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Case Report

Health Impacts Caused by the Fukushima Nuclear Disaster: A Case in Soso District

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Abstract

The 2011 triple disaster in Fukushima, Japan- an earthquake, tsunamis, and a nuclear power plant- was a huge public health challenge in the affected area. The health impact caused by the disaster was not limited to that by radiation. Here in a case of Soso district, Fukushima is presented to articulate the complexity of the health issues after a nuclear accident. Health issues include settlement of evacuation zones, mass evacuation due to fear of radiation, prolonged displacement and in-house evacuation, shortage in hospital staff, and influx of workers whose health status is not good enough. Understanding these problems is essential to develop effective and practical disaster risk reduction plan in future nuclear disaster all over the world.

ABBREVIATIONS

NPP: Nuclear Power Plant

INTRODUCTION

A huge disaster is a public health emergency that brings about massive health impacts in the affected area. The cause of health deterioration is not limited to direct damage by the disaster. Social disruption after the disaster, such as evacuation, destruction of infrastructures, and disruption of provision of healthcare, may lead to deterioration of population health.

A nuclear disaster is one of such public health emergencies, and gaining a holistic view of the health impact caused by a nuclear disaster is essential to developing an effective and practical disaster mitigation plan in the future.

On 11 March 2011, an earthquake of magnitude 9.0 and subsequent tsunamis of up to 14 m struck the northeast coast of Japan. The tsunamis disabled the cooling system of the reactors of the Fukushima Daiichi nuclear power plant (NPP) in Fukushima Prefecture, Japan. Meltdown began soon after the tsunamis, and the first visible explosion, which was suspected to be caused by a hydrogen gas leak, occurred on 12 March. Over the following 3 weeks, several suspected hydrogen detonations occurred.

Immediately after the accident, the Japanese National Government designated evacuation zones. The areas within the 20km radius of the NPP were labeled as no-entry zones and approximately 70,000 residents in the area were mandated to evacuate. The 20 -30 km radius of the NPP was designated as an indoor evacuation zone, and about 15,000 residents in the area were recommended to stay at home to avoid excessive external radiation exposure. Even though evacuation from the indoor evacuation zone was voluntary, mass evacuation occurred in this area due to fear of radiation.

This triple disaster -earthquake, tsunamis, and a NPP accident- and subsequent mass evacuation have brought unforeseen public health challenges to disaster-affected areas. Although the health impact caused by radiation emission by the accident appears to be minimal [1] major health issues have instead arisen through social disruption, caused largely by fear of radiation. In addition, long-term displacement due to evacuation orders may pose health risks such as mental stress, job loss, and inactivity among the residents. However, there has been little incentive to gain a holistic view of emerging public health problems caused by this disaster.

Soso district, located about 15-40 km north of the plant (Figure 1), was one of the area's most affected by the triple disaster. Soon after the disaster, researchers came to the area and have been reporting a variety of health problems at the area. Using the health-related data in SoSo district in Fukushima, this presentation will illustrate the complexity of health and public health problems caused by a nuclear accident.

Case Presentation: health problems in Soso district

Residents within mandatory evacuation zone who were left behind: Soon after the NPP accident, most outsourcing companies outside Fukushima prohibited their staff from entering into the area within 50km radius from the NPP from security reasons. As a result, residents within the indoor evacuation zone were left without consistent food supply, which may have further accelerated evacuation from the area. The population of the Soso district was reported to decrease from nearly 100,000 to 40,000 after the evacuation order [2].

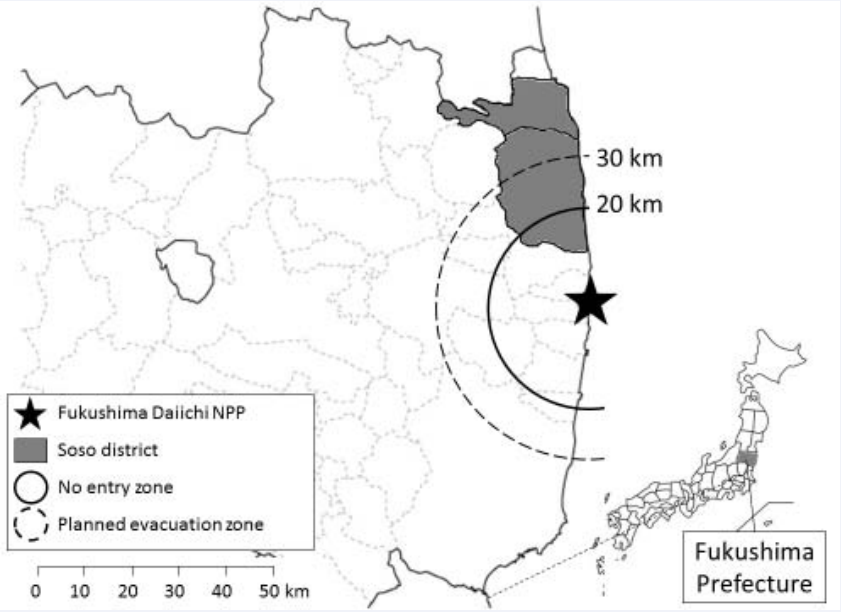

Figure 1 Map of Soso district (Soma and Minamisoma City).

In these circumstances, elderly people with poor access to information and transportation were sometimes abandoned. According to data from a fire station in Minamisoma City, 6 emergency calls were received from within the no-entry zone during the 3 days after the evacuation order had been made. All were from elderly residents and one was taking home oxygen gas therapy, who made calls because they had no methods of transportation for evacuation. A medical doctor who conducted inspections within the in-house evacuation zone for a month after the disaster remembers that he saw several elderly people who apparently died from starvation or dehydration in their own homes.

Impact of unplanned mass evacuation on vulnerable population: Contrary to abandonment, proactive evacuation also caused health deterioration especially among vulnerable population such as the elderly. According to a report of National Cabinet, of the 850 patients hospitalised in the 7 hospitals within the no-entry zone, at least 60 died by the end of March, of whom at least 10 died during evacuation [3]. Another study also revealed that mortality rate among the institutionalised patients at nursing care homes significantly increased after evacuation [4].

Decline in health due to prolonged displacement and in-house evacuation: Long-term displacement in temporary housing was another cause for health risks among residents. Soma City Municipal Government provided physical performance evaluations in 2012, targeting the elderly within temporary housing. Interestingly, residents living in temporary housing showed significantly stronger grip strength than those in the control group. On the contrary, the temporary housing group showed weaker standing stability. This strongly suggests that people lost leg strength within a year by living in temporary housing [5].

From fear of radiation exposure, elementary schools in Fukushima restricted the time of outdoor exercise of their students, which might have impacted physical activity among the children. According to the results of physical performance tests at 8 elementary schools in Fukushima, agility and endurance among the children appeared to be worse after the disaster, compared to a pre-disaster period (Unpublished data).

Decrease in the number of hospital staff around the evacuation zone: Health impacts were not limited to the direct ones on the residents, but also included indirect impacts due to collapse in healthcare systems. Monthly records of the number of staff members at 7 local hospitals in Soso district revealed that staff shortages at hospitals reached peaked within one month after the disaster, and only 47% of the staff reported to work. The number of the staff gradually recovered, but shortages remained even 18 months after the disaster. As a result, the workload of hospital staff increased by about 20% [6].

This strongly suggest that after chemical, biological, radiological, and nuclear disasters, just keeping hospitals safe from direct damage by a disaster is not sufficient to maintain healthcare system. Social disturbance caused by fear of invisible risk may disrupt healthcare system functioning for an extended period due to staff shortage.

Health problems of decontamination workers in precarious employment: There has been a huge influx of decontamination workers into radio-contaminated areas of Fukushima Prefecture. The number of decontamination workers in Fukushima Prefecture was approximately 30,000 in 2015, most of whom are migrant workers from outside of Fukushima. As migrant workers tend to have low socio-economic status and may be prone to unhealthy lifestyles, it is possible they may be at higher risk of chronic conditions.

Health data among hospitalised decontamination workers at

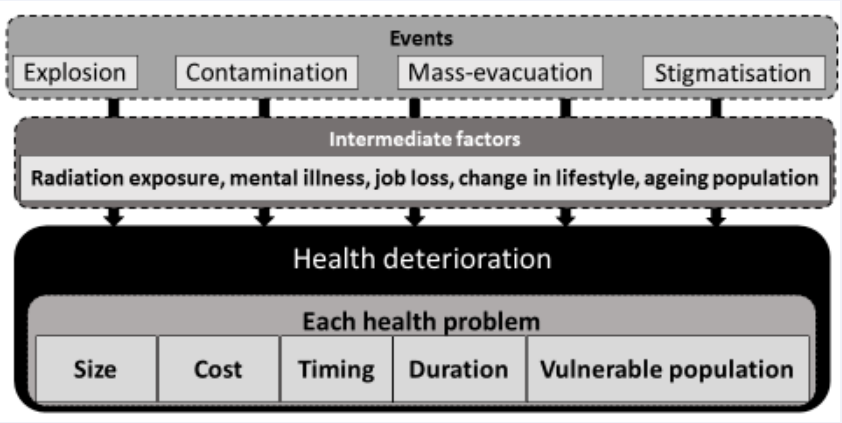

Figure 2 Process of health deterioration after the triple disaster.

a hospital in Minamisoma City revealed that 83% were current smokers, 24% were binge drinkers, and 10% were not covered by national health insurance. In the demographics of underlying chronic diseases, 56 % of the patients were hypertensive, of whom 78% were untreated. Similarly, 20% had hyperglycaemia, of whom 57% were untreated. From these results, it is possible that influx of workers with poor social support is becoming a burden of healthcare in the disaster areas [7].

DISCUSSION

These diversity of health problems in post-disaster Fukushima tells us that only taking account of health issues related to radiation exposure is not a sufficient approach for future nuclear disaster preparation. Instead, in the same way as any other type of disaster preparation, enhancing 'absorbing, buffering, and responding capacity' [8] will be a key to effective nuclear disaster preparedness in potential disaster areas.

As is mentioned in the Sendai Framework for Disaster Risk Reduction [8], 'the recovery, rehabilitation and reconstruction phase... is a critical opportunity to "Build Back Better", including through integrating disaster risk reduction into development measures, making nations and communities resilient to disasters' (32). The following cases from Soso district may provide some clues to future nuclear disaster recovery plans, as well as preparedness.

Building buffering capacity: Reducing vulnerable population

To prevent abandonment of vulnerable people at the time of mass-evacuation, it is imperative to understand who are the most vulnerable and where they are living. After the triple disaster, Soma City municipal government made a list of the most vulnerable elderly residents who could not evacuate by themselves, so that rescue staff could help them evacuate in the case of another explosion. Fortunately, there was no such explosion, but the list of the most vulnerable was used to build shared homes for such people. The benefit of these homes are two-fold: first, in case of another disaster, people can easily detect where the most vulnerable are living, and can evacuate them quickly; and second, in non-disaster settings, such facility is effective to avoid 'solitary death' (a phenomenon of dying alone and not being found for several weeks) among the elderly, which is an increasing social issue in ageing societies.

This case suggests that detection of vulnerable population before disaster is one of the keys to reduce abandonment people during social disruption after a disaster. In addition, effective intervention on such population can not only be an effective disaster risk reduction (DRR) but also be a beneficial plan for social development.

Building absorbing capacity: Promoting health among residents

A major cause of disaster-related deaths after the Fukushima disaster was exacerbation of chronic conditions [9]. Therefore, it can be said that the most effective intervention to mitigate indirect health impact by a huge disaster, is to improve health status of the residents before a disaster. For example, if the number of patients with chronic conditions such as diabetes and hypertension is small, indirect health impacts caused by a disaster will also be small. In the same way, if people had knowledge on healthy lifestyle factors, such as regular exercise, evacuation-related inactivity might have been smaller. Pre-existing health protection against chronic conditions may be key to disaster mitigation.

After the triple disaster, medical doctors in Fukushima began providing lectures, health check-ups, and activities to promote the health of residents, such as lectures on healthy lifestyles, gymnastic exercises, and health consultation for decontamination workers. Partly due to these interventions, the prevalence of untreated hypertension appears to be decreasing after the disaster. Again, these health promotion activities are not only good mitigation of disaster effects on health, but also are beneficial for health if performed before a disaster.

CONCLUSION

The nuclear disaster in Fukushima was not a simple event of NPP explosion and radiation contamination, but included a complex series of secondary events including mass-evacuation, stigmatisation, and loss of jobs, which may indirectly deteriorate residents' health through intermediate factors such as abandonment and mental illness (Figure2). However, with an

over-focus on radiation and cancer, many health problems in Fukushima are still overlooked. Cases from the recovery phase in Fukushima strongly suggest that the most effective disaster preparedness strategy against a disaster, regardless of whether its natural or manmade, is ' to ensure healthy lives and promoting well-being for all at all ages' (United Nations Sustainable Development Goal 3). More attention needs to be paid on how to integrate disaster recovery plans into social development in non-disaster settings.

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Conflict of Interest

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