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Psychosocial effects of the Fukushima disaster and current tasks: Differences between natural and nuclear disasters

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Abstract

There are substantial differences between natural and nuclear disasters in terms of the psychosocial impact associated with many factors such as human and material losses, psychological acceptance, community cohesiveness, stigmas, and media influence. Although the Great East Japan Earthquake and tsunami that occurred in Fukushima, Japan, was a major disaster, the impact of the subsequent nuclear accident seemed to be even more devastating on residents' mental health. These effects included not only posttraumatic responses but also chronic psychiatric symptoms such as depression and alcohol abuse, which can also contribute to self-destructive behavior such as suicide. In addition to these psychiatric problems, Fukushima residents had to endure public and self-stigma towards the radiation effects. In particular, negative risk perceptions about the genetic effects of radiation were associated with depressive symptoms among the evacuees. Significant exhaustion and various types of depressive symptoms have been reported among relief workers in Fukushima, who require more intensive care and treatment. To maintain and develop the current care network in Fukushima successfully, cooperation between different resources involving outside experts is key.

keywords: nuclear disaster, depression, posttraumatic stress disorder, stigma, suicide

(accepted for publication, 21st November 2017)

I. Introduction

As explosions occurred at the Fukushima Daiichi nuclear power plant (FDNPP) following the huge tsunami in March 2011, very few seemed to be able to predict the current situation in Fukushima, where over 100,000 people have been evacuated, either voluntarily or involuntarily, for an extended period of time. The Japanese have historically experienced various types of natural disasters, including earthquakes, typhoons, and tsunamis, and faced many difficulties, eventually overcoming them with great effort. However, the Fukushima disaster took on quite a different

appearance from other natural disasters. As described below in detail, the Fukushima disaster has several unique features compared with natural disasters, including an unclear relief process, invisible effects, uncertainty regarding information, distrust towards various experts such as the authorities, and ambiguous losses. These features seemed to make Fukushima residents experience strong anxiety, which induced manifold mental health problems (e.g., depression, posttraumatic responses, and alcohol abuse). In addition, the Fukushima residents who were evacuated or relocated to other prefectures often faced somewhat public stigmas regarding marriage,

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reproduction, and compensation, which are seldom seen in natural disasters. Therefore, Fukushima residents are not only suffering from psychiatric problems but also enduring psychosocial problems such as stigma or discrimination from the public. With regard to the complicated psychological issues in Fukushima, a multifactorial causal relationship consisting of posttraumatic and psychosocial responses, as well as chronic anxiety was observed (Figure 1). These responses among residents, including evacuees, could lead to the development of various psychiatric issues, such as depressive or avoidant symptoms, and even more destructive behavior such as alcohol abuse and suicide [1].

In this article, we review the various psychosocial influences on the people of Fukushima caused by the nuclear accident. Furthermore, we propose future directions for mental health care for Fukushima residents.

II. Differences between natural and nuclear disasters

The Fukushima disaster revealed clear differences in many aspects from past natural disasters. Differences between major nuclear disasters such as the Fukushima disaster and natural disasters have been previously reported [2,3] (Table 1). For example, in general, the onset of a natural disaster is sudden, and its peak impact is in the earliest phase. Many areas affected by a natural disaster are visible and can easily be differentiated from

non-disaster areas. Natural disasters are also thought to be psychologically acceptable as a calamity beyond human understanding. Furthermore, compensation schemes after a natural disaster are relatively simple and easy to understand, and groundless rumors or stigmas among the public are seldom seen. Many people evacuated because of government orders tend to be relocated relatively close to their home community. In addition, after many natural disasters, psychological recovery among evacuees is closely contingent upon the progress of physical relief, including the reconstruction of lifelines or other important infrastructures such as hospitals, public offices, and schools.

On the other hand, the impact of the Fukushima nuclear disaster was largely invisible, which made it difficult to clarify the boundary between disaster and non-disaster areas. In contrast to natural disasters, the impact of nuclear disasters is more likely to be persistent, which may lead to constant fear of fallout or radiation exposure among people living in and around a disaster area. In nuclear disasters, physical losses due to the disaster itself are unclear, so it is not easy for many evacuees to accept substantial losses physically or psychologically. These ambiguous losses, furthermore, might elicit disappointment and anger among evacuees and diminish their hopes of returning to their hometown someday. Many people seemed to be strongly influenced by the mass media, including social networks, and often endure groundless rumors or stigmas from among the public [3]. With regard to the Fukushima

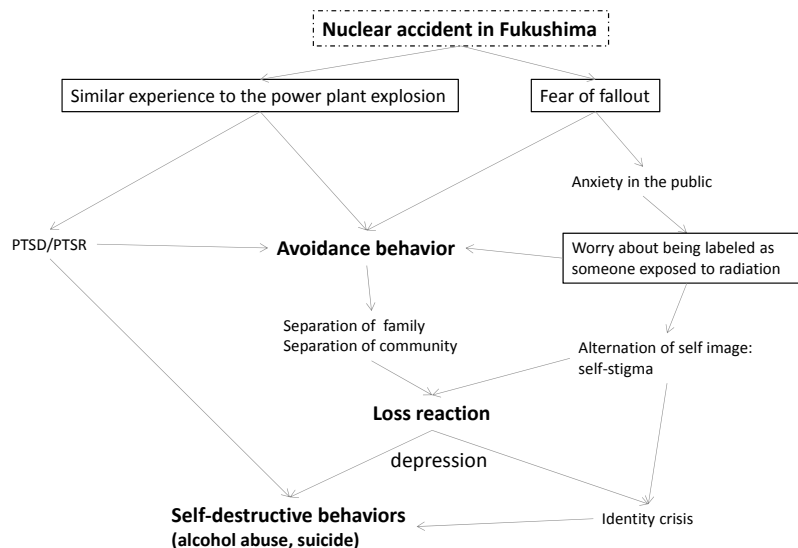


Figure 1 Multidimensional psychosocial reactions inside/outside of Fukushima [3] Three experiences (“similar experience to the power plant explosion”, “fear of fallout”, and “worry about being labeled as someone exposed to radiation”) that led to various reactions among people living inside/outside of Fukushima were considered key to understanding the participants’ complex emotional responses. The unique and specific reactions to the nuclear disaster are shown on the right.

Table 1 Differences between natural disasters and the Fukushima disaster

	Natural disasters	Fukushima disaster
Impact of trauma	Acute, instant	Chronic, continuous
Affected area	Visible, clear	Invisible, unclear
Physical loss	Apparent	Ambiguous
Psychological acceptance	Relatively easy	Very difficult
Anger or disappointment	Relatively low	Very strong
Compensation	Simple, limited	Complicated, unsettled
Groundless rumors	Rare	Common
Stigma and self-stigma	Rare	Common
Influence of media	Relatively low	Very strong
Voluntary evacuation	Few	Numerous
Remote evacuation	Few	Numerous
Cohesiveness of community	High	Low
Psychological recovery	Dependent on physical relief	Independent of physical relief

disaster, compared with evacuees from other affected areas, especially those areas affected by the tsunami, such as Iwate and Miyagi Prefectures, a much higher proportion of evacuees from Fukushima volunteered to move to remote areas [4]. In general, psychological recovery among evacuees after a nuclear disaster is often dissociated from physical recovery (e.g., rebuilding of infrastructure and decontamination), which also leads to delays in returning home.

III. Psychiatric problems

1. Posttraumatic responses

Similar to other natural disasters, many people in Fukushima who experienced the tsunami or FDNPP explosion showed symptoms of posttraumatic stress disorder (PTSD). In the early phase of the disaster, a retrospective survey was conducted on new outpatients who had visited psychiatric clinics in Fukushima Prefecture [5]. The results of that survey showed that 13.9% of the total number of patients ($n = 1321$) showed symptoms of PTSD or adjustment disorder, and 17.2% were experiencing depressive episodes; symptoms in more than 30% of these patients were found to be possibly associated with the nuclear accident. Another study [6] performed in the same early phase that focused on rescue workers near FDNPP revealed that psychological distress was strongly associated with concern about radiation exposure. In addition, other studies [7, 8] conducted on Tokyo Electric Power Company

plant workers 2–3 months after the accident demonstrated that high psychological distress was associated with discrimination and slurs.

With regard to the general population in Fukushima, since February 2012, Fukushima Medical University has been conducting major population-based mental health surveys (the Mental Health and Lifetime Survey: MHLS) involving approximately 210,000 people who had previously lived in the evacuation area [9]. In these surveys, questionnaires, which include a version of the PTSD checklist for specific trauma (PCL-S) [10], are mailed to the targeted population annually. The findings show that 21.6% of the adults surveyed score above the cutoff value (≥ 44) on the PCL-S at 10 months after the accident, which is almost equal to that of workers after the 9/11 World Trade Center attacks in the United States using the same cutoff value for the PCL-S [11]. A 3-year trend survey [12] of the same cohort indicated that the age-adjusted prevalence of probable PTSD based on the results of the PCL-S gradually decreased over time, from 19.0% (10 months) to 17.8% (35 months) for men, and from 25.3% (10 months) to 23.3% (35 months) for women. Another study [13] conducted in Saitama Prefecture on the evacuees from Fukushima at 1 year after the disaster showed that 59.4% of residents scored ≥ 30 on the Impact of Events Scale-Revised [14], which is a 22-item self-rating scale for screening post-traumatic stress symptoms. The findings revealed that PTSD symptoms were also associated with chronic physical and mental diseases, anxiety about livelihoods, lost jobs and

social ties, and concerns about monetary compensation [13].

However, these studies have some limitations. First, there is a lack of control group comparisons between residents of Fukushima Prefecture and those living in other areas. Second, there is a lack of information about which traumatic event—the earthquake, the tsunami, or the explosions at the FDNPP—was the strongest. In spite of these limitations, it is apparent that many people, especially evacuees, are likely to have strong PTSD symptoms, leading to hesitation in their returning home because of avoidance. Therefore, to promote the relief of more affected areas in Fukushima, posttraumatic stress responses among evacuees should be mitigated through the provision of psychological interventions, as well as adequate risk communication.

2. Depression and related issues

In addition to PTSD, the complicated situation in Fukushima as described above also seemed to lead to chronic psychiatric issues such as depression, suicide, and alcohol abuse. Actually, the results of the MHLS showed that the prevalence of probable depression among adult evacuees, based on the 6-item Kessler (K6) scale (score ≥ 13), were as follows: 14.6% in 2012, 11.9% in 2013, and 9.7% in 2014 [12]. Despite a gradual decrease, these scores were still considerably higher than that of the general population of Japan (3%) [15]. Furthermore, a close relationship was observed between depressive symptoms and the perception of individual risk toward radiation. The MHLS performed in 2012 showed that the respondents who believed that radiation exposure was very likely to cause adverse health effects were significantly more likely to have depressive symptoms compared with other respondents [16]. In addition, a 3-year MHLS trajectory analysis revealed that a negative risk perception regarding the genetic effects of radioactive exposure was strongly associated with depressive symptoms [17]. From the clinical perspective, considering this close relationship between depressive symptoms and the perception of radiation risk, one hypothesis can be proposed: people with depressive symptoms are more likely to be pessimistic toward the effects of radiation and other common issues (e.g., financial and health problems, and future plans), which may exacerbate their depressive state and become a vicious circle. Therefore, it is important to consider the existence of depressive symptoms among people who continue to have excessively negative worries about the adverse health effects of radiation exposure while providing risk communication.

Another psychiatric problem often seen after natural disasters is alcohol abuse [18, 19]. The MHLS showed

that changes in alcohol consumption patterns after the disaster, not only in terms of substantial increases in alcohol consumption but also in terms of abstinence, were associated with a high risk of severe psychological distress [20]. It seems that the prevalence of problem drinking according to CAGE (an acronym for “attempts to Cut back on drinking, being Annoyed at criticisms about drinking, feeling Guilty about drinking, and using alcohol as an Eye opener”) scores remained relatively high in both males (20.7% in 2013 and 20.4% in 2014; $P=0.18$) and females (10.5% in 2013 and 10.5% in 2014; $P=0.91$) [12]. In spite of the lack of CAGE data from the general population in Japan, these findings suggest that primary prevention strategies need to be prioritized for people at increased risk of alcohol abuse and depression.

Given the evoked issues of PTSD, depression, and alcohol abuse after a disaster, increases in suicide should be a great concern. Kölves et al. [21] reviewed 42 studies concerning the relationship between suicide cases and natural disasters occurring before the Great East Japan Earthquake. Their findings indicated that, in some disasters, suicide and non-fatal suicide behavior rates increased after an initial decline. They also hypothesized that a temporary decrease in the suicide rate after a major disaster might result from the “honeymoon phase” following disasters [21]. Furthermore, Matsubayashi et al. [22] examined the relationship between suicide rates and the severity of past natural disasters occurring in Japan using prefecture-level panel data from 1982–2010. They found that suicide rates only decreased after less destructive disasters, while they were more likely to increase after massive disasters [22]. They considered that this difference in suicide rates could be the result of weakened social ties between community members following a major disaster [22].

Actually, in Fukushima Prefecture, 83 cases of suicide in the 5 years after the Fukushima disaster were officially certified as disaster-related by the Japanese Police Agency [23], which is much higher compared with other prefectures such as Iwate and Miyagi, which were mainly affected by the tsunami [23]. Given this difference, such a substantial increase in suicide cases in Fukushima could conceivably be the result of the effects of the nuclear power plant accident, rather than those of the earthquake or tsunami. In other words, the decrease in community resilience in Fukushima might have caused the increase in suicide cases.

Furthermore, initially, the standardized suicide mortality ratio (SMR) decreased after the 2011 disaster (108 in 2010, 107 in 2011, 94 in 2012, and 96 in 2013), but then increased to 126 in 2014, which exceeded pre-disaster levels (the reference of the SMR is the average suicide rate among the general population in Japan) [24]. This pattern, an increase

after a short-term drop, is similar to that noted in a review by Kölves et al. [21].

IV. Psychosocial issues

1. Caregivers' anxiety and its influence on their children

After the disaster, many residents without clear prospects or expectations relocated to different places inside or outside of Fukushima. In fact, the MHLS found that 65.7% of the respondents had relocated more than three times since the disaster, and that 39.2% of families had been separated [11]. Along with long-term evacuation, family members often had to be separated from each other because of physical reasons or differences in risk perception regarding radioactive exposure [3]. Regarding risk perception after major nuclear power plant accidents such as those at Three Mile Island or Chernobyl, young mothers have tended to have more anxious feelings towards radiation exposure [25, 26]. In addition, a survey [27] in Fukushima at the time of the disaster showed that 28% of pregnant residents had depressive symptoms, which was thought to be higher than that in the general population in Japan [27]. A nationwide epidemiological study [28] conducted 1 year after the disaster found that married couples were more concerned about radiation and food safety, and Fukushima residents, particularly those with young children, engaged in more preventative behaviors against radiation [29].

These intense anxieties concerning radiation among caregivers, especially young mothers, may elicit behavioral problems among their children. In a small survey [30] of 97 mothers visiting a pediatric clinic in Fukushima City during the first 5 months after the disaster, 77.2% reported that their children had different types of behavioral problems, such as hyperactivity, irritability, and withdrawal behavior. Moreover, 85.1% of the mothers had the idea to relocate to a less affected area, if possible [30]. These concerns of caregivers and the restrictions on their children's outdoor activities may have contributed to the higher obesity rates observed among children in disaster-affected areas [31].

In addition to self-administered questionnaires for adults, such as the K6 and PCL-S, the MHLS used the Strengths and Difficulties Questionnaire (SDQ) for younger populations (age <16 years), which should be completed by caregivers, to identify problematic behaviors among their children [9]. At around 1 year after the disaster, the prevalence of children having some type of behavioral problem according to the SDQ (score ≥ 16) was 24.4% in those aged 4–6 years, 22.0% in those of primary school age (6–12 years), and 16.2% in those of junior high school

age (12–15 years) [11]. Overall, 21.2% of the children were identified as requiring support; this decreased to 15.3% in the following year [32]. However, this rate was still higher compared with that in an area not affected by the disaster (9.5% of those aged 4–12 years) [33]. Considering that many children were barely able to understand the health risks associated with radiation, it is conceivable that these findings resulted from substantial worry about caregivers, thereby indicating close psychological interaction between caregivers and their children. Therefore, psychological interventions for children showing behavioral problems should be conducted with adequate psychoeducation and support for their caregivers, especially young mothers.

2. Community fragmentation and self-stigma among evacuees

In general, the bonds and cohesiveness among residents tend to become stronger after a natural disaster. Moreover, natural disasters may enhance the resilience of communities and reduce mental health problems. A previous epidemiological study [34] revealed that the prevalence of PTSD was considerably lower among those who had experienced a natural disaster than among those who had experienced other man-made incidents or serious crimes (e.g., motor vehicle accidents, physical assaults, and rapes). In Fukushima, people seemed to be divided into many different groups having different opinions regarding the health risks of radiation exposure, future prospects, compensation or other financial issues, political beliefs, and so on [35]. These findings suggest that complications and dissension seem to develop among people when they face a certain situation in which a critical decision needs to be made about relocating, child-rearing, or marriage.

As a result, the following three types of discordance might be produced, each of which could lead to dissonance within both families and the community: 1) family members having different opinions on the physical risks caused by radiation exposure; 2) interfamilial conflicts caused by differences in residential restrictions or compensation; and 3) frustration between evacuees and neighboring areas where large numbers of evacuees are being taken in (e.g., Iwaki City) [3]. These types of discordance might reduce the community resilience that existed before the disaster, leading to increases in a variety of mental health problems among residents.

Moreover, nuclear disasters are associated with other complicated social issues not seen in natural disasters: radiation and self-stigma. Despite there being few studies that reveal the features of public and self-stigma among Fukushima residents, these have been noted in several non-scientific reports. For example, young women in Fukushima

were afraid that some people viewed them negatively owing to assumptions regarding the effects of radiation on future pregnancy or genetic inheritance [3]. Because of such misconceptions or worries, when moving to other prefectures, they often tried to conceal the fact that they had lived in Fukushima and experienced the nuclear power plant accident [36].

As described above, the MHLS includes questions regarding two types of risk perception towards radiation; one is about delayed health risks (e.g., thyroid cancer or leukemia), and the other is about genetic effects on the subsequent generation [31]. Surprisingly, a consistently larger proportion of respondents have had a high-risk perception of genetic effects than of delayed health risks [37]. In 2012, the first survey year, over 60% of respondents had a high-risk perception about genetic effects [16]. While this proportion has been decreasing annually, it has only been doing so gradually, and in the latest survey, was still over 40% [37]. Compared with worries about delayed effects such as thyroid cancer, negative risk perceptions about genetic effects tend to be considered as being associated with reproduction or marriage, which could induce self-stigma among evacuees. A study of people with chronic psychiatric disorders such as schizophrenia showed that self-stigma caused by public stigma often made them more unstable and anxious, and could even reduce self-efficacy/-esteem [38]. It is possible that, when Fukushima residents attempt to establish their identity as a community member from Fukushima, they can also become more vulnerable to mental health problems such as depression owing to low self-esteem or social isolation.

This possible self-stigma among Fukushima residents should be more similar to that experienced by survivors of the atomic bombs that were dropped on Hiroshima and Nagasaki than to that experienced by survivors of natural disasters. Atomic bomb survivors, especially young women, also tried to hide their life histories and refused to talk about their experiences [39]. This tendency among young female survivors to conceal their experiences was also associated with more severe psychological symptoms compared with male survivors [39]. Given the high-risk perception of genetic effects and the existence of self-stigma among Fukushima residents, a public anti-stigma campaign involving the mass media, as well as risk communication or psychiatric interventions, could be necessary.

V. Tasks and challenges

Mental health care resources in Fukushima are insufficient to be deployed widely in disaster-affected

areas. One reason is that, in spite of a shortage of experts before the disaster, a number of medical staff who had been working in Fukushima relocated to other areas after the disaster, mainly because of worries about the effects of radiation exposure. On the other hand, fortunately, a number of professions working outside of Fukushima showed great concern and thus came to Fukushima to provide mental health care or treatment. This newfound cooperation led to the establishment of several new mental health care facilities and organizations in Fukushima. For example, one of these major resources is the mental health support team at Fukushima Medical University, which consists of 15 medical staff and has been performing brief counseling by telephone every year. This team has been calling approximately 4,000 evacuees at risk of psychiatric disorders such as PTSD or depression according to the results of the MHLS [40]. Another major facility (Fukushima Kokoro No Care Center), with about 50 staff members, including psychiatrists, social workers, clinical psychologists, nurses, and occupational therapists, has also been implementing mental health intervention programs since 2012. This center, which has six branches in Fukushima, has been providing active outreach services and group interventions for evacuees [41], as well as sharing necessary information with other preexisting mental health resources, in an attempt to foster good relationships. Certainly, cooperation between different care resources in Fukushima is key to the success of seamless and long-term care. The current tasks of mental health care providers in Fukushima are as follows:

- Developing more efficient screening systems or tools to identify people at risk of psychiatric disorders and related issues, especially suicidal behavior
- Intensive health promotion activities for preventing lifestyle-related problems such as alcohol abuse, sleep disorders, and poor dietary and exercise behaviors.
- Fostering good cooperation with different types of health professionals
- Elaborating risk communication skills
- Carrying out public anti-stigma campaigns involving the mass media
- Providing intensive mental health care for relief workers, especially public employees
- Securing long-term financial support from the government to maintain and develop the current care network

Although 7 years have passed since the Fukushima disaster, many difficult tasks remain unsolved in the domain of mental health care. In particular, public employees working in disaster areas are likely to be considerably exhausted. In fact, one study [42] revealed that the current

prevalence of depression among all workers belonging to two towns in the coastal area of Fukushima was as high as 17.8%. The provision of adequate psychiatric interventions and the establishment of an efficient care system for these workers are urgently needed. A continuous supply of mental health professionals and other relief workers is also crucial for providing further long-term care for Fukushima residents. Finally, information about the current situation in Fukushima needs to be positively conveyed to as many outside experts as possible to foster cooperation in the future.

Conflict of interest

There are no conflict of interest.

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福島原発災害による心理社会的影響と現在の課題 —自然災害と原子力災害の相違—

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抄録

原子力災害と自然災害との間には、人的・物的損失のありかた、心理的受容、コミュニティの凝集性、様々なタイプのスティグマ、メディアの影響など、数多くの点で大きな相違が存在する。福島においても、東日本大震災による津波・地震の影響は非常に大きなものであったが、引き続いて引き起こされた原子力発電所事故の住民への影響はさらに増して多大であったと考えられる。そうした影響は、心理的外傷反応にとどまらず、うつ病やアルコール乱用といった慢性的な精神障害をもたらし、それらによって自殺といった自己破壊的行動さえも引きこされている可能性がある。こうした精神医学的問題に加えて、福島の避難者も含めた住民は、放射線の影響に関する一般大衆のスティグマやセルフ・スティグマにも晒されている。とりわけ遺伝に関する放射線影響についてのネガティブな認知は、避難住民の抑うつ症状と強く関連している。さらに、福島で復興事業に従事する就労者に強い疲弊と様々なタイプの抑うつ症状が出現していることが報告されており、彼らに対するより密接なケアや治療が現在求められている。現在福島で展開しているケア・システムを維持・発展するためには、県外も含めた異なる支援資源間の協力が重要である。

キーワード：原子力災害，うつ病，外傷後ストレス障害，スティグマ，自殺