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NOTE

Symposium on disaster-related deaths after the Fukushima Daiichi Nuclear Power Plant accident

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Abstract

Disaster deaths can be classified into direct and indirect deaths. Direct deaths are those caused by the direct physical effects of disasters, such as earthquakes, tsunamis, and radiation exposure. Indirect deaths are those caused by secondary health effects such as emergency evacuation, relocation, evacuation environment, disruption of health care delivery services, and psychosocial effects. In addition, in Japan, the term disaster-related deaths refers to indirect deaths in accordance with the disaster condolence payments system, which provides relief for bereaved families. On 11 March 2011, the Great East Japan Earthquake exposed several issues related to disaster-related deaths in Japan. Therefore, on 1 February 2022, a symposium on disaster-related deaths hosted by this study was held on the website. The symposium discussed the issues and challenges associated with disaster-related deaths for future disaster preparedness. The authors introduced the concept of 'shaking' at the symposium by defining 'shaking' as 'the repeated changes in the social and living environment that worsen health conditions, regardless of the disaster'. It was also pointed out that vulnerable populations are more likely to experience more pronounced health effects. This generalised concept of 'shaking' associated with disaster-related deaths suggests that it is important to anticipate disasters before they occur to take specific preventive measures, targeted at vulnerable populations. This study found that disaster-related deaths in Japan create several problems in terms of future radiation disaster preparedness and medical countermeasures. In the future, there will be a need to examine the relevance of the issues of disaster-related deaths identified as a result of this symposium for future radiation disaster preparedness.

1. Introduction

Disaster deaths can result either from direct or indirect death [1]. Direct deaths are those caused by the direct physical effects of disasters, such as earthquakes, tsunamis, and (external and internal) radiation exposure after nuclear accidents. Indirect deaths have been reported to occur due to the following causes (a) disruption of the supply-demand balance at the hospital level, (b) disruption of the health care system at the

community level due to confusion in the chain of command during an emergency evacuation, information chaos, and insecurity, (c) social isolation, stress, and anxiety, (d) social change and neglect due to social isolation, stress, and loss of financial support, (e) exacerbation of underlying diseases due to interruption of health care delivery services [2]. In the Chernobyl nuclear power plant accident, 134 direct effects of acute radiation injury were identified within three weeks of the accident, and 28 deaths were reported. In contrast, indirect effects have been reported only at an anecdotal level [3]. In addition to the terms direct and indirect deaths, there exists the term disaster-related deaths. In the United States, disaster-related deaths include both direct and indirect deaths caused by disasters [3]. In contrast, disaster-related deaths in Japan were defined by the government as 'deaths because of aggravation of injuries caused by the disaster or illnesses caused by the physical burden of living in evacuation shelters, etc, which are recognized as being caused by the disaster based on the Law Concerning Provision of Disaster Condolence Grants (1973 Law No. 82) actually, disaster condolence payments including those for which no payment has been made, but excluding those whose safeties are unknown as a result of the relevant disaster' as of 1 April 2020 [4]. Thus, this paper applies the definition of disaster-related deaths outlined by the Japanese government in 2020.

Disaster condolence payment, which is included in this definition of disaster-related deaths, is a system that emerged because of the history of fatal disasters in Japan. Various systems and policies have been developed to guarantee the human rights of disaster victims, and thus, the disaster condolence payments system has become a core element in Japan. The system dates back to 1967 when the Uetsu torrential rain disaster that affected Niigata and Yamagata prefectures led to the promulgation of the disaster condolence payments system to provide relief to disaster victims [5].

On 17 January 1995, the Great Hanshin-Awaji Earthquake (GHAE) was the first incident that resulted in the recognition of indirect deaths because of disasters in Japan [6]. Before the GHAE, only direct deaths caused by disasters were eligible for disaster condolence payments. However, after the GHAE, disaster-related deaths that were certified under the disaster condolence payments system also became eligible for disaster condolence payments.

Notwithstanding, the current system design has several challenges. On 11 March 2011, the Great East Japan Earthquake (GEJE) revealed that 3784 disaster-related deaths had occurred since September 2021. The Fukushima Prefecture was particularly affected by the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident, with over 2329 (60%) disaster-related deaths, indicating its severe impact [7]. In addition, the health effects of the FDNPP accident were multifaceted and long-term, distinct from previous disaster-related deaths [8]. The researchers of this study have been hosting consistent study groups on disaster-related deaths in the affected areas since the FDNPP accident. From the study group engagements, the question arose as to whether the problems and issues related to disaster-related deaths in Japan have been addressed in a system that can protect disaster victims.

Therefore, on 1 February 2022, we held an online symposium on disaster-related deaths entitled 'The Essence of Disaster-Related Deaths: Future Challenges to be felt in the field'. The speakers for this symposium consisted of medical professionals and lawyers who have worked together in the affected areas following GEJE and the FDNPP accident.

2. Methods

This online symposium was organised by the Department of Radiation Health Management, Fukushima Medical University, in cooperation with the Nuclear Regulation Authority. A management office was set up to organise the symposium. The management office prepared for the symposium by holding several online meetings prior to the symposium. A draft title and potential speakers were proposed. Once the draft program was finalised, prospective speakers were contacted, and their consent to speak was obtained. The management office invited stakeholders such as medical institutions, law firms, government agencies (national and local), and the media to participate. The purpose of this paper was to discuss the problems and improvements in disaster-related deaths in Japan after the earthquake, tsunami, and FDNPP accident at GEJE (hereinafter referred to as 'triple disaster') and to make recommendations on what should be done to prepare for future radiation disaster medicine.

3. Results

The presenters and participants of this online symposium were as follows.

Speakers:

(a) Motohiro Tsuboi; Department of Emergency and Critical Care Medicine, Japanese Red Cross Saitama Hospital, Saitama, Japan.

(b) Akihiro Uto; Uto-Yamada law office, Sendai City, Japan.
(c) Fumiyasu Zaima; Sora-Umi Law Office, Tokyo, Japan.
(d) Toshihiko Watanabe; Hamadori Law Office, Iwaki City, Japan.
(e) Masaharu Tsubokura; Department of Radiation Health Management, Fukushima Medical University, Fukushima City, Japan.
(f) Sawano Toyoaki; Department of Surgery, Jyoban Hospital of Tokiwa Foundation, Iwaki City, Japan.

A total of 191 people from the medical, legal, administrative, university, and research fields participated in the study.

The two main topics of discussion were secondary health effects associated with radiation disasters and the institutional problems faced by disaster-related deaths in Japan.

3.1. Secondary health effects associated with the FDNPP accident

Reportedly, the health effects after the FDNPP accident were caused by both the direct effects of radiation exposure, as well as various social and living environment changes, including the implementation and lifting of the evacuation order. These secondary health effects were not merely short-term as they were shown to be long-term and diverse [9]. Specifically, these effects could be categorised ranging from days to weeks, months to years, and beyond.

First, using a day-to-week scale, the study reported an increased risk of death associated with: nursing home and hospital evacuation, living in poor conditions in shelters or home evacuation, deep vein thrombosis and pulmonary embolism caused by evacuation in a car, as in economy class syndrome, and cardiac disease caused by high blood pressure due to stress or withdrawal of medication after a disaster [10–16]. Second, using a month-to-year scale, the increased risk of death was caused by lifestyle changes. Specifically, psychological effects such as post-traumatic stress disorder, alcoholism, depression, and suicide were reported in this study [17]. Exacerbation of lifestyle-related diseases such as diabetes, hypertension, and dyslipidaemia, as well as a decline in cancer screening rates and deaths because of cardiac disease among reconstruction workers, were also reported [18, 19]. Third, using a multi-year scale, various social health problems were reported, including changes in the social environment, changes in long-term care insurance services, disparities and poverty, discrimination and prejudice, aging and depopulation of the community, migration to public housing, and the effects of dealing with long-term evacuation [20].

However, the health effects caused by post-disaster changes in both the society and the surrounding environment should not be attributed to the lifestyle actions of individuals, such as dietary habits and lack of exercise. Frequent changes in society and the surrounding environment after a disaster can severely worsen the health status of disaster victims. Healthy young people have relative adaptability to these changes and individuals who have access to social support can overcome the negative health effects after a disaster. However, people living with disabilities, older adults, and other vulnerable groups who require increased social support may not be able to withstand the recurring environmental changes. The health of these vulnerable populations is more susceptible to deterioration, resulting in the reported deaths associated with the indirect effects of disasters. Thus, a multidimensional view of the health effects caused by disasters is required because of the associated secondary health effects, which often result from multiple factors as the causal relationship with a single effect gradually fades over time.

3.2. Mitigating system issues for disaster-related deaths in Japan

The Sendai Framework for Disaster Reduction 2015–2030 outlines the goal of the United Nations Disaster Reduction Reduction Agency to reduce disaster fatalities. To achieve this goal, it is pertinent to identify, understand, manage, and reduce disaster risk as a priority action [21]. Objective medical data and informed disaster medical response are necessary to reduce indirect disaster deaths. However, medical data are limited for large-scale natural disasters [22, 23]. The Organization for Economic Cooperation and Development suggests that quantitative analysis is necessary to indicate the economic support measures for disasters per country considering the risk of disaster and its impacts on health [24]. However, it was discussed that the analysis of 'disaster-related deaths', (i.e. deaths indirectly caused by disasters) in the current context of Japan, has several major limitations for medical validity. Consequently, three factors were identified contributing to the problem of validity; namely problems with: the definition of disaster-related death in Japan, the method of application, and the method of certification.

First, is the issue of definition. In Japan, the current definition of a disaster-related death refers to the provision of condolence payments for bereaved families and is synonymous with death because of disaster. In contrast, the US definition of disaster death is defined separately from condolence payments. The Japanese definition based on condolence payments is problematic because it overestimates the number of disaster-related deaths. This symposium found that in some cases, individuals eligible for condolence

payments after FDNPP accidents (i.e. certified as disaster-related deaths) were dissociated from indirect disaster deaths. It was also pointed out that there may have been an overestimation of disaster-related deaths.

Second, with regard to the issue of the application method, it was underscored that death first requires an application for certification examination by the bereaved family despite its disaster status. For example, the application process for unclear disaster situations placed a heavy burden on the bereaved families and resulted in more problems in contexts where no bereaved families were present to submit applications, thus contributing to the underestimation of disaster-related deaths. In contrast, it was found that in the US, applications from the bereaved family were not required to determine a disaster death, since the death certificate includes a statement that outlines the cause of death [3].

Third, is the issue of certification methods. There is no unified national standard for recognising disaster-related deaths in Japan. Some local governments use certification criteria based on the time of death and the post-disaster period, but the actual operation and certification decisions are left to each local government, which could lead to underestimation or overestimation. However, this type of operation may have worked well in the GEJE and FDNPP accident. That is, the accident was unprecedented in both scale and combination, and it was not clear at the time what form the potential health hazards would take. In fact, there have been cases of deaths occurring more than 10 years after the FDNPP accident in which the effects of the accident have been recognised [25]. Thus, if the criteria for recognising disaster-related deaths had been developed simply by the time of death and the period after the disaster, it may not necessarily have answered a variety of individual cases. However, it is also necessary to make the criteria for certification more reasonable while also emphasising science.

4. Discussion

The symposium revealed the need for a multidimensional view of the health effects associated with disasters and the issues in the condolence payments system. Thus, two measures were presented to be prioritised for future radiation disaster medicine. First, is the need to generalise the concept of health effects in disaster-related deaths and take countermeasures. Second, is the need to review the system of disaster-related deaths.

4.1. Generalisation of health effects of disasters

The authors introduced the concept of 'shaking' at the symposium by defining 'shaking' as 'the repeated changes in the social and living environment that worsen health conditions, regardless of the disaster'. For example, in the context of general practice, rather than disasters, one example would be the situation in which the health condition of an elderly person deteriorates due to repeated relocations and hospitalisations. In particular, disasters are a context in which a wide variety of social and living environment changes are likely to occur. After the nuclear accident, health effects associated with exposure to radiation were limited. However, the evacuation and subsequent relocation, and the accompanying changes in social and living environments, such as lifestyle, employment status, and relationships with family members, occurred in succession and caused significant damage to health conditions. What could be notable about the concept of 'shaking' is that it can be applied to various types of crises such as COVID-19. For example, in the COVID-19 pandemic, repeated waves of infection led to behavioural restrictions and lockdowns, resulting in loss of employment and strain on health care resources. They caused repeated changes in the social and living environment, such as changes in employment patterns and lifestyles, changes in family relationships, and changes in the behaviour of patients visiting medical institutions, which worsened their health conditions [26]. As described above, 'shaking' is a concept that broadly extends beyond disasters, and the nuclear power plant accident and COVID-19 can be considered as environments in which it is particularly likely to appear.

4.2. Improving the system of disaster-related deaths: medical care perspective

This report found that Japan's system for disaster-related deaths was not created originally for future disaster preparedness. Instead, it was created in the historical context of the disaster condolence payments system, which was designed to provide relief to bereaved families.

This differs significantly from the US system, which separates the definition of indirect death from the system of relief for survivors because of disasters. In the US, the cause of death because of a disaster is stated clearly on the death certificate, which is the basis for death statistics. In addition, an application for financial assistance is filed with the Federal Emergency Management Agency of the United States. Moreover, the International Classification of Diseases 11th Revision (ICD-11), is cited for clinical use [3]. In contrast, disaster deaths in Japan are not recorded on either the death certificate or according to ICD-11.

Reducing disaster deaths is an important issue for medical care providers. In particular, many indirect deaths were reported in accidents related to the FDNPP. Thus, reducing these indirect deaths is important

and requires quantitative medical evaluation. However, Japan's current system of disaster-related deaths has major limitations for quantitative medical evaluation. Specifically, two factors limit the accumulation of medical data on disaster-related deaths. First, Japan's definition of disaster-related deaths is based on the condolence payments system. Second, there are no diagnostic criteria for deaths caused by a disaster.

Thus, the following should be prioritised in the system of disaster-related deaths from the perspective of the medical community. To adequately improve the accumulation and analysis of past cases of disaster-related deaths, two data collection methodologies were considered for further quantitative evaluation to reduce such deaths. The first is to utilise the current system based on the condolence payments system. This would require improvements in the application process to reduce the burden on bereaved families, the creation of certain certification criteria to increase the validity of the certification, and the collection of patient information (age, gender, pre-existing conditions, welfare information, disaster status, etc) in a unified format. Second, a new system should be created with reference to the US system and other systems. Specifically, the system should be two-step, that is, structured medically for the indirect diagnosis of death that is separate from condolence payments. Thereafter, this is followed by an application for financial assistance based on that diagnosis. Notably, several issues need to be discussed in the future. The decision-making process will be shifted from the current municipal judgment committee to the clinician on site. Thus, both the institutional reforms are necessary for future disaster preparedness. However, historically, Japan's system for disaster-related deaths has its origins in the condolence payment system, which involves a variety of stakeholders, including lawyers, government officials, and others in addition to medical professionals.

5. Conclusion

The symposium revealed the need for a multifaceted approach to the health effects of disasters and problems with the condolence payment system. Consequently, two measures were proposed that should be prioritised in future radiation disaster medicine. The first is the need to generalise the concept of health effects related to disasters so that universal measures can be taken against future disasters. The symposium defined 'shaking' as 'the repeated changes in the social and living environment that worsen health conditions, regardless of the disaster'. We found that disasters are a context in which a wide variety of social and living environment changes are likely to occur. Second, we identified drawbacks inherent to the current system regarding disaster-related deaths. In order to reduce the number of disaster-related deaths in Japan, we considered it necessary to establish an institutional framework that would allow the accumulation and analysis of medically valid medical data on disaster-related deaths.

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Conflict of interest

The authors declare no conflict of interest.

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