Unveiling Risk Communication Breakdowns: A literature review on the 2011 Fukushima Disaster

Abstract

This literature review explores key failures in risk communication following the 2011 Fukushima nuclear disaster. Through an examination of 17 peer-reviewed journal articles, three main categories have been identified: the use of technical language, inconsistent dissemination of information, and downplaying the extent of risks. Findings reveal challenges in conveying clear and understandable information to the general public. Besides, lack of coordination and delays in communication increased public distrust. Furthermore, the government and TEPCO's approach of devaluating the extent of risks heightened public anxiety and mistrust. Overall, this analysis offers a deepened understanding of the debates surrounding risk communication and its potential failures following a nuclear disaster.

Introduction

On March 2011, the Great East Japan Earthquake shook the country's north-eastern region, succeeded by a large tsunami. Massive ocean waves damaged the cooling system of the Fukushima Daiichi Nuclear power plant (FDNPP), which was under the operation of the Tokyo Electric Power Company (TEPCO). Consequently, three nuclear reactors melted down, releasing radioactive substances into the surrounding environment (Walravens et al., 2022). Following the disaster, experts, medical professionals, the Japanese government and TEPCO engaged in risk communication strategies to inform the population about the potential risks associated with radiation exposure. The primary and early concerns among the Japanese population included: evacuations and subsequent relocations coupled with controls of the potential contaminated surroundings and food safety. Amidst the public uncertainty, the Japanese government and the units involved failed to properly inform the public of the potential risks and the severity of the incident (Shimura et al., 2015). Accordingly, the research question guiding this literature review is as follows: *What were the key failures in risk communication after the 2011 Fukushima nuclear disaster?* The relevance of the topic is heightened by the increased awareness about the crucial role of effective risk communication in disaster situations. Indeed, according to Perko (2016), the Fukushima case is described as a 'practice scenario' for experts in risk communication (Perko, 2016).

Although risk communication is usually regarded as the communication prior to a disaster, according to Coombs (2011), the disaster response phase may also require risk communication strategies. In this sense, effective risk information can become a key aspect of the post-crisis communication needs assisting the psychological and physical recovery of the population (Coombs, 2011). Hence, in conjunction with the evident prevalence of risk communication studies after Fukushima, crisis communication will not be covered in the present literature.

Methodology

This research has been conducted through Web of Science, a database that provides access to a large selection of peer-reviewed journals across various disciplines. The search strategy combined the following keywords: "risk communication" AND Fukushima AND/OR challenges AND/OR radiation risks. The terms used for the initial search included "risk

communication" AND Fukushima. In subsequent searches, the two remaining concepts, challenges OR radiation risks, were combined with the initial terms to narrow down the scope. For instance, the second search included: "risk communication" AND Fukushima AND challenges. Besides, additional articles were incorporated through the references of the selected results based on the snowballing principle. The initial search generated 257 results. Following a thorough examination, 50 articles were pre-selected based on their potential relevance for the present study. 38 were excluded as they lacked coherence with the object of study, resulting in the selection of 12 articles from the initial search. From the second and third search, 2 additional studies were selected. Finally, 3 articles were included through snowballing resulting in 17 articles selected for this literature. In the attempt of broadening the scope, crisis communication was left out because it led to reduced results. Hence, by including the selected keywords, this study aims at identifying relevant literature that addresses potential risk communication failures after the 2011 Fukushima disaster.

Results

This literature review aims at highlighting the existing debates surrounding risk communication and its potential failures following the 2011 Fukushima disaster. Based on coherence and commonality between the studies, the findings are discussed under three domains: use of technical language; inconsistent dissemination of information; and downplaying the extent of risks. Several studies have underscored the importance of communicating risks effectively allowing people to take decisions with accurate, timely and consistent information. However, this can only be achieved if trust is established (Kasperson, 2014).

Category 1: Use of technical language

Already in 1988, Covello and Allen identified seven fundamental principles as the basis for effective risk communication. The seventh principle advocated for the use of clear and free-jargon language to prevent confusion and frustration among individuals (Covello, 2011). Nevertheless, numerous scholars argued that risk communication after the Fukushima disaster lacked compliance with this principle. Shortly after the incident, the available information was predominantly technical, prompting the Japanese public to resort to sources of questionable reliability. While this initially provided some comfort, Ng & Lean (2012) emphasized the need for plain and clear language in order to reach a larger audience and avoid misinterpretations (Ng & Lean, 2012). Conversely, other scholars highlighted the lack of radiation education as a contributing factor to the public's distrust and difficulty in understanding basic norms and concepts employed by the government and scientific experts (Kanda, 2014; Tomvik et al., 2016).

Particularly in the time of the evacuation, clarity in conveying protective measures becomes crucial. However, Perko (2016) noted that the use of arcane and technical expressions by diverse radiological units led to misunderstandings among the general public. (Perko, 2016). For instance, terms such as *cloud,* indicating serious contamination, were misused spreading anxiety and confusion among the population (Claire Mays et al., 2016). Additionally, reference to mistaken or unexplained norms, for example the *normal level,* led to numerous misinterpretations (Perko, 2016). Misrepresentations and misinterpretations of risks were also present in the media, where only one out of five articles provided clear and sufficient radiation information (Tomvik et al., 2016). After some time, in response to language-related criticism, an investigation was conducted on a risk communication strategy employing a

jargon-free approach. However, many citizens perceived it as a form of 'brainwashing' rather than as a 'safety initiative' (Polleri, 2021).

Table 1. *Category 1: Use of technical language*

Covello (2011)	*Seven fundamental principles for effective risk communication; (7) Use of clear language*
Ng & Lean (2012)	*Initial technical information led to the public's reliance on 'questionable' sources*
Tomvik et al. (2016); Kanda (2014)	*Lack of education to understand basic technical concepts*
Perko (2016)	*Mistaken or unexplained norms (e.g. 'normal level')*
Claire Mays et al. (2016)	*Use of concepts such as 'cloud' without proper explanation*
Tomvik et al. (2016)	*1 in 5 articles published provided free-jargon information*
Polleri (2021)	*Free-jargon communication strategy; 'brainwashing' perception*

Category 2: Inconsistent dissemination of information

In addition to the use of language, the Fukushima disaster encountered further risk communication challenges, one of them being the inconsistent dissemination of information This ranged from a lack of accurate and timely information to a coordination gap between the government and the scientific units involved (Kinoshita, 2013; Funabashi & Kitazawa, 2012). Shimura et al., (2015) identified communication challenges between the government, health experts and local citizens as a major concern (Shimura et al., 2015). At the early stages of the disaster, risk communication on food safety became crucial. However, incomplete information was spread due to ongoing risk assessment (Walravens et al., 2022). To further aggravate the situation, the Japanese government delay in notifying government municipalities about the scale of the incident led to disorderly evacuations (Goto et al., 2014). Similarly, TEPCO and the government regulatory bodies released risk information extremely slowly. Consequently, the public believed that the bodies were concealing crucial information, causing the population to take self-measures; this included, leaving their homes and evaluating radiation levels on their own (Kimura, 2016).

Risk communication was crucial in explaining radiation exposure. However, explanations varied across scientific experts leading to increased anxiety and distrust towards medical specialists (Kanda, 2014). Ng & Lei (2012) noted that loss of confidence towards health professionals arose from potential rumours on the effects of radiation. Following a widespread dissemination on the ineffectiveness of potassium iodide to protect the thyroid gland, rumours arose suggesting that salt could be a potential substitute. Despite this, health experts did not contest it; instead, contradictory claims from medical reports were published further exacerbating the situation. (Ng & Lean, 2012).

Table 2. *Category 2: Inconsistent dissemination of information*

Funabashi & Kitazawa (2012); Kinoshita (2013)	*Lack of timely and accurate information. Also, coordination difficulties between units involved*
Shimura et al. (2015)	*Poor communication between the government, medical professionals and the population*
Walravens et al. (2022)	*Early food safety risk communication was hindered by incomplete information*
Goto et al. (2014)	*Delayed government notification of the incident scale led to disorderly evacuations*
Kimura (2016).	*Slow release of risk information caused public distrust and increased self-measures*
Kanda (2014)	*Divergent expert explanations on radiation exposure*
Ng & Lean (2012)	*Loss of confidence towards health experts due to radiation rumours*

Category 3: Downplaying the extent of risks

Back to Covello & Allen's fundamental principles, honesty and transparency between the parties involved stands out as one of the most valuable features in effective risk communication (Covello, 2011; Mays et al., 2016). Experts concur that it is preferable to inform the public that 'the situation is not as severe as they first thought' than having to say that 'things are worse than initially perceived' (Figueroa, 2013).

In the Fukushima case, the lack of honesty and transparency was reflected in the denial and downplaying of the extent of risks. Shortly after the incident, the Japanese government assured that the reactors were functioning normally. This initial response led to the perception that the government was devaluating the severity of the situation. Subsequently, as events unfolded, the government's rating of the disaster escalated from level 4 (local consequences) to level 7 (extensive environmental and health consequences), validating the public's perception (Figueroa, 2013; Robertson & Pengilley, 2012). Likewise, TEPCO took over 2 months to disclose the meltdown of the Unit 1 reactor, something that many Japanese believe the company had prior knowledge of but chose to withhold. Overall, delays in providing information exacerbated people's feelings of distrust. (Kimura, 2016; Figueroa, 2013; Funabashi & Kitazawa, 2012).

The phenomenon of risk minimization can be attributed to various factors. One significant factor is the 'panic myth', a belief that informing the public about risks may lead to widespread panic. Indeed, this was the explanation given by the Japanase government for not informing the population. However, it is widely discussed among risk communicators that panic is rather rare (Figueroa, 2013). Besides, another factor that explains the devaluation of risks concerns the reputation and interests of the Japanese nuclear community. Historically, the Japanese nuclear *mura* ('community') has consciously downplayed the extent of risks. The community was concerned that if nuclear risks were openly recognized, the public would

request the closure of the nuclear power plants. Consequently, they believed that the preparation for future potential disasters would lead to 'unnecessary' anxiety. This mindset has been reinforced by the concept of *anzen shinwa,* meaning 'safety myth', which has been perpetuated by entities like TEPCO to project an image of absolute safety while countering anti-nuclear opinions (Funabashi & Kitazawa, 2012; Kitamura, 2014).

Table 3. *Category 3: Downplaying the extent of risks*

Covello (2011); Mays et al. (2016)	*Honesty and transparency are key for effective risk communication*
Figueroa (2013)	*It is preferable to inform that the situation is less severe than expected than having to say it is worse*
Figueroa (2013); Robertson & Pengilley (2012)	*The government's initial assurance of reactor's normalcy was later reassessed (level4 →level7)*
Figueroa (2013); Kimura (2016); Funabashi & Kitazawa (2012)	*TEPCO's delayed disclosure of Unit 1 reactor meltdown increased public distrust*
Figueroa (2013)	*'Panic myth' used by the government to justify risk devaluation*
Funabashi & Kitazawa (2012); Kimura (2016)	*'Safety myth' to safeguard the nuclear sector.*

Discussion

The abovementioned findings represent a comprehensive review of three key categories regarding risk communication failures after the 2011 Fukushima disaster. The use of language underscores the importance of clear and understandable terminology in risk communication. It highlights the need for risk communication strategies that prioritize clarity and simplicity over technical language. However, the findings suggest that simply avoiding technical language may not suffice; there is a need for broader and stronger education on radiation knowledge to ensure effective risk communication. In terms of the dissemination of risk information, the findings underscore the challenges posed by inconsistent spread of information. The governmental delays in notifying the affected population and the coordination challenges between the stakeholders involved heightened public concerns and evoked individual initiatives for protection. Hence, this emphasizes the need for coordinated and consistent communications to reduce misunderstandings and foster public confidence. One of the most concerning aspects highlighted above relates to the tendency to downplay the severity of risks. Whether motivated by concerns of inciting panic or to protect the nuclear sector, this approach led to significant loss of public trust. The failure to provide transparent and honest evaluations of the situation not only impedes effective risk communication but may also worsen the disaster's consequences. These findings highlight the need for accountability and transparency even when communicating unsettling information.

Finally, a potential research gap could focus on the public's perception of the free-jargon strategy employed. The investigation can contribute to better design and implement a jargon-free communication strategy to be perceived as trustworthy and transparent rather than as a form of manipulation. Exploring these reactions can offer valuable insights into how the

public's perception of risks is shaped by the language used by risk communicators. It may reveal underlying factors that influence perceptions of transparency, trustworthiness, and potential manipulation. Overall, it highlights a possible discrepancy between what risk communicators understand as effective and how this is received by the public. By addressing this disparity, risk communication practices may be improved to better meet public's expectations and promote increased trust.

Conclusion

This literature review has effectively addressed the research question by examining key concepts and debates surrounding risk communication failures following the 2011 Fukushima nuclear disaster. As abovementioned, the first debate highlights how the use of technical language hindered effective risk communication and increased confusion among the population. Likewise, significant inconsistencies in the dissemination of information have been discussed as potential failures in providing timely and accurate information. Finally, it reviews the downplaying of risks leading to public scepticism and distrust. These failures not only increased anxiety and confusion among the population but also eroded trust in governmental and scientific institutions.

This literature review is aware of the language restrictions and the potential generalization of the findings. On the one hand, this research focuses on English literature, which may have led to the omission of key studies published in other languages. This limitation could have affected the relevance and depth of the analysis, considering the significance of primary sources and Japanese literature. On the other hand, this study is aware of the diversity of contexts and varying factors that may not be captured in this discussion. Hence, it does not intend to generalize the findings discussed. Overall, it is crucial for governmental bodies and policymakers to prioritize honesty, accountability and use of accessible language in future risk communication strategies.

Bibliography

Coombs, W. T., & Holladay, S. J. (2010). The Handbook of Crisis Communication https://doi.org/10.1002/9781444314885

Covello, V. T. (2011). Risk communication, radiation, and radiological emergencies: strategies, tools, and techniques. *Health physics*, *101*(5), 511-530. https://doi.org/10.1097/hp.0b013e3182299549

Figueroa, P. M. (2013). Risk communication surrounding the Fukushima nuclear disaster: an anthropological approach. *Asia Europe Journal*, *11*, 53-64. https://doi.org/10.1007/s10308-013-0343-9

Funabashi, Y., & Kitazawa, K. (2012). Fukushima in review: A complex disaster, a disastrous response. *Bulletin of the Atomic Scientists*, *68*(2), 9-21. https://doi.org/10.1177/0096340212440359

Goto, A., Rudd, R. E., Lai, A. Y., Yoshida, K., Suzuki, Y., Halstead, D. D., ... & Reich, M. R. (2014). Leveraging public health nurses for disaster risk communication in Fukushima City: a qualitative analysis of nurses' written records of parenting counseling and peer discussions. *BMC Health Services Research*, 14(1), 1-9. https://doi.org/10.1186/1472-6963-14-129

Kanda, R. (2014). Risk communication in the field of radiation. *Journal of Disaster Research*, *9*(sp), 608-618. https://doi.org/10.20965/jdr.2014.p0608

Kasperson, R. (2014). Four questions for risk communication. *Journal of Risk Research*, 17(10), 1233-1239. https://doi.org/10.1080/13669877.2014.900207

Kimura, A. H. (2016). Risk communication under post-feminism: Analysis of risk communication programmes after the Fukushima nuclear accident. *Science, Technology and Society*, *21*(1), 24-41. https://doi.org/10.1177/0971721815622738

Kinoshita, T. (2014). Short history of risk communication in Japan. *Journal of Disaster Research*, *9*(sp), 592-597. https://doi.org/10.20965/jdr.2014.p0592

Kitamura, M. (2014). Risk Communication in Japan Concerning Future of Nuclear Technology. *Journal of Disaster Research*, *9*(sp), 619-627. https://doi.org/10.20965/jdr.2014.p0619

Mays, C., Valůch, J., Perko, T., Daris, I., Condi, C., Miśkiewicz, A., ... & Železnik, N. (2016). Looking for citizen-centered communication: dialogues between radiological protection or nuclear safety specialists and media professionals. *Journal of radiological protection*, *36*(2), 143-159. https://doi.org/10.1088/0952-4746/36/2/s143

Ng, K. H., & Lean, M. L. (2012). The Fukushima nuclear crisis reemphasizes the need for improved risk communication and better use of social media. *Health physics*, *103*(3), 307-310. https://doi.org/10.1097/hp.0b013e318257cfcb

Perko, T. (2016). Risk communication in the case of the Fukushima accident: impact of communication and lessons to be learned. *Integrated environmental assessment and management*, 12(4), 683-686. https://doi.org/10.1002/ieam.1832

Polleri, M. (2021). Radioactive performances: Teaching about radiation after the Fukushima Nuclear Disaster. *Anthropological Quarterly*, 94(1), 93-123. https://doi.org/10.1353/anq.2021.0015

Robertson, A. G., & Pengilley, A. (2012). Fukushima nuclear incident: the challenges of risk communication. *Asia Pacific Journal of Public Health*, *24*(4), 689-696. https://doi.org/10.1177/1010539512453258

Shimura, T., Yamaguchi, I., Terada, H., Robert Svendsen, E., & Kunugita, N. (2015). Public health activities for mitigation of radiation exposures and risk communication challenges after the Fukushima nuclear accident. *Journal of radiation research*, *56*(3), 422-429. https://doi.org/10.1093/jrr/rrv013

Tomkiv, Y., Perko, T., Oughton, D. H., Prezelj, I., Cantone, M. C., & Gallego, E. (2016). How did media present the radiation risks after the Fukushima accident: a content analysis of newspapers in Europe. *Journal of Radiological Protection*, *36*(2), S64-81. https://doi.org/10.1088/0952-4746/36/2/s64

Walravens, T., O'Shea, P., & Ahrenkiel, N. (2022, January). 'Let's eat Fukushima': communicating risk and restoring 'safe food'after the Fukushima disaster (2011-2020). *Japan Forum,* 34(1), 79-102 https://doi.org/10.1080/09555803.2022.2046131