



Title	Solution-oriented risk governance practices toward reconstruction and improved well-being after the Fukushima disaster
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Citation	Annals of the ICRP. 2026
Version Type	AM
URL	https://hdl.handle.net/11094/104858
rights	
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Solution-oriented risk governance practices toward reconstruction and improved wellbeing after the Fukushima disaster

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Abstract- The Fukushima disaster of March 2011 reduced individuals' wellbeing and public satisfaction. This paper emphasises the importance of focusing on efforts to improve the wellbeing of affected people and their satisfaction with decision-making processes after a nuclear disaster. This is supported by research and practical examples from the aftermath of the Fukushima disaster. First, interviews with risk communicators following the Fukushima disaster revealed that the top goal of risk communication practices is to restore daily life, including improving wellbeing. Second, various risks and benefits after the Fukushima disaster can be compared using wellbeing indicators as outcomes, providing implications for the justification and optimisation of radiological protection. Third, the regulations after the Fukushima disaster were based on the assurance of reasonable safety regarding the radiation exposure level, and stakeholder involvement toward the improvement of public satisfaction and acceptance. Fourth, fairness was one of the most important factors in the public acceptance of the final disposal sites for decontaminated soils generated after the disaster. These examples highlight that wellbeing indicators can be used as powerful tools that incorporate the concepts of radiological protection to achieve solution-oriented risk governance practices.

Keywords: Fukushima nuclear accident; Happiness/Wellbeing; Risk assessment; Risk communication; Stakeholder involvement

1. INTRODUCTION

Improving wellbeing (i.e., happiness in this study) is the ultimate human goal. The Fukushima disaster caused a decline in the well-being of the affected people (Hommerich, 2012; Tiefenbach and Kohlbacher, 2015). Furthermore, this decline in wellbeing occurred long after the disaster, as shown by findings that returnees reported a greater sense of wellbeing than those who did not know whether to return (Murakami et al., 2020). In addition, the decision-making process regarding the response to radiation issues after the disaster had a great impact on public satisfaction (Murakami, 2016; Takada et al., 2022).

This paper emphasises the importance of focusing on the wellbeing of affected people and satisfaction with the decision-making process after a nuclear disaster. This is supported by research and practical examples from the aftermath of the Fukushima disaster. Two examples of individual wellbeing and two of public satisfaction are presented. First, the importance of enhancing the wellbeing of people affected by a nuclear disaster is described through interviews with risk communicators. Second, it is shown how the wellbeing indicator can be used to compare various risks following a nuclear disaster. Third, using food regulations and the lifting of evacuation orders as examples, the importance of involving stakeholders in enhancing public satisfaction is emphasised. Fourth, an important future issue after the Fukushima disaster is addressed: namely, the need to determine the final disposal site for

removed soil by 2045 and note that an approach with fairness consideration increases public acceptance. Through these examples, the relevance of addressing wellbeing indicators after a nuclear disaster is demonstrated for justification, optimisation, stakeholder involvement, and justice, as discussed in the field of radiological protection (ICRP, 2009; 2018; 1977).

2. RESEARCH AND PRACTICAL EXAMPLES

2.1. Interview with risk communicators

Risk communication to people affected by the Fukushima disaster has been wide-ranging, including not only dialogue about radiation issues but also comprehensive health counselling and general lifestyle support (Murakami et al., 2017). Understanding the objectives of these risk communicators' activities leads to the identification of recovery visions. Based on interviews with ten risk communicators who have been promoting risk communication since the Fukushima disaster, their objectives were categorized into six lower-objectives (i.e., 'alleviating anxiety and stress', 'supporting decision-making', 'gaining trust,' 'promoting understanding', 'deepening mutual understanding', and 'sharing values and empathy') and two higher-objectives (i.e., 'returning to normal life' and 'cultivating a wider perspective') (Honda et al., 2020). Importantly, 'returning to normal life' consists of the following four components: 'residents to be able to live healthily and happily', 'residents being able to feel safe and restoring their confidence', 'bring back the local community', and 'establish daily life'. The first component included the risk communicator's words regarding individuals' wellbeing: *'I want families to be able to live happily in a place of their choosing'*. Thus, achieving wellbeing among affected people is a major objective of post-disaster risk communication. Moreover, a questionnaire survey of the people affected by the Fukushima disaster showed that risk communication with family, friends, or medical professionals was positively associated with wellbeing through behavioural changes and self-efficacy (Kobayashi et al., 2021).

2.2. Risk comparison using the wellbeing indicator

Comparisons of the various risks and benefits of a nuclear disaster are essential for justifying and optimising radiological protection. Given that wellbeing is a higher objective, it is reasonable to use it as an indicator of risk comparison. In other words, mitigating various risk events to maximise wellbeing should be commensurate with the society being built after a nuclear disaster. Therefore, in this study, it was considered the risks not only of death but also of feelings of wellbeing. Indicators of happy life expectancy (i.e., the lifespan that people live with a subjective emotional feeling of wellbeing) and its loss or gain were developed (Murakami et al., 2023a; Murakami et al., 2021; Murakami et al., 2018).

Risk comparisons using loss or gain of happy life expectancy have been made for various risk events, such as cancer from radiation exposure, diabetes, psychological distress, and return, with important social implications (Murakami et al., 2023a; Murakami et al., 2021; Murakami et al., 2018). Additional psychological distress and diabetes were greater than the risk of cancer from radiation, and reducing these risks is important, especially during the chronic phase (Murakami et al., 2023a; Murakami et al., 2018). The benefit of return was greater than the risk of cancer from radiation (Murakami et al., 2021).

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2.3. Regulations

88 Exposure from foods and drinking water was limited after the Fukushima disaster
89 (Murakami and Oki, 2014). The provisional regulation values set immediately after the disaster
90 were revised to more stringent values one year later. Although some may question whether the
91 new regulatory values were useful in effectively reducing exposure, this revision was based on
92 the concept of ensuring greater safety and security (Ministry of the Environment, 2023). More
93 specifically, revised regulatory values were established mainly reflecting the consumers'
94 wishes, following the statement in ICRP Publication 111: 'For management of the radiological
95 quality of foodstuffs in a country with a contaminated territory, relevant stakeholders [...] and
96 representatives of the general population should be involved in deciding [...]' (ICRP, 2009).
97 A more localised effort was made in the Round-Table project in Kashiwa City, a hotspot for
98 radiation contamination, where discussions among stakeholders (e.g., consumers, food
99 producers, and experts) led to the establishment of food management by themselves (Igarashi,
100 2022). This importance of stakeholder involvement could be found in the lifting of evacuation
101 orders. The lifting required sufficient discussions among the residents, municipality, and
102 prefecture in addition to other two conditions (i.e., exposure levels of < 20 mSv/year and
103 progress in decontamination as well as restoration of infrastructure and daily services (Ministry
104 of the Environment, 2023).

105 These discussions involving stakeholders were not focussed on radiation exposure safety,
106 but rather addressed questions such as 'what kind of society we want to achieve after the
107 disaster?'. This type of stakeholder-involved regulation is called 'Standard II' to distinguish it
108 from the traditional top-down regulation 'Standard I' that assures safety (Murakami, 2016).
109 Standard II, which involves stakeholders, is the basis for supporting how we aim to realise a
110 society in which people are satisfied after a nuclear disaster.

111

2.4. Public acceptance of final disposal of removed soil

112 One of the long-term issues that remained after the Fukushima disaster was the final disposal
113 of soil removed after large-scale decontamination. Siting final disposal without adequate public
114 acceptance would be detrimental to public satisfaction. Similar to studies on the acceptance of
115 nuclear power plants (Starr, 1969; Visschers and Siegrist, 2013), public acceptance of the final
116 disposal of removed soil has been found to be related to trust, perceived risk, and perceived
117 benefits (Shirai et al., 2023). However, the concepts of justice discussed in the field of
118 radiological protection (ICRP, 2018) play a major role in public acceptance. Studies have
119 reported that two fairness factors, procedural fairness (e.g., the decision was made using an
120 approach that reflects the opinions of the residents at the site) and distributive fairness (e.g.,
121 there are multiple sites for final disposal), have a strong impact on public acceptance of this
122 final disposal (Murakami et al., 2023b; Takada et al., 2022). Notably, approximately 60% of
123 the respondents (i.e., majority) would accept final disposal if the decision was based on the
124 opinion-reflective approach (Murakami et al., 2023b). These studies emphasise that an
125 approach that considers fairness is essential for a society in which the public can be satisfied
126 with the recovery process.

127

3. CONCLUSIONS

128 This study provides examples of the importance of improving the wellbeing and decision-
129 making processes that satisfy people. These examples reveal that addressing wellbeing and
130 public satisfaction is an extension of what has been discussed in the context of radiological
131 protection and deserves attention in risk governance for solving problems after a nuclear

disaster. First, improving individual wellbeing or public satisfaction can be treated as an indicator of stakeholder involvement practices in the recovery process. Second, wellbeing can be used as an indicator to discuss justification and optimisation in the face of various risks. Third, evaluating fairness as a factor that determines public acceptance in the decision-making process helps to concretise the importance of the concept of justice in a post-radiation disaster society.

It is emphasised that wellbeing indicators can be used as powerful tools that incorporate the concept of radiological protection to achieve solution-oriented risk governance practices.

ACKNOWLEDGEMENTS

I would like to thank Editage (www.editage.jp) for English language editing. This research was performed by the Environment Research and Technology Development Fund (JPMEERF22S20906) of the Environmental Restoration and Conservation Agency provided by Ministry of the Environment of Japan and “The Nippon Foundation-Osaka University Project for Infectious Disease Prevention.”

REFERENCES

- Hommerich, C., 2012. Trust and subjective well-being after the Great East Japan Earthquake, tsunami and nuclear meltdown: Preliminary results. *Int. J. Jpn. Sociol.* 21, 46-64.
- Honda, K., Igarashi, Y., Murakami, M., 2020. The structuralization of risk communication work and objectives in the aftermath of the Fukushima nuclear disaster. *Int. J. Disaster Risk Reduction* 50, 101899.
- ICRP, 2009. Application of the commission's recommendations to the protection of people living in long-term contaminated areas after a nuclear accident or a radiation emergency, ICRP Publication 111. *Ann. ICRP* 39.
- ICRP, 2018. Ethical foundations of the system of radiological protection. ICRP publication 138. *Ann. ICRP* 47, 1-65.
- ICRP, 1977. Recommendations of the ICRP. ICRP Publication 26. *Ann. ICRP* 1.
- Igarashi, Y., 2022. The Round-Table project in Kashiwa: a dialogue to reconcile consumers and farmers in the Tokyo suburbs after the Fukushima accident. *Radioprotection* 57, 209-215.
- Kobayashi, T., Takebayashi, Y., Goto, A., Nakayachi, K., Murakami, M., 2021. May risk communication with non-experts contribute to post-disaster restoration of normalcy? A survey on the disaster-struck prefectures after the Great East Japan Earthquake. *Int. J. Disaster Risk Reduction* 65, 102564.
- Ministry of the Environment, 2023. Booklet to provide basic information regarding health effects of radiation (3rd edition). <https://www.env.go.jp/en/chemi/rhm/basic-info/>. Accessed on December 16, 2023.
- Murakami, M., 2016. Risk analysis as regulatory science: Toward the establishment of standards. *Radiat. Prot. Dosim.* 171, 156-162.
- Murakami, M., Oki, T., 2014. Estimated dietary intake of radionuclides and health risks for the citizens of Fukushima City, Tokyo, and Osaka after the 2011 nuclear accident. *PLOS ONE* 9, e112791.
- Murakami, M., Ozaki, A., Ono, K., Nomura, S., Takebayashi, Y., Tsubokura, M., 2023a. Comparing the risks of diabetes, psychological distress, and radiation-induced cancer exposure after the Fukushima disaster using the loss of happy life expectancy. *medRxiv* (preprint), 2023.05.01.23289327.
- Murakami, M., Sato, A., Matsui, S., Goto, A., Kumagai, A., Tsubokura, M., Orita, M., Takamura, N., Kuroda, Y., Ochi, S., 2017. Communicating with residents about risks following the Fukushima nuclear accident. *Asia-Pac. J. Public He.* 29, 74s-89s.
- Murakami, M., Takada, M., Shibata, Y., Shirai, K., Ohnuma, S., Yasutaka, T., 2023b. NARE 2023 (Hirosaki).

- Murakami, M., Takebayashi, Y., Ono, K., Kubota, A., Tsubokura, M., 2020. The decision to return home and wellbeing after the Fukushima disaster. *Int. J. Disaster Risk Reduction* 47, 101538.
- Murakami, M., Takebayashi, Y., Ono, K., Tsubokura, M., 2021. Risk trade-off analysis of returning home and radiation exposure after a nuclear disaster using a happy life expectancy indicator. *J. Radiat. Res.* 62, i101-i106.
- Murakami, M., Tsubokura, M., Ono, K., Maeda, M., 2018. New "loss of happy life expectancy" indicator and its use in risk comparison after Fukushima disaster. *Sci. Total Environ.* 615, 1527-1534.
- Shirai, K., Takada, M., Murakami, M., Ohnuma, S., Yamada, K., Osako, M., Yasutaka, T., 2023. Factors influencing acceptability of final disposal of incinerated ash and decontaminated soil from TEPCO's Fukushima Daiichi nuclear power plant accident. *J. Environ. Manage.* 345.
- Starr, C., 1969. Social benefit versus technological risk. *Science* 165, 1232-1238.
- Takada, M., Shirai, K., Murakami, M., Ohnuma, S., Nakatani, J., Yamada, K., Osako, M., Yasutaka, T., 2022. Important factors for public acceptance of the final disposal of contaminated soil and wastes resulting from the Fukushima Daiichi nuclear power station accident. *PLOS ONE* 17, e0269702.
- Tiefenbach, T., Kohlbacher, F., 2015. Happiness in Japan in times of upheaval: Empirical evidence from the national survey on lifestyle preferences. *J. Happiness Stud.* 16, 333-366.
- Vischers, V.H.M., Siegrist, M., 2013. How a nuclear power plant accident influences acceptance of nuclear power: Results of a longitudinal study before and after the Fukushima disaster. *Risk Anal.* 33, 333-347.