Justice of Sharing Information as Commons After the Nuclear Disaster in Fukushima

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Abstract

The term “commons” refers to common space shared or managed by people. Included in this space are various institutions and infrastructures foundational to human lives. We also count information regarding contents of shared space as commons because people cannot choose appropriate actions for their well-being without sufficient knowledge.

The explosion at the Fukushima Daiichi Nuclear Power Plant that followed the Great East Japan Earthquake and tsunami on March 11, 2011, had a significant impact on people who lived in and around Fukushima Prefecture. The most serious of many difficulties that ensued after the disaster was the issue of sharing and managing information about radiation and its influence on people’s health.

Parents have experienced substantial anxiety about the possible effects of contamination on themselves and on the younger generations; their frustration has been exacerbated by the lack of specific information regarding this issue. Such information should be regarded not only as personal but also as common and of public interest.

Regarding “informed consent,” it is usually thought that a medical diagnosis and recommended treatment are to be treated as confidential patient information. In the case of Fukushima, however, threats to health arising from an environmental factor could, arguably, mandate the sharing of information regarding health risks with all people living in an affected area.

The aim of this study is to acknowledge the integrity of sharing environmental and health-related information through the questionnaire to residents of Minami Soma City, Fukushima. An additional objective is to determine how to construct an appropriate sharing system for common information.

Key words: Nuclear crisis, informed consent, justice, health, sharing information, content analysis

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1. Introduction

The explosion at the Fukushima Daiichi Nuclear Power Plant caused by the Great East Japan Earthquake and tsunami that occurred on March 11, 2011, had a tremendous impact on people who lived in and near Fukushima Prefecture. The potential effects on health from diffused radioactive materials have been a concern for disaster victims; they have experienced considerable anxiety regarding post-disaster living conditions and possible harm to their children and grandchildren.

Radioactive materials are invisible. Intense exposure may result in the attachment of these materials to certain tissue components within the body; long-term effects could result in cancer or death. Further, radiosensitivity and the time required for radioactive materials to be eliminated from the body vary according to the type of radioactive material to which an individual has been exposed. Therefore, the degree of health damage caused by exposure to radioactive materials varies considerably based on individual factors and age.

More than two years have passed since the nuclear accident in Fukushima. During this time, governmental and prefectural agencies have taken certain actions to assist disaster victims. Immediately after the nuclear accident, the government designated evacuation zones. Measurement of radiation exposure and implementation of risk management policies have been authorized during decontamination operations. [1)2)] Regarding the effects on health from radioactive exposure, the government set reference values for radioactive materials, established a framework for risk management of low-dose radiation exposure, and performed predictive calculations on the diffusion of radioactive materials. Results of analyses have been published on the government's website. [3)] As a precautionary health measure, Fukushima Prefecture began ultrasound examination of children's thyroids in October 2011 since the thyroid is considered to be susceptible to becoming cancerous based on exposure to radiation. [4)]

However, only a portion of the results of thyroid examinations have been made public. Specific details have not been released, and full information disclosure has not occurred. It has been pointed out by the media that many people living in Fukushima Prefecture anxious about these events. [5)]

Minami Soma City of Fukushima Prefecture faces the Pacific Ocean; it is located to the north of and within a radius of 10 to 30 kilometers from the Fukushima Daiichi Nuclear Power Plant. The southern part of the city is designated as an evacuation zone, but people in the northern part have maintained their lifestyles since the disaster. Children under the age of 18 who lived in Minami Soma when the disaster struck have undergone thyroid examinations initiated by the prefecture as part of the Fukushima Prefectural People's Health Management Survey.

Prior to this study, the authors had performed research regarding building consensus for the regional reconstruction of Minami Soma; methodology included conducting hearing investigations and offering concrete support for regional construction activities led by citizens in Minami Soma

City. [6] Serious issues were discovered in the post-disaster regional regeneration process through direct involvement with the residents of Minami Soma. These concerns included employment and livelihood, children's health, and differences in the interests and concerns between people in restricted entry zones and those in other areas. However, we were unable to fully comprehend the interests and concerns of residents in Minami Soma toward health issues related to radioactive materials.

In this study, therefore, we have attempted to understand the specific interests and concerns regarding health issues related to radioactive exposure of residents in Minami Soma City who were victimized by the Fukushima Daiichi Nuclear Power Plant explosion. Then, we considered how to convey information to the residents. Analyzing the sources of anxiety for residents of the city a year and a half after the disaster will allow us to recognize problems that exist in the methods used so far for providing or sharing information. Additionally, it will offer important clues when considering what kind of information provision will be appropriate for experts or the government to share with residents to ensure their safety.

2. Objectives

The aim of the study is to consider how information, as commons, should be shared by gaining an understanding of the interests and concerns regarding radioactive materials of those who experienced the Great East Japan Earthquake in Minami Soma City, Fukushima Prefecture, and who continued to reside in the city a year and a half later.

3. Methods

1) Subjects

The subjects of the analysis were documents written anonymously in the free description style by 187 residents of Minami Soma City, Fukushima Prefecture, who survived the Great East Japan Earthquake and who continued to live there through July 2012. Topics explored were their interests and concerns toward radioactive materials. The documents were distributed as handouts at a public event called "Shinsai 500-nichi Soshite Korekara: Anata no Soboku na Gimon wo Issho ni Kangae Sensei ni Kiitemiyo! 'Souda, Sensei ni Kiitemiyo!'" (meaning "500 days since the disaster: Let's think together about your simple questions and ask the teachers! 'Yes, let's ask the teachers!'"). The event was organized by volunteers from Minami Soma City with the support of the city's board of education; organizers wished to offer a venue in which residents of the city could exchange questions or concerns regarding radiation with scientific experts.

2) Analysis Method

In this study, we performed a quantitative text analysis using software known as textseer1.1

[4]for responses to questionnaires written in the free description style. Our objective was to understand the sources of anxiety, interests, and concerns of respondents toward exposure to radioactive materials. A quantitative text analysis is a method used to quantitatively sort, analyze, and understand qualitative data, such as data from freestyle descriptions. In the quantitative text analysis, a morphological analysis and syntax analysis are first performed using natural language processing techniques. In a morphological analysis, text data that are analyzed are divided into morphemes—the smallest units of meaning, and information such as word classes are automatically assigned. A syntax analysis is used to recognize the relationships between words in accordance with grammatical rules and to identify relationships between modifiers and that which is modified. [7)8)9)] Performing these analyses using analysis software allows researchers to comprehend important phrases in the texts that appear frequently and to identify the strength of the relationships between words (degree centrality). In addition to a quantitative text analysis, "text mining" is a method used to dig out useful information from a vast amount of text (qualitative) data. In this study, however, we believed that it was appropriate to extract interests and concerns after investigating the intentions of those who described them. Therefore, a quantitative text analysis was performed on the sentences written in the free description style, according to the following instructions:

(1) Carefully read the entire freestyle texts to identify the underlying issues associated with anxiety and concerns.

(2) Analyze words that are modifiers and words modified through a dependency analysis; aim to understand the subjects of concerns and corresponding levels of anxiety. In other words, find out what people are concerned about and how strong the concerns are. A dependency analysis inevitably identifies words that are related, thereby allowing researchers to understand precisely the relationships between words and contexts.

(3) Analyze degree centrality—a measure used to assess important words based on the frequency of associations (edges) that connect words (nodes). This method allows researchers to grasp topics of greatest interest.

(4) Based on the results of the dependency analysis and the degree centrality calculation, create a network diagram to show what people are interested in and concerned about and how strong the interests and concerns are.

After carefully reading the texts, we noticed that there were many adverbial expressions such as "really," "why," and "how come," and that many expressions that reflected doubt and anxiety were used in sentences that included adverbs. Therefore, an analysis was performed with a focus on adverbs.

[4] Developed by Takanori Kawashima and Hajime Murai, Tokosumi Laboratory, Tokyo Institute of Technology Graduate School

3. Analysis Results

1) Subjects and Strengths of Interests and Concerns

Table 1 Contents and Frequencies of Interests and Concerns Identified through Dependency Analysis

Subjects of Interests and Concerns		Frequency
Word (modifier)	Word modified	Number (Dependency)
Second test	Necessary	6
Fine	Worried	5
Body	Effect	5
Minami Soma City	Life	4
Thyroid examination	Result	4
Lump	Cyst	4
Children	Health	4
Internal exposure	External exposure	4
Internal exposure	Worried	4
Tap water	Use	3
How much	Exposure	3
Children	Future	3
This time	Accident	3
Children	Body	3
Glass badge	Result	3
Effect	Worried	3
Food	Internal exposure	2
Children	Thyroid examination	2
Community	Life	2
Ordinary	Life	2

Table 1 provides a summary of subjects of interest and concern that were extracted from a dependency analysis. The set of modifying and modified words detected most frequently was “second test-necessary,” which was associated with the situation in which “the second test is necessary.” This set of words was followed by the fine-worried and body-effect sets, and then by the Minami Soma City-life, thyroid examination-result, lump-cyst, children-health, internal exposure-external exposure, and internal exposure-worried sets. The results of the dependency analysis identified these sets of words as sources of greatest concern: the second test is necessary, worried whether fine or not, effect on body, life in Minami Soma City, result of thyroid examination, children’s health, worried about internal exposure.

2) Subjects of Great Interest and Concern

Shown in Table 2 are the words extracted as a result of performing an analysis using degree centrality and the centralities of their degrees. The word with the highest centrality was children, which indicates that interests and concerns regarding children ranked highest. This word was followed by effect, internal exposure, worried, all of which imply that those living in Minami Soma City were worried about the effect of internal exposure on children.

Table 2 Subjects of Great Interest and Concern

Word	Centrality
Children	15
Effect	10
Internal exposure	9
Worried	8
Result	6
Fine	6
Minami Soma City	6
Examination	5
Thyroid	5
Life	5

3) The Entire Picture Regarding Interests and Concerns of Minami Soma City Residents

The network diagram in Figure 1 was created based on the dependency analysis; it provides a complete overview regarding subjects of interest and concern. The words extracted from the dependency analysis are indicated with circles (nodes). Arrows (edges) indicate the direction of modification. The array of children → effect → worried indicates the context "worried about the effect on children."

The sizes of the circles around the modifying and modified words indicate the frequency of dependency. Words with relatively large circles (e.g., children, effect, worried, radioactivity) were used frequently.

Figure 1 indicates that a great deal of interest and concern has been shown toward the following:

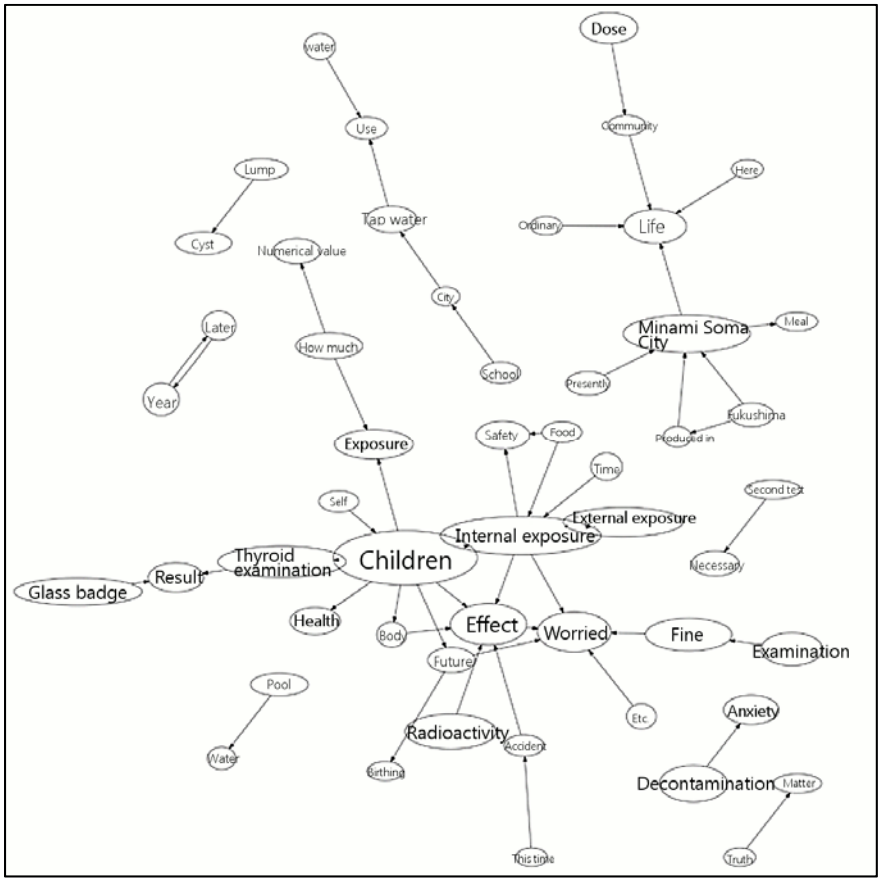
(1) Matters related to children: For example, there was a great deal of interest in health, body, future, effect of radioactivity, effect of accident, internal exposure, and result of thyroid examination.

(2) Matters related to radiation: For example, there was a great deal of interest in effect of

radiation, effect of internal exposure, safety of internal exposure, and internal exposure from food.

(3) There was a great deal of interest regarding life in Minami Soma City.

Figure 1 Network of interests and concerns



4) Information Associated with Choice of Action

By examining at length the interests and concerns of residents that affected their decisions about what to do, we noted that adverbial expressions appeared in a characteristic manner within analyzed texts. Table 3 summarizes adverbs that appeared frequently, frequency of appearance, and rate of appearance. Because adverbs modify verbs, we were able to comprehend the psychological states of residents by extracting the adverbs used and the verbs linked with them.

The following adverbs indicate interrogation: really, why, how come. These words accounted for approximately 19% of the total adverbs used. These adverbs were used in such contexts as, “whether … really no problem,” “whether … really fine,” “whether … really safe,” “whether … really remain healthy,” and “wonder how come...” From the above contexts, we understood that respondents had received information previously to assure them of their safety and continued good

health, but that they were skeptical about the information received. Thus, they were not able to trust the credibility of the information.

Table 3 Adverbs Expressing Concerns and Their Frequencies

Word	Frequency of Appearance (Number of Times)	Rate of Appearance (%)
Really	22	0.245
How	19	0.211
From now	7	0.078
How much	7	0.078
Often	6	0.067
Especially	6	0.067
In reality	5	0.056
Very	5	0.056
Yet	5	0.056
Still	4	0.045
Why	3	0.033
Slightly	3	0.033
Probably	3	0.033
Properly	3	0.033
Already	3	0.033
If	2	0.022
How come	2	0.022
Absolutely	2	0.022
Approximately	2	0.022
As is	2	0.022
Always	2	0.022

The following adverbs are used to seek concreteness (also accounting for approximately 19% of the total adverbs used): how, how much, properly, in reality, for. They were used in such contexts as, “how to deal with it,” “how much,” “I think … was probably caused by the accident… how is it in reality?” Other examples include: “I had a test done… but how is it in reality?” “I wonder what kind of effect ... materials have in reality,” and “I want reports with concrete numbers even when no abnormalities are detected.” From the above contexts, we were able to see that there was a need for concrete information on which individuals could base their decisions, such as specific methods,

volumes, numbers, contents, and explanations of test results.

The following adverbs are related to time: from now, yet, still, eventually. These words accounted for approximately 12% of the total adverbs used. The expressions used with these adverbs were used in such contexts as, “whether I could continue my life like this,” “I still cannot dry my futon outside,” and “not decontaminated yet.” We noticed that respondents were becoming increasingly anxious about whether they should continue their current lifestyles.

Regarding adverbs pertaining to matters in the future (e.g., from now), respondents were concerned about “whether there is really no effect from now on.” They also indicated that they were “worried about those who will become a father or mother from now on.”

Based on the above analyses, we were able to understand the following:

(1) The residents of Minami Soma City had received information already regarding their personal safety and their children’s safety, and their ability to maintain their lifestyle in the city, despite diffusion of radioactive materials. However, they were skeptical about whether things were really fine.
(2) Information that they could base their decisions on was scarce.
(3) They were not sure whether they could continue their current lifestyles, and their concerns included not only the present situation but also future circumstances. Thus, it is necessary to provide them with information with due consideration to time frames.

4. Discussion

1) Choice of Action and Information

The catastrophic nuclear power plant accident was an unprecedented event for residents of Fukushima, and it continues to affect their plans for the future. In particular, health issues associated with radioactive materials are linked directly to their daily routines. Decisions regarding where to live, what to eat or drink, where to play, and how to proceed with medical testing to maintain their health must be made by the disaster victims in their efforts to limit exposure to radiation.

The results of the analyses performed a year and a half after the earthquake disaster revealed that the residents living near Fukushima’s nuclear power plant were skeptical about the information that they had received. Therefore, the information provided to them by the government or scientific experts lacked credibility. Scarcity of information needed to make present and future lifestyle decisions can be cited as the primary reason for the lack of credibility. In other words, the residents have not been given sufficient information for making intelligent choices regarding their actions.

Information on health issues associated with radioactive exposure that should be shared as commons for those who live in the area. Furthermore, the question of how the government or experts should provide or share correct information is a matter of justice. Results of this study indicated that the credibility of the information will be questioned if information provided by the government or

experts is insufficient for helping residents' decision-making. In other words, there appears to be a problem with the perception regarding how information should be provided. Furthermore, if the government or scientific experts were to limit the volume or quality of information shared to prevent increased anxiety among residents, such actions would be regarded as paternalistic. Residents would lose much of their freedom to choose their own actions—a freedom that Aristotle says is made possible by justice. [10)]

2) Information space and Time

How should information, which could be useful when making decisions about the future, as well as the present, be provided? Various experiences are accumulated within the space in which one lives. Everyday decisions are made based on numerous pieces of information. The accumulation of decisions becomes empirical knowledge; as time advances, one will be able to predict future results based on little information. For example, a mother does not understand initially why her child is crying; with the accumulation of experience, however, she can predict why the child is crying based on the way that he/she cries. Consequently, she can make decisions easily (e.g., giving milk). The space in which a series of actions—from provision of information to obtainment of information, to sharing of information—are taken may be referred to as the Information space, which changes over time. Because the current Information space consists of accumulated empirical knowledge, predictions and decision-making regarding future events will be based on experiences from the preceding information space. Using the concept of "history of space," the authors have shown that the space people live in changes with time and has its own history. [11)]

In the case of the nuclear accident in Fukushima, the residents had not experienced living with the risks of exposure to radioactive materials. Because this experience was not within their information space, it has been difficult for them to predict the future Information space of living with the risks of radioactive exposure. Similarly, the government and experts have not gained enough empirical knowledge regarding the risks of radioactive materials. In other words, information providers and information receivers are being urged to make predictions about the future within a completely unfamiliar Information space.

One may ask how future predictions and choices can be made within this unfamiliar Information space. To be able to make predictions with little relevant experience, a new information space must be created. Because neither the government nor experts have had sufficient experience living in an environment with radioactive materials, it is important for both information providers and information receivers to share this new Information space of living in which they are becoming aware of the risks of radioactive materials.

Just as time changes by the second, the information space changes en route to the future. Consequently, the information received as of this moment can also change over time, which is a

matter of course. Information that the government and experts obtain might be limited. Residents will not be able to understand the changing information space unless they are provided with information that has been updated and modified as time passes. We determined that skepticism by the residents of Minami Soma regarding information they had received in the past was caused by the fact that they had not been able to share the changing information space with the government and scientific experts.

Decisions about what to do are made not only by individuals but also through interaction with others, including family members. Health issues concerning children and their future are matters of serious concern to other family members. Sometimes, a consensus needs to be built among stakeholders, such as families and relatives, about what action should be taken. Regarding future health issues, the authors used the concept of “prospective consensus building” and pointed out that choices about current situations must be considered after exploring historical trails and opinions, as well as risks associated with the future. [12)13)] Information sharing among stakeholders in consensus building can be regarded as the form of Information space that takes into account each time frame of the past, present, and future.

The best way to provide an information space for events not experienced previously (i.e., the catastrophic disaster that occurred in Fukushima) is to respond to concerns of residents in Minami Soma City. In other words, residents should be presented with sufficient and concrete information to support public statements assuring them that they are fine or safe. Adequate information will validate or invalidate their doubts about the credibility of information received, which they have expressed with the following words: really, why, how, from now, still. Giving answers to these questions does not necessarily mean assuring them that conditions are fine or safe. Furthermore, it is essential that those issuing information disclose fully that information may be modified over time. Transparency from information providers (i.e., government and experts) during the process of creating a new information space will allow information receivers (i.e., residents) to make fair and equitable decisions.

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