How Risk Communication Can Contribute to Sharing Accurate Health Information for Individual Decision-Making

An Empirical Study from Fukushima During a Post-emergency Period

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Abstract Risk communication is an established concept within the risk analysis framework. It is a tool for conveying the results of the scientific assessment and management of risk, for sharing safety-related information, and exchanging views and values amongst varying stakeholder groups. Its ultimate aim is to build trust through social interaction. However, the nature of effective risk communication is yet to be fully understood and, consequently, gaps in perception about risks between experts and nonexpert remain significant. In order to address this issue and suggest how risk communication can contribute to the creation of shared awareness of the risks and benefits of nuclear energy in Japan, this chapter will show an empirical study conducted in Japan between 2011 and 2012 in the post-Fukushima accident period. In the study, scientists explained nuclear safety and health effect of radiation to local residents evaluated from radiation-affected areas in Fukushima. It concludes that a carefully designed risk communication programme can serve as an effective tool to narrow gaps in perception between experts and nonexperts about risks, and as a useful and trustworthy source of safety information for individual decision-making.

Keywords Nuclear disaster · Fukushima · Public communication
Participation

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Introduction

It is widely agreed that the accident at the Fukushima Daiichi nuclear power plant was triggered by natural events combined with technical failures and was a human-induced disaster as well (National Diet of Japan 2012; Investigation Committee 2012). From this unfortunate accident, we have learned that human and organisational factors associated with emergency planning, response and decision-making for nuclear safety need to be more carefully reviewed and enhanced. Contributions from the social sciences, especially from risk management and risk communication, play key roles.

Risk communication is an established concept within the risk analysis framework. It is a vital tool for conveying the meaning of scientific assessments and risk management, for sharing safety-related information and exchanging views and values amongst various stakeholder groups, or for triggering behavioural change and resolving conflicts. Its ultimate aim is to build trust through dialogue and social interaction (Rosa et al. 2014).

However, it would not be an overstatement that the nature of effective risk communication is yet to be fully understood. As a result, risk communication is sometimes only partially integrated into risk management practice or is not considered at all. This marginalisation of risk communication is observed in a variety of risk communication practices, or more evidently, in the perception gaps that exist between the lay public and experts about risks.

This chapter will address this pressing issue and suggest how risk communication can contribute to create shared awareness about the risks and benefits of nuclear energy by illustrating an empirical study in Japan conducted between 2011 and 2012 in the post-Fukushima accident period. In the study, scientists explained nuclear safety and health effect by radiation to local residents during a series of risk communication practices planned for the evacuees from a disaster-affected region, Iitate Village of Fukushima Prefecture. The author was directly involved as the planner and as the facilitator as well. This exploratory study investigated why communication between professionals and laypersons often fails and, ironically, how it can sometimes lead to a mistrust of science.

Before presenting the empirical study, the next section reviews literature on risk communication and public participation in general and about Japan in particular.

Risk Controversy and Dialogues: Literature Review

Science and technology are inevitably associated with uncertainty. Neither 100% safety nor zero-risk exists. In other words, risk can be reduced but it can never be zero. What we need to achieve is not a situation of 'zero risk' but to a degree that society deems acceptable. In addition, society demands that risk managers are in control of the risk and not subject to reoccurring surprises, i.e., such as financial meltdowns and system failures.

Studies of risk communication in the past have shown that risk-related controversies depending on their characteristic (Rosa et al. 2014). And it is known that those in which even experts are divided on safety issues, or those that are closely bound with values, ethics, religious beliefs, or world views, tend to be intense. This makes forming a consensus more difficult. Worldwide disputes over genetically modified crops are a symbolic example (Krebs 2013; Nishizawa and Renn 2006). The debate over low-dose radiation exposure from the reactors at Fukushima is another example—risk perception remains high in contrast to expert's scientific risk assessment.

Social theorists have long recognised the existence of a new constellation of attitudes and concerns about risks derived from complex and uncertain aspects of science and technology such as the long-term and irreversible effects of global warming or economic impacts on agriculture by the application of genetic engineering; and they have pointed to the need for new ways of handling risk-related issues in the face of changing social circumstances (Beck 1992; Giddens 1991).

In this context, dialogue-based risk communication and citizen participation in risk controversies has increasingly come to be seen as a useful response. Scholars such as Forester (1999), Renn et al. (1995) and Schön (1983) suggest that it leads to critical self-reflection on the part of key actors and a greater mutual understanding between them, and that this in turn creates a more favourable environment both for problem-solving and for democratic governance. It is suggested that dialogue-based risk communication and participatory methods likely to be effective in risk debates that are complicated and for which scientific conclusions about the risks are ambiguous (Renn 2008).

In recent years, there has been more attention to dialogue-based communication in Japan. An example is a health communication practice for the residents during the volcanic eruption in the mountains on Miyake Island in 2000. A communication programme about health effects of volcanic gas was carried out by a team of university researchers (Kikuchi et al. 2006). There are also reports on community-based participatory disaster planning, as in the case of a village in Tottori (Okada et al. 2013; Okada 2015).

Notwithstanding of these, typical communication practices in Japan are still designed to be top-down. Hence, truly participatory and dialogue-based risk and crisis communication is limited (Nishizawa 2005; Nishizawa and Renn 2006).

It was therefore not surprising that the initial emergency communications on the events at Fukushima Daiichi nuclear plant by the central government were largely one-way. It was symbolised in a frequently quoted phase, 'no immediate impact (tadachini eikyoha nai)'. This was criticised by the public as well as the media who both felt that the central government and scientists were trying to make the effects of the radiation look less severe (Nakanishi 2014; Nishizawa 2013). Subsequently, local residents in Fukushima demanded their local governments provided them with more reliable safety information.

It was in this context that, 6 months after the accident, the author was appointed to be a risk communication advisor by Iitate Village Municipality of Fukushima from September 2011 to March 2012 and involved in implementing a public communication programme for its concerned residents.

Risk Communication for the Residents of Iitate Village, Fukushima 2011–2012

Initial Group Interview in September 2011

Iitate is a small village in northern part of Fukushima that used to be known for its organic farming and for raising cattle. However, after the accident, it became to be known domestically and internationally as a village badly affected by the nuclear fallouts. The village is located 25–45 km from the Fukushima Daiichi Nuclear Power Plant. Initially, it was outside the mandatory evacuation zone that was set right after the explosions. Nevertheless, it was discovered a few months later that the radiation level was higher than initially estimated due to nuclear fallouts blown by the wind. Of the approximately 6500 people who lived in the area before the accident, virtually all left the village as a precautionary measure when the evacuation zone was widened 2 months after the disaster. As of April 2013, the level varied from 4.5 μ (micro) Sv/h in a heavily contaminated area to 1.4 μSv/h in a less contaminated area.[1]

Consequently, many village residents had become sceptical of both scientists and officials both from the central and the local governments—they had been initially told to remain in the village but later the entire village was advised to evacuate the area. They felt betrayed by the authority, left behind, frustrated and scared, without being given any substantial safety information to protect their families for half a year. The municipality was at a loss about how to convey accurate safety information onto the village residents, because it was unfamiliar with techniques for communicating with the public about radiation. It was in this context that they invited a group of experts who had expertise on radiation science and public health.

The Iitate Village municipality asked the Risk Communication Advisory Group, which consisted of four experts including scientists and a medical doctor, to plan and implement an emergency communication programme. The author was its primary architect as its only expert on risk communication. Its role was to help scientific experts explain the science of radiation and the health effects from exposure to radioactive materials to local residents who had been evacuated from areas contaminated by nuclear fallout from the Fukushima Daiichi nuclear plant. The Municipality agreed not to intervene in the programme and its structural and content-wise design was left fully to the hands of the Advisory Group.

[1]By January 2016, the value had decreased even more, to less than 1 μSv/h, at the majority of measured areas; according to the official data from Fukushima Prefecture (Fukushima Prefecture 2016).

Risk communication needs to be well-designed and the cost of poorly design communication is high (Baruch and Kadvany 2011). As noted in a preceding section, risk communication aims to create mutual trust through its process, yet, if such a programme was run primary one-way, it would raise scepticism that its hidden aims are to persuade participants towards certain directions and could result in creating distrust instead.

In order to conduct a pilot study, the author selected one particular residential complex (Y) in Fukushima City where approximately 250 had taken refuge. Nearly 40% of the refugees were children under the age of twelve. Parents and grandparents were particularly concerned about the health effects of radiation on their children. In order to design such a programme, the author visited the sheltering site with a graduate student for initial group interviews in September 2011. Twenty residents, ranging in age from 25 to 80, voluntarily participated in and were interviewed to assess their level of knowledge of radiation and to determine their needs. The interviews lasted for a day.

The interviews revealed that interviewees had received little information about radiation from the local government or from schools during the six months after the accident. When asked about their sources of information, they said it was primarily television or the Internet. They expressed anger, disappointment and fear and said that they needed safety information that was trustworthy. The information they had received from the media was contradictory or largely frightening and, consequently, they could not fully trust it. Many felt abandoned, frustrated and scared without any substantial safety information to protect their families.

Communication Programme with a Radiation Expert in October 2011

Together with another communication advisor who was an expert in radiation science, the author attempted to implement a communication roundtable at the sheltering living complex, inviting about 20 local residents to participate, ranging in ages from 25 to 80 years.

The communication session lasted one and half hours, with a 60-min lecture about radiation and its health effects, followed by a Q&A session. The attendees, the lecturer and the author (facilitator) sat together on tatami mattresses. This created a friendly atmosphere in which participants could readily ask any questions or express their concerns.

Initially, the session looked to be successful. Feedback by questionnaire demonstrated that the participants had improved their understanding of radiation, and their fears about health effects were lessened. Yet, when the author conducted follow-up telephone interviews with several participants after the initiative, it was revealed that the programme had had little real influence on their thinking. They remembered very little from the lecture with a few exceptions. For example, in the lecture, it was mentioned that bananas naturally contain a radioactive material, potassium 40. However, rather than calm her one woman's fears about radiation, she said that she would not give her daughter bananas anymore. Hot springs that naturally contain radon were also mentioned in the talk and people remembered this. Fukushima has several radon hot springs. In other words, people remembered some things from the programme, but these were not the things that would help them make better personal decisions about living in Fukushima. Accordingly, the communication programme needed to be changed so it better suited the needs of the attendees.

Follow-up Interviews: More Active Listening Necessary

In order to implement a more adequate and effective programme, the author conducted another group interview in January 2012 with 11 volunteers. Interviewees were separated into two groups; a group of the elderly (average over 60 years old, $N = 7$) and a group of mothers (average 30–39 years old, $N = 4$).

The results of the interviews with the former group, the elderly, showed that this generation was more interested in prospects for rebuilding lives than radiation-related information. They saw the decision to return to the village as in the hands of the younger generation. They showed little interest in knowledge about radiation. A frequently referred sentence was: 'We want to know when we can return (home)'. Their primary concerns were not about radiation.

On the other hand, the results of interviews with the mothers illuminated two issues. The first was that they are seriously concerned about the health effects of radiation on their children and based on this, they had taken actions to protect them by changing the food that the children ate. The second was that a divergence occurred between what they actually wanted to know and what they actually heard from experts. What mothers wanted was hands-on information that they could use to help them protect their children and not the more detailed and scientific information provided by the experts.

The failure of the initial communication programme deployed in October 2011 made us realise that an effective communication programme can be planned only after active and careful listening to the target audience. The interviews with the group of mothers highlighted that they had a high interest in practical radiation-related information, but not in the *science* of radiation. They found it difficult to understand the science of radiation and its relevance to their situation. They wanted crucial information on how to protect their families, and not an academic classroom lecture. In particular, they wanted reliable information on the risks of consumption of radiation-contaminated food and the measures that they could take to limit their radiation exposure. In risk decisions, people feel safer when they have personal control over a risk (Slovic 2000). The group of mothers expressed its disappointment because they were yet to be given such hands-on information by the scientists.

Attentive listening is also important in risk communication for trust building. Earle et al. (2007) demonstrate that shared values are immensely important to public trust. Active listening conveys an unspoken message: 'We care, and therefore we listen to you'. Charles (Chuck) Casto, former United States Nuclear Regulatory Commission (NRC) executive who provided support to the Japanese government and U.S. Ambassador after the Fukushima accident, suggests that explaining science to local residents can be only possible after carefully listening (Casto 2016). His observation corresponds to the experience that the author had in Fukushima.

In summary, the attendees of communication exercises in Fukushima felt frustrated because the information provided by the scientists was not what they expected and wanted. It was either too scientific, and thus difficult to grasp, or not relevant to what they needed for their everyday life.

Furthermore, the author realised that the two groups involved, the elderly and mothers, needed to be approached separately. Among other things, the younger generation expressed a reluctance to talk frankly and give honest views in front of the older generation. It is understandable, since Iitate is a small village and its social structure is strong and conservative unlike cities like Tokyo. In particular, the behavioural expectation for females to be silent and obedient prevails in Iitate. Without active listening, such important elements could have been easily overlooked.

Revised Communication Programme in February 2012

Based on the results of the group interviews, the author formed a small study and designed and piloted a communication initiative that involved a study hour on 'foods and radiation'. The programme took place in February 2012. Four mothers volunteered to take part. Three had participated in the earlier group interviews and the author was acquainted with them.

The author prepared information material on 'How to deal with radioactive material in foods'. This explained that eating locally grown vegetables and drinking tap water was safe and why. In addition, the author asked a mother who acted as a quasi-leader of the group to bring in foods like milk and banana, to make it more participative, hands-on and more visibly clear. The discussion of how to deal with foods was deliberately slow paced and took almost 2 h. The author provided them with her email address and promised to answer any questions that they had later.

Before starting the discussion, the author asked participants what they wanted to know regarding the food they eat. Their interests varied; some wanted to know about the safety of eating local fish and others about drinking tap water. The author did not begin with a description of the risk of radiation, but instead, explained that there is no such thing as zero risk in foods. Some natural toxins are found in many vegetables, and non-pasteurised milk and raw eggs have certain risks that can be fatal. Conventional foods contain carcinogenic and neurotoxicants, such as acrylamide in potato fries, coffee and burnt bread. Hijiki (a sort of seaweed seen as a healthy food in Japan) contains inorganic arsenic and is banned from being sold in the UK.

The level of risks can be more readily grasped by being compared to accepted risks. The primary chemical of concern from Fukushima was caesium. However, potassium 40 has similar pharmacokinetics (ICRP 1990) and is a naturally occurring radioactive isotope in many foods. So, the author discussed that many foods, such as potato chips, milk and banana, contain 'natural' radioactive potassium 40 and that we consume as much as 100 Bq per a day of such radioactive material. That is, 20 Bq of potassium 40 is consumed from one bag potato chips, 20 Bq by eating a large-sized banana, 50 Bq by drinking 1 L milk, and 5 Bq by drinking a large can of beer; according to the Japanese Ministry of Education, Science and Technology (MEXT) (2011). In order to make this seem more real to participants, food was placed on the table in front of everyone.

This was followed by showing the results of sampling of vegetables that had been conducted by the Ministry of Health, Labour and Welfare of Japan. The current and future regulatory values of radioactive caesium in Japan were then explained. Finally, the author showed the results of monitoring tests conducted by Coop Fukushima that measured the actual amount of radioactivity found in cooked meals at home. The measurement conducted at 51 households in Fukushima prefecture demonstrated that the detected radioactivity came predominantly from potassium 40 and only a limited amount of caesium was detected (Fig. 1). Those households where caesium was found were reported to have used vegetables not on the market, but rather from edible mushrooms and plants taken from wild sources by the households themselves.

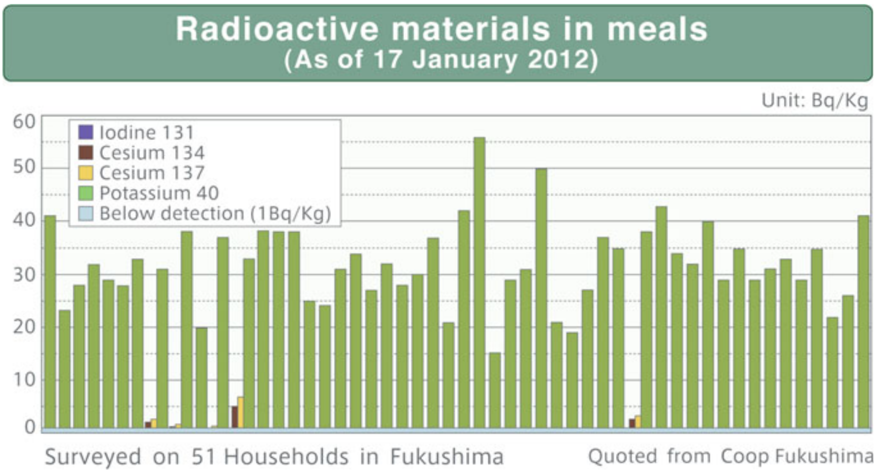

Fig. 1 Radioactive ceasium in meals in January 2012 (Study on 51 households in Fukushima Coop.) *Source* Fukushima Coop (2012) www.fukushima.coop/kagezen/2011.html

The participants said that the dialogue was more helpful and practical than the conventional explanations they had heard from the scientists visiting Fukushima. They said that they had overestimated the risks from radiation and said they would change the way they choose foods and water. An example was the way they chose drinking water. Originally, they were afraid of giving tap water to their children and usually bought more expensive bottled water. However, after the dialogue they said they would stop purchasing bottled water. The dialogue appeared to deliver credible safety information and help households decide what to consume.

Discussion

Effective risk communication delivers to its audience a clear and convincing view of risks by appealing to it emotions and needs; people interpret information largely using intuitive (emotion-based) heuristics. Scientists tend to explain facts using numbers and logic but this approach is not consistent with intuitive heuristics. In other words, risk communication needs to be designed so that it speaks to System 1 (intuition (emotion)), rather than to System 2 (logic); as psychologists or behavioural economists like Kahneman (2012) discuss.

Another key element in risk communication is risk comparison as noted in a preceding section (Nakanishi 2014). There is a tendency that when focused on one risk, people tend to perceive that the level of the risk is higher than it actually is (Nakada et al. 2012). Therefore, the author tried to explain the strength of the risk from radiation in comparison to other socially accepted risks; particularly radioactive potassium 40 in foods.

There is a persistent misunderstanding that the primary goal of risk communication is to ‘persuade’ the public, so that they will accept the risk in question, or to accurately convey scientific facts (Nishizawa 2015). In fact, the goal should be to give the information that people need to make appropriate decisions about their lives and community. As was argued in a preceding section, one needs to listen to those involved, so that risk communication can be tailored to their concerns, needs and interests. This is to say that risk communication starts by listening.

Creating an atmosphere where one can ask ‘dumb’ questions is also an important factor, and one which is often neglected in practice. It was the reason that we all sat on the tatami floor together, drinking tea. This allowed the conversation to be sometimes derailed by talk about the weather, families and even fashion. However, it allowed it to flow and provided a platform for questions that were about risk and of importance to the participants. The session was set in the early afternoon before their children came home; this helped mothers attend the session.

In paying attention to the 'risk-information route', it is also essential to make risk communication programme more effective. It is known that risk-related information is conveyed mainly through two communication channels: the mass media and by word of mouth (Renn et al. 1995). In fact, the mothers in the study said they felt that the most reliable source of information was their mothers' friends. Hence, it was hoped that accurate and useful information about radiation would pass on amongst the mothers' circle; ripple effects in the horizontal connection. They did say that they would pass the information further onto their friends who were not able to come to the session. This experience illustrates the importance of peers for adding credibility to messages and demonstrates that people are more likely to believe important safety information from familiar and/or trusted sources/persons. Trust is of utmost importance.

From the series of largely exploratory studies in Fukushima, we may argue that common failures in providing safety information were identified not in scientific information itself, but in the ways such information was conveyed to lay people. As discussed in the preceding sections, scientists primarily try to explain the science of radiation by the use of numbers and logic. However, lay people understand health-related safety information by images and emotions in the context of their needs. Experts want to be scientifically correct whereas the public need hands-on, clear and concise explanation of practical use. Scientists' adherence to scientific accuracy is understandable but communicating scientific information requires a different skill set and objective. This lay–expert gap is an element of mistrust of science and needs to be more readily acknowledged. In order to narrow the gaps, experts need to deliver the safety-related information that is asked for, tailoring their language to be more readily understood by their lay audience.

Our experience in Fukushima made us realise that more frequent science-lay encounters will help scientists become more aware of the needs of the lay people and of how they understand information. We also learned that it is best that the first encounter occurs during a noncrisis situation and not during a crisis itself. Furthermore, we learned that, before talking science, experts need to express empathy and concerns in front of the affected audience. This will lead to a more honest and trustworthy dialogue between them.

Conclusion

The present chapter discussed how to provide information that is both accurate and of practical use for local residents in relation to nuclear risk. The present case was complicated as the local residents felt abandoned and had persistent mistrust towards scientists and authority. As a result, one-way communication failed. Hence, interactive and a dialogue-based communication was used not only to deliver accurate information but also to create mutual understanding and build trust. In the event of an emergency, it is essential to deliver information concisely and within a short period of time. However, when a certain amount of time has elapsed, it becomes more important to consider delivering information tailored to the characteristics, emotions and needs of each population group. As reported in this chapter, demands for information about radiation information were notably different between the child-rearing generation and the older generation. It was the former group that needed hands-on and practical advice about radiation, not the latter. The programme used must to be tailored to the needs of its target audience. Therefore, it is necessary to actively listen to audience in the design of the programme in order to make it more useful and credible. It is good to remember that good communication starts from good listening.

With the increasing deployment of nuclear technology in developing countries in Asia and elsewhere, as well as the persistent negative perceptions within and outside Japan about agricultural products grown or caught in Fukushima and neighbouring regions, the bitter lessons from Fukushima need to be shared on an international basis. This will hopefully contribute to the creation of emergency communication programmes that are more robust, resilient and trustworthy. We learned from Fukushima that we can communicate more effectively regarding risks during noncrisis situations in a way that cannot be achieved during a crisis. Accurate safety information therefore needs to be shared during noncrisis situations and, in order to pursue this, the creation of truly participatory and dialogue-based public 'spheres (platforms)' for science-lay encounters need to be rigorously developed during noncrisis situations. Such platforms are also paramount for creating an atmosphere of trust and confidence that provide the basis for joint decision-making during crises. More fundamentally, risk communication needs to be paid more attention from the spheres of science and technology.

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