



Eleven years of community efforts for the recovery from the nuclear disaster

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ARTICLE INFO

Keywords:

Fukushima
Risk communication
Nuclear disaster
Recovery
Experts

ABSTRACT

Eleven years have passed since the accident at the Fukushima Daiichi Nuclear Power Station (FDNPP) in 2011. Since the accident, Nagasaki University (Nagasaki, Japan) has been assisting the reconstruction efforts of Kawauchi Village, Fukushima Prefecture, which was the first village to declare it safe for residents to return to their homes. In April 2013, Nagasaki University and the Kawauchi Government Office concluded an agreement concerning comprehensive cooperation toward the reconstruction of the village. Furthermore, the university began comprehensive support for the residents of Tomioka and Ohkuma towns. Eleven years after the accident, there are gaps in the recovery process in each municipality around the FDNPP. Radiation medical science experts should carefully understand the recovery situation in each municipality to contribute effectively.

Recovery efforts after a nuclear power disaster and risk communication: Establishment of satellite office in Kawauchi Village

Nuclear disasters are very rare events, but it is clear that they can cause severe social disruption (Sugimoto et al., 2013). In the initial phase of the accident, experts at Nagasaki University engaged in crisis communication with residents of Fukushima to distribute the correct information about radiation (U.S. Environmental Protection Agency, 2012).

After the emergency phase ends, it is important to not only restore local infrastructure, but to also remove all radioactive substances (decontamination) from local living environments. As demonstrated by the case of the FDNPP, recovery from a nuclear power disaster is unavoidably a much longer and slower process than that from other kinds of disasters. It is also necessary to deal with all the public anxiety. For this reason, an open dialog between local residents, governments and experts of radiation medical science is extremely important (Takamura et al., 2016).

Kawauchi Village is located within 30 km of the Fukushima Daiichi Nuclear Power Plant (FDNPP) (Fig. 1). After the accident, the residents of the village evacuated to Koriyama City, where the Kawauchi Government Office had shifted its operations (Orita et al., 2013). After the termination of the accident in December 2011, the mayor of Kawauchi decided to return to the village. Then the village office implemented

roadway repairs, new factories for the new employment of residents, and reopening of grocery stores.

Nagasaki University has been assisting in the recovery efforts of Kawauchi by evaluating radiation exposure doses and risk communication with the residents (Fig. 2). In December 2011, we estimated the external radiation exposure doses of the residents of Kawauchi, and showed that projected external radiation exposure of the residents was sufficiently low in Kawauchi (Taira et al., 2014).

In March 2012, the Kawauchi Village Office relocated its operations back to the village, and the residents started returning. In March 2012, the return of residents to Kawauchi started; however, the rate of returned residents was relatively limited initially. When residents start returning, we identified factors associated with the residents' intention to return (ITR) to the village and showed that, for female residents, living in areas with relatively higher ambient doses and expressing anxiety over radiation exposure were independently associated with their decision to not return (Orita et al., 2013). These results suggest that risk communication about radiation exposure and health between experts and residents is essential to support the recovery of the village.

To support the recovery efforts of the village, a public health nurse from Nagasaki University stayed for an extended period to provide individual consultation on radiation exposure and health. In April 2013, a satellite office of Nagasaki University was established in the village (Takamura et al., 2016). Through risk communication with residents in cooperation with the Kawauchi Village Office, we supported the

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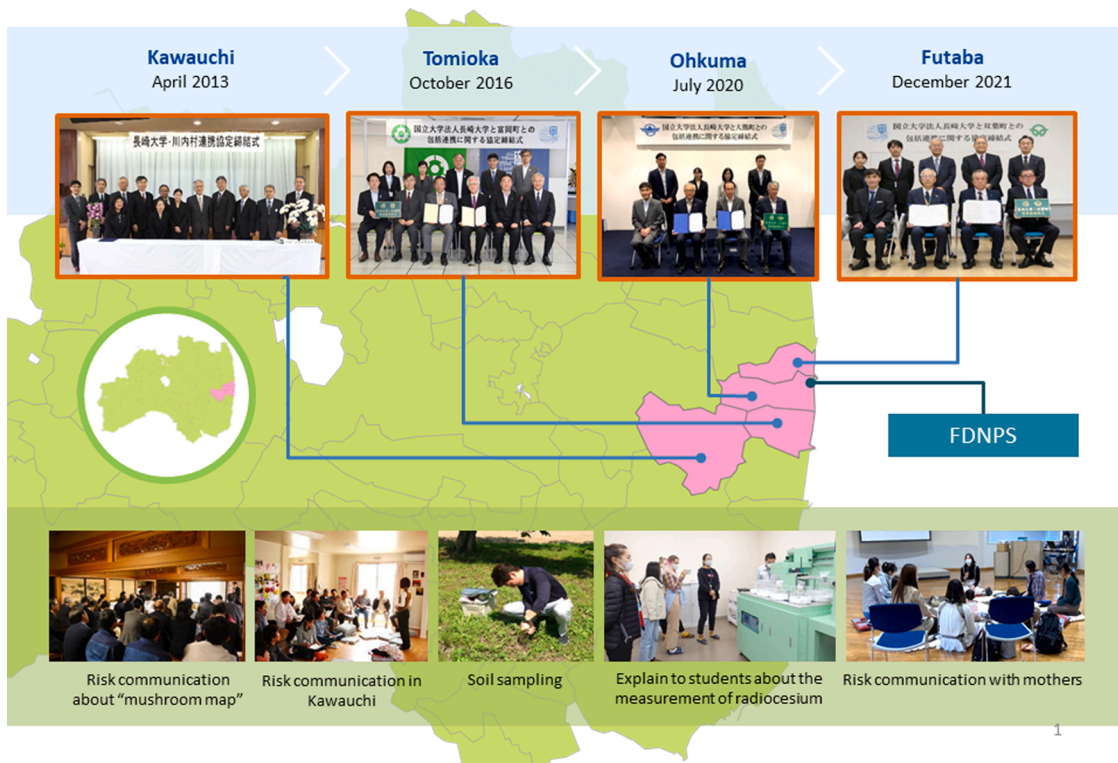


Fig. 1. Location of Kawauchi Village, Tomioka Town and Ohkuma Town.



Fig. 2. Images of individual consultations on radiation health effects by a public health nurse in Kawauchi Village (Takamura et al., 2016; Takamura et al., 2021).

recovery efforts of the village. We aim the goals of our risk communication efforts as the following three steps.

- 1 To build a trust between village and town officers and experts: for village and town officers, it is the first time to support the residents

who returned back to their home after lifting evacuation order. Experts should show how to support residents through the measurement of ambient doses around residential houses, radiocesium concentrations in foods and explanation of obtained results. These

Table 1

Recovery situation of each municipality in the coast area (Hamadori) of Fukushima as of January 2022.

	Katsurao	Namie	Futaba	Ohkuma	Tomioka	Kawauchi	Naraha	Hirono	Total
Population	1,335	16,205	5,657	10,165	12,043	2,432	6,682	4,700	59,218
Returned	448	1,786	0	356	1,816	2,001	4,144	4,229	14,780
Predicted returns (%)	46.1	16.7	10.8	12.5	15.1	80.9	54.3	83.3	29.4
Predicted number of returns	615	2,706	611	1,270	1,818	2,001	4,144	4,229	17,394

accumulation of “good practices” are important to build a trust between officers and experts.

- 2 To support residents who returned back to their home so that they could satisfy their decision: Usually, residents who have returned back to their home after lifting evacuation order have sense of belonging to their community, and questions about radiation exposure and its health effects related with their life. Experts should provide information which is necessary for such residents so that they can obtain the confidence to continue to live.
- 3 To provide evidences about radiation exposure and its health effects which are available for residents who have not decided to return to their home town: Residents who have not decided to return back to their home town usually have anxieties about radiation exposure and its health effects. Experts should provide scientific evidences which is available for such residents so that they can make decisions.

Residents of Kawauchi had anxieties especially about food safety such as mushroom, health effects due to radiation exposure in children and mothers. In consideration with such situations, in cooperation with village office, we invited residents who are interested in each topic, such as radiocesium concentrations in mushroom, and radiation exposure and its health effects in children and mothers. In each risk communication, experts explain about 15-30 minutes and accept questions from residents. We prepare printed materials or slides according to each topic. Currently, almost 80% residents have returned back to Kawauchi (Table 1). The village has almost finished the recovery phase from the disaster, and novel efforts to revitalize the community are ongoing. Nagasaki University organizes domestic and international seminars on the recovery from the nuclear disaster in Kawauchi. Although several on-site seminars have been cancelled due to the COVID-19 pandemic, we held these events online. Through sharing the experiences, we hope that Kawauchi village will become a place for young professionals and students to learn about recovery efforts from a nuclear disaster.

Development of recovery supports: Cases of Tomioka and Ohkuma towns

The town of Tomioka is located within 20 km of the FDNPP (Fig. 1). After the accident, residents of Tomioka evacuated to Kawauchi, and the town office relocated to Koriyama.

In 2017, the evacuation order for Tomioka was partially lifted. Although decontamination efforts were complete, it was clarified that most residents did not plan to return to Tomioka because many of them had already established new lives in the places to which they evacuated (Table 1). To support the recovery efforts of Tomioka’s residents, a comprehensive agreement was concluded between Nagasaki University and the town itself. In April 2017, the university established a satellite office there.

We firstly organized risk communication in Tomioka, with residents who had already returned back so that they were satisfied with returning to their home town. Then, we approached residents who had not yet decided whether to return to Tomioka. For example, we participated in an event which Tomioka town office organized for residents living outside the town, and explained radiation exposure and health effects.

Furthermore, Nagasaki University started the recovery support process for the town of Ohkuma, where the FDNPP is located, in 2019 (Fig. 1). After the decontamination and reestablishment of

infrastructure, the evacuation order in part of Ohkuma was lifted in April 2019, and the town office returned there. However, the number of residents who have returned to their hometown is still limited (Table 1). In July 2019, the university started supporting the recovery efforts for the town through the dose evaluation of the residents, environmental monitoring, and risk communication with the residents. Similar to Kawauchi and Tomioka, Nagasaki University concluded comprehensive agreements with Ohkuma in July 2020, and with the town of Futaba.

Conclusion

Eleven years have passed since the accident at the FDNPP, and almost 80% of residents have returned back to Kawauchi. On the other hand, only 1,816 of 12,043 (15.1%) residents have returned back to Tomioka, and 356 of 10,165 (3.5%) residents have returned back to Ohkuma, respectively (Table 1). Furthermore, no residents have returned back to Futaba town (Table 1). These suggest that ten years after the accident, there are gaps in the recovery process in each municipality around the FDNPP. Of course, there are many reasons other than radiation that residents decided not to return to their hometown, such as educational issues of children and occupational issues of parents, and so on. Nevertheless, radiation medical science experts should carefully understand the recovery situation in each municipality to contribute effectively.

A nuclear disaster is an extremely rare occurrence. Once such an event happens, however, the disruption to local communities can be enormous. Areas hit by this kind of disaster also undergo a very long period of recovery. Therefore, it is desirable that experts address public concerns in accordance with the exposure phase (emergency exposure or existing exposure situation). Above all, the most important thing is to prepare appropriate disaster responses during ordinary (non-emergency) times.

Author contribution

All authors wrote the manuscript.

Declaration of Competing Interest

There is no conflict of interest in this study.

Data Availability

No data was used for the research described in the article.

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