1. What does radiation exposure induce in human beings?

A1. When people are exposed to low-dose radiation, stochastic effects can appear in proportion to the radiation exposure dose. Most important stochastic effects are increase of cancer morbidity and hereditary effects. But, as for human beings, no reports demonstrated the increase of hereditary effects.

Q2. Is it necessary to have medical checkup tests?

A2. The effects of radiation exposure appear according to its dose. The dose in Tokatsu area is too low to appear significant effects due to radiation exposure. The residents need not have special medical checkup tests unless they show any symptoms.

Q3. Should we send our children somewhere safe?

A3. The radiation exposure dose in Tokatsu area is too low to evacuate children. Besides radiation exposure, there are many factors that would damage health. Totally considering them, the risk of radiation exposure in Tokatsu area is not significant.

Small-sized consultation meetings

Q1. Is it safe for children to play outside the house?

A1. There might be some additional risks when children play outside the house. One is to inhale contaminated dusts and another is to eat contaminated sands. But, these actions very slightly increase radiation exposure doses (less than several percents of the external exposure dose) according to specialists' calculation.

Q2. Is it safe for children to eat foods including materials obtained in neighboring areas?

A2. As food materials sold at supermarkets and glossary stores are checked, their radioactivity is less than reference values. Children can safely eat them. Unbalanced diets can produce more serious adverse effects on health conditions of children.

Q3. Is it necessary to check thyroid glands of children?

A3. The situation in Tokatsu area is quite different from that of Chernobyl area. The radiation exposure dose of thyroid glands of children in Tokatsu area is much smaller than that around Chernobyl area. It is not necessary to check thyroid glands of children in Tokatsu area. But, it is important to consult with medical doctors when some symptoms appear in thyroid glands of children because thyroid glands are often involved by many kinds of disease.

Questions put to officers of local governments are excluded. Only questions put to specialists are listed.

Table 2. Questionnaire for the usefulness of small-sized group consultation meetings

Questions

1. Did the small consultation meeting successfully alleviate the parents' anxiety and fear of the radiation exposure issues?
2. Was the small consultation meeting useful in improving the activity of children?
3. Was the small consultation meeting better than the seminar-style meeting?
4. Was the time zone of the meeting appropriate?
5. Was the small consultation meeting totally useful to your nursery school or kindergarten?
6. Do you want to hold this style of consultation meeting again?
7. Can you cooperate in this kind of questionnaire survey again?

Choices

- Yes
- No
- No change
- Unsure

Table 3. Results of the questionnaire for the usefulness of small consultation meetings

No. of the question	Yes	No	No change	Unsure
1	16 (80)	0	2 (10)	2 (10)
2	5 (25)	0	12 (60)	3 (15)
3	18 (90)	0	0	2 (10)
4	17 (85)	2 (10)	0	1 (5)
5	18 (90)	0	0	2 (10)
6	10 (50)	6 (30)	0	4 (20)
7	20 (100)	0	0	0

We asked 20 facilities and all of them answered. Numbers in parentheses are percentages of each choice.

spend time daily, such as play yards and classrooms of schools and kindergartens. In some special environments radiation doses were higher than 1 microSv/h, such as in rain gutters or areas under eaves. It was unlikely that the exposure to the low radiation dose under 1 microSv/h induced any health damage in the local residents including small children in the 6 Tokatsu cities.

The procedures for nuclear accidents have been announced by ICRP³⁾ and the local governments ought to perform the procedures in case of an accident, but it was difficult for residents to readily obey these procedures. Japanese citizens have a strong fear of health effects due to radiation exposure, because they are not well educated about the risk of radiation exposure even though Japan is the only country which experienced atomic bomb tragedies. Psychological studies have shown that when the public has little knowledge about something, it is judged to be safe only when it has "zero" risk⁸⁾. Slovic⁹⁾ pointed out the following findings in his study about the evaluation of risks in the daily life: the specialists with enough knowledge about radiation issues consider that driving a car was more dangerous than nuclear power, whereas the public with little knowledge about radiation issues has a strong fear of nuclear power. The best way to improve this situation would be to thoroughly educate the public about the effects of radiation exposure on human health, although it is difficult to do this within a short period.

To prevent a panic reaction by the residents, it is important to relieve their anxiety and emphasize the low risk and how it would not damage human health. One solution would be to explain the current situation of the contamination by radioactive materials and its effects on human health to the residents. Nakayachi¹⁰⁾ reported that it is important to build a relationship of trust to relieve their anxiety and, for that purpose, the small-sized group consultation meeting can be more suitable than the large-sized seminar-style meeting, because communication with each other is easier in a small-sized group consultation meeting.

In the seminar-style meeting, most of the attendees believed that radiation is dangerous even if its dose is small. Under such situations, it was difficult for attendees to understand the fact that the current situation was never dangerous. This can be explained by the reports by some psychologists that it is necessary to share values to build a relationship of trust. But, we want to say that the specialists must not go along with attendees' wrong opinions to share values.

The questionnaire survey in the kindergartens, where the small-sized group consultation meetings were held, clearly revealed the usefulness of this type of meeting. Although we could not perform the same questionnaire survey for the large-sized seminar-style meeting and failed to precisely compare the usefulness of these meetings, the authors who attended the meetings as the specialists got a better

impression in the small-sized group consultation meeting.

One of problems in the small-sized group consultation meetings might be that the specialist is condescending because the audience usually has little knowledge about radiation exposure issues and they cannot refute what the specialist says, even if the specialist is providing incorrect information. Specialists should not be opportunists and they must recognize that serious social problems could occur if their explanation was incorrect. The presence of an objective person would be helpful to avoid this kind of problem. In the small-sized group consultation meetings held in both Kashiwa and Nagareyama cities, the staff of each city office took part in the meetings as objective observers. It is also noteworthy that the attendees in the small-sized group consultation meetings could ask questions of more than one specialist with different academic backgrounds. We believe that our thoughtful measures minimized the confusion of the residents in Kashiwa and Nagareyama cities.

The questionnaire survey was performed only for the representative of kindergartens. And, no other quantitative analyses were done to objectively evaluate the usefulness of two kinds of meetings. This is a big limitation of this study and we should hesitate to draw a definite conclusion. But, we expect that the readers can understand the situation that it was impossible for us to perform the uniform style of questionnaire survey for attendees of both types of meetings to evaluate the usefulness of the meetings they attended due to political and ethical reasons.

6. Conclusions

In "hot spot" issues in Tokatsu area, the radiation doses were too low to induce any damage to the residents' health. This fact led the local governments to measure the radiation doses in Tokatsu area more precisely and also gave higher priority to prevent panic reactions by the residents. In Kashiwa and Nagareyama cities, the city offices and the specialists of radiation sciences collaborated and held both large-sized seminar-style meetings and small-sized group consultation meetings to explain the minimal effects of radiation exposure on the residents' health and to relieve the anxiety of the residents who had little knowledge about radiation exposure. We experienced that the small-sized group consultation meetings were more helpful than the large-sized seminar-style meetings because a relationship of trust between the specialists and the residents could be established more effectively. On a long-term basis, it is important to educate the residents well so that they can calmly act in case of a nuclear accident.

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