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The Mental Health of Long-Term Evacuees outside Fukushima Prefecture after the Great East Japan Earthquake

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Ten years after the Great East Japan Earthquake, thousands of residents of Fukushima Prefecture were still living as evacuees. Among them, unignorable numbers of people were living outside of the prefecture. A survey was conducted with evacuees to Ibaraki, the neighboring prefecture of Fukushima, to investigate their medium- to long-term mental care needs. A questionnaire was sent to 1,470 households that had been living in Fukushima on March 11, 2011, and who were evacuated to Ibaraki by October 2016. Binary logistic regression analyses were performed to identify risk factors for major depressive disorder, post-traumatic stress disorder (PTSD), and suicidal ideation. Of the participants, 16.5% had a high risk for major depressive disorder, 39.0% exhibited a high risk for PTSD, and 19.7% indicated suicidal ideation. "Own injuries and illnesses" and "Worries about the hometown" were risk factors for major depressive disorder, PTSD, and suicidal ideation. "Not receiving compensation for damages" was a risk factor common to major depressive disorder and suicidal ideation. There is a high possibility that many people who have evacuated to other prefectures might still be suffering from psychological symptoms after the disaster. Worries about their hometowns were highly related to their mental disorders.

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Introduction

The Great East Japan Earthquake (GEJE), which occurred on March 11, 2011, caused catastrophic damage to the Pacific Coast of the Tohoku and Kanto regions. The number of missing and dead was about 18,500 (National Police Agency 2021). The number of evacuees just after the disaster was over 340,000 people (Reconstruction Agency 2018). Notably, Fukushima Prefecture suffered from the triple disaster of an earthquake, a tsunami, and the Fukushima Daiichi nuclear accident, which killed or injured 1,993 residents (National Police Agency 2021). Moreover, 170,000 residents were evacuated long-term (Fukushima Prefecture 2019a).

It is known that disaster victims develop a stronger fear of man-made disasters, especially radiation disasters, compared to natural disasters (Silove et al. 2006; Neria et al. 2008). The Chernobyl nuclear accident, which occurred in 1986, was a radiation disaster rated as seven on the International Nuclear Event Scale (INES), which is similar to the rating for Fukushima Daiichi. In response to the Chernobyl accident, over 400,000 residents were forced to evacuate. Six years after the accident, a study comparing heavily contaminated and uncontaminated areas reported that more people in heavily contaminated areas suffered psychological distress (Havenaar et al. 1997). The Chernobyl and the Fukushima nuclear accidents have many things in common, such as forcing people to evacuate to distant places and lengthening the processing period after the accident.

Previous surveys have indicated that the nuclear accident and life as evacuees have had negative effects on

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the mental condition of evacuees from Fukushima. A survey conducted nine months after the disaster in Hirono-machi, which was included in the emergency evacuation preparation zone, indicated that 66.8% of the respondents showed symptoms of depression and 53.5% showed a high risk of post-traumatic stress disorder (PTSD) (Kukihara et al. 2014). Moreover, a survey conducted with residents in the evacuation area indicated that 14.6% of the respondents showed a high risk of psychological distress one year after the disaster (Yabe et al. 2014). These figures are five times higher than the percentage for the general population (Kawakami 2007). The percentage of respondents showing symptoms of PTSD was 21.6% one year after the disaster (Yabe et al. 2014), which is nearly equal to that after the September 11 terrorist attacks in the US (DiGrande et al. 2008). Three years after the disaster, the percentage of respondents with a high risk of psychological distress and PTSD had decreased compared to one year after the earthquake, but was still high (Oe et al. 2016). Moreover, it has been indicated that the suicide risk for Fukushima evacuees is high (Ohto et al. 2015; Orui et al. 2018).

Among the 170,000 evacuees from Fukushima, 70,000 evacuated to other prefectures in Japan. In 2016, five years after the disaster, the evacuation order was still in effect around the Fukushima Daiichi Nuclear Power Plant, and 40,000 people remained evacuees (Reconstruction Agency 2016). Tsujiuchi et al. (2016) reported that 59.4% of evacuees from Fukushima had symptoms of PTSD one year after the disaster. A survey two years after the disaster with people evacuated to Ibaraki, which is a neighboring prefecture of Fukushima, indicated that 83.4% of the respondents had symptoms of depression and 53.2% had symptoms of PTSD (Sato et al. 2016). The survey conducted in the same year with all the evacuees (Yabe et al. 2014) reported that the percentage of respondents with symptoms of PTSD was 18.3%, suggesting that the percentage of evacuees with psychological problems living outside of Fukushima might be higher than that of those living in their home prefecture.

Fukushima is the main source of support for evacuees from Fukushima. Since there are few contact points for direct consultation at evacuation sites in other prefectures, evacuees living outside of Fukushima have had a more difficult time receiving support and information than those living in Fukushima. Therefore, we hypothesized that there are many evacuees living outside of Fukushima suffering from depression, PTSD, and suicidal ideation in the medium- to long-term after the GEJE. However, only a few surveys have been conducted with evacuees outside of Fukushima, and there are no reports on their suicidal ideation. Therefore, we conducted a questionnaire survey with evacuees from Fukushima living in Ibaraki to examine their mental health states, including suicidal ideation and the need for psychological care.

Materials and Methods

Participants

We selected Ibaraki as a target area since many Fukushima residents have evacuated to Ibaraki due to the Fukushima Daiichi Nuclear Power Plant accident. Approximately 4,000 Fukushima residents evacuated to Ibaraki (Fig. 1), which is located next to Fukushima over 70 km away from the Fukushima Daiichi Nuclear Power Plant, and many of them continue to live in Ibaraki. As of October 2016, when this survey was conducted, the number of evacuees from Fukushima to Ibaraki was 3,721 (Fukushima Prefecture 2018). For the study, surveys were sent to members of 1,470 households that had been living in Fukushima at the time of the GEJE and evacuated to Ibaraki by October 2016 because of the GEJE.

Survey methods

A self-administered questionnaire was sent to the participants with the cooperation of "*Fūai-net*," which is a non-profit organization designated by Fukushima as a support center for livelihood reconstruction. The questionnaire was included with the regular mail that *Fūai-net* was sending to all households through each local government in Ibaraki. Participants were asked to return the questionnaire by post. One person aged 20 years or older in each house-

Fig. 1. The map of Fukushima and Ibaraki Prefectures. Ibaraki Prefecture is located next to Fukushima Prefecture over 70 km away from the Fukushima Daiichi Nuclear Power Plant.

hold was requested to respond to the questionnaire. The survey period was from October to December 2016.

Question items inquired the following: (1) basic attributes of the participants: age (20-49, 50-59, 60-69, and over 70 years of age), sex (male and female), educational background (elementary/junior high school, senior high school, vocational/junior college, university/graduate school, and other), place of residence before the disaster (difficult-to-return zone: areas where the annual integrated doses are over 50 millisievert; restricted residential zone: areas where the annual integrated doses are between 20 and 50 millisievert; zones preparing to lift evacuation orders: areas where the annual integrated doses are certain to fall to 20 millisievert or less; other: areas where no evacuation order was issued); (2) degree of damage: cause(s) of damage (the earthquake, the tsunami, the nuclear accident, and harmful rumors), composition of the damage (own injuries/illness, dead/missing family members or friends, complete/partial destruction of the house, losing a job, and family separation/discord); (3) number of times of evacuation; (4) current life conditions: receiving or not receiving compensation (in areas where evacuation orders have been issued, compensation for evacuation costs, evacuation compensation, loss of income, etc.); (5) current health conditions: causes of stress in the past month [(a) economic problems: bankruptcy, bad business performance, debt, poverty, and unemployment; (b) work-related problems: job changes, poor work performance, and human relationship problems at workplaces; (c) neighborhood problems: discord with neighbors or isolation; and (d) worries about the hometown: the condition of the house in Fukushima, the possibility of returning home, and anxiety about nuclear-related issues]. Moreover, participants' mental conditions were assessed using psychological assessment scales based on three perspectives: depressive symptoms, PTSD symptoms, and suicidal ideation. A blank space was provided at the end of the questionnaire for additional comments. In addition, information about a consultation service for mental health problems was provided in the questionnaire description, and people with mental health problems were encouraged to seek advice and support.

Psychological assessment scales

The participants' mental conditions were assessed using the following psychological assessment scales. The Kessler Psychological Distress Scale (K6), developed by Kessler et al. (2003), is a scale for assessing the degree of depression and anxiety. It is a 5-point rating scale consisting of six items for evaluating symptoms of depression and anxiety during the past 30 days. The Japanese version of the K6 was developed by Furukawa et al. (2008), and its reliability and validity have been confirmed. The scores range from 0-24 points. Higher scores indicate a higher possibility of mood or anxiety disorders. The cut-off value for predicting mood or anxiety disorders with this scale is a score of 13 points (Kessler et al. 2003). Therefore, we used a score of 13 points as the cut-off value for depression and anxiety.

PTSD symptoms were assessed using the Impact of Events Scale-Revised (IES-R), which was developed by Weiss (2004) after revising the original version developed by Horowitz et al. (1979). The Japanese version of the IES-R was developed by Asukai et al. (2002), and its reliability and validity have been confirmed. This scale is composed of three symptoms, Intrusion, Avoidance, and Hyperarousal, assessed by 22 items that were developed based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Participants are asked about their condition during the past week, and they respond using a 5-point scale. The scores range from 0 to 88 with higher scores suggesting a higher possibility of PTSD. The cut-off value for a high risk of PTSD is regarded as a score of 25 points (Creamer et al. 2003). Therefore, we used a score of 25 points as the cut-off value for PTSD.

Regarding suicidal ideation, participants were asked, "Have you thought of committing suicide during the past 30 days?" and the participants responded using a 5-point scale that ranged from "never" to "always." We divided the respondents into two groups: those responding "never" were classified into the "non-suicidal ideation group," and those responding "rarely," "sometimes," "often," or "always" were classified into the "suicidal ideation group."

Statistical analysis

The statistical analysis software SPSS Ver.25.0 was used for the analysis. Firstly, participants with the cut-off value of 13 points or higher on the K6 were classified into the high-risk group for major depressive disorder, participants with the cut-off value of 25 points or higher on the IES-R were classified into the high-risk group for PTSD, and participants with responses ranging from "rarely" to "always" for the question regarding suicidal ideation were classified as the group with suicidal ideation. Secondly, the ratio of each question item was compared using a chi-square test. Thirdly, binomial logistic regression analysis (forced entry method) was conducted with the items that were significant in the chi-square test ($p < 0.05$) as independent variables and the presence of major depressive disorder, a high risk of PTSD, and suicidal ideation as dependent variables. We also calculated the odds ratio (OR), which is an index of relative risk, with a 95% confidence interval (CI). Lastly, correlation analysis was conducted for suicidal ideation, depressive symptoms, and PTSD symptoms to examine multicollinearity and binomial logistic regression analysis (forced entry method) was conducted using suicidal ideation as the independent variable and depressive symptoms and PTSD symptoms as the dependent variables.

Ethical issues

The survey was conducted anonymously for the protection of personal information. The purpose and methods

of this study was explained to the subjects in writing: "The purpose of this study is to deepen understanding of the importance of mental health care in times of disaster without letting the experience of the GEJE fade away, and to use it to improve medical and welfare services in the future." Their informed consent was considered given if the participants responded to and returned the questionnaire. This study was conducted after getting the approval of the medical ethics committee of the University of Tsukuba (No. 1094; date of approval: August 9, 2016).

Results

Evacuees' attributes, damage conditions, and psychological symptoms

Among the 1,470 potential participants of this study, 310 responded, which is a response rate of 21.1%. Table 1 shows the depressive symptoms, PTSD symptoms, and suicidal ideation of the evacuees based on their attributes. Table 2 shows the damages that they experienced.

The number of participants with a high risk for depressive disorder (K6 ≥ 13) was 51 (16.5%). In this group, the percentage of evacuees that had not received compensation for damages ($p < 0.01$), and those that were injured or ill because of the disaster ($p < 0.01$), were significantly higher than that of evacuees who had received compensation and who were not injured or ill. Causes of stress in the past month indicated that the percentage of participants in this group experiencing stress from work-related problems ($p < 0.01$), neighborhood problems ($p < 0.05$), and worries about their hometown ($p < 0.01$) was significantly higher than that of participants not experiencing these types of stressors.

The number of participants that were regarded as having a high risk of PTSD (IES-R ≥ 25) was 121 (39.0%). A significant age difference was confirmed in the risk for PTSD ($p < 0.05$). In this group, the percentage of those that mentioned damage caused by harmful rumors ($p < 0.01$), being injured or ill because of the disaster ($p < 0.01$), having experienced deaths or missing family members or friends ($p < 0.01$), and having experienced separation or discord among family members ($p < 0.01$) was significantly high. Causes of stress in the past month indicated that the percentage of participants having stress caused by economic problems ($p < 0.05$), work-related problems ($p < 0.05$), neighborhood problems ($p < 0.01$), and worries about their hometown ($p < 0.01$) was significantly higher than that of those not experiencing such stressors.

Among the participants, 61 (19.7%) had suicidal ideation. The percentage of those with suicidal ideation among the evacuees was higher among those that mentioned not receiving compensation for damages ($p < 0.01$), damages caused by harmful rumors ($p < 0.05$), getting injured or ill ($p < 0.01$), having stress from work-related problems ($p < 0.05$), neighborhood problems ($p < 0.01$), and worries about their hometown ($p < 0.01$), compared to that of those not having these types of problems.

Factors affecting psychological conditions of evacuees

Correlations between depressive symptoms and PTSD symptoms, as well as suicidal ideation and age, sex, and significant items revealed in the chi-square test were examined using binomial logistic regression analysis. Firstly, we examined correlations with depressive symptoms, which indicated that getting injured or ill because of the disaster (OR 5.49, 95% CI 2.21-13.63), not receiving compensation for damages (OR 3.59, 95% CI 1.23-10.51), having work-related problems (OR 4.67, 95% CI 1.71-12.75), and having worries about their hometown (OR 4.41, 95% CI 1.86-10.91) were significant risk factors for major depressive disorder (Table 3).

Next, we examined the correlations with PTSD symptoms, which indicated that damage caused by harmful rumors (OR 2.73, 95% CI 1.25-5.96), getting injured or ill because of the disaster (OR 3.58, 95% CI 1.48-8.62), family separation or discord caused by the disaster (OR 1.99, 95% CI 1.07-3.72), neighborhood problems (OR 3.86, 95% CI 1.73-8.60), and worries about their hometown (OR 3.85, 95% CI 2.11-7.03) were significant risk factors for PTSD (Table 4).

Lastly, we examined correlations with suicidal ideation, which indicated that getting injured or ill (OR 4.56, 95% CI 1.99-10.45), not receiving compensation for damages (OR 4.40, 95% CI 1.79-10.81), and having worries about their hometown (OR 2.64, 95% CI 1.27-5.49) were significant risk factors for suicidal ideation (Table 5).

The relationship between depressive symptoms, PTSD symptoms, and suicidal ideation

Spearman's rank correlation coefficients between depressive symptoms, PTSD symptoms, and suicidal ideation ranged from 0.43 to 0.45, suggesting a low degree of multicollinearity. We subsequently examined correlations with suicidal ideation, which indicated that both depressive symptoms (OR 3.79, 95% CI 1.75-8.21) and PTSD symptoms (OR 9.26, 95% CI 3.59-23.91) were significant risk factors for suicidal ideation.

Discussion

Psychological symptoms of evacuees living outside Fukushima

The results of this survey identified conditions and risk factors for major depressive disorder, PTSD symptoms, and suicidal ideation in long-term evacuees from Fukushima who have been forced to live outside their hometown because of the complex nature of the GEJE. There are currently no reports examining long-term evacuees living outside of Fukushima and the factors related to their suicidal ideation. The strength of this study abides in its revelation of the many evacuees living outside of Fukushima who continue to have suicidal ideation in the medium- to long-term after the GEJE and who require psychological care. In addition, the study identified risk factors for suicidal ideation and examined the areas where psychological care is

required.

It has been reported that the percentage of Japanese people with a cut-off value of over 13 points on the K6 is 3% during normal times (Kawakami 2007). The present survey indicates that the percentage of participants with a cut-off value of over 13 points on the K6 was 16.5%, which is five times higher than that during normal times.

Tsujiuchi et al. (2012) surveyed Fukushima residents who evacuated during an acute phase of the GEJE. Their results indicated that 67.3% of people had a cut-off value of 25 or higher on the IES-R, which was extremely high. The survey of evacuees conducted by Sato et al. (2016) three years after the disaster revealed that the percentage of participants with a cut-off value of over 25 on the IES-R was 53.2%. The current survey conducted five years after the disaster indicated that this percentage had decreased to 39.0%. However, approximately 40% of the evacuees continuing to suffer from PTSD symptoms is considered a serious problem.

It is known that the number of people with suicidal ideation increases after a disaster (Chou et al. 2007; Stein et al. 2010). According to a survey conducted by the Nippon Foundation in Japan in August 2016 on people aged 20 years and over in all prefectures, 3.4% of people had had suicidal ideation within the past 1 year and 1.6% of people had suicidal ideation at the time of the survey (The Nippon Foundation 2017). In our survey, 19.7% of the participants responded that they had had suicidal ideation in the past month. Although the survey method used by the Nippon Foundation was different, our survey results are still very high. In Miyagi Prefecture, a survey conducted three years after the disaster reported that 9.8% of the victims had suicidal ideation (Morishima et al. 2019). This survey in Miyagi, as did our own, used a self-administered questionnaire to examine rare suicidal ideation in the last month, but the method of classifying participants into the group with suicidal ideation was different. When, for comparison purposes, we classified "rarely" into the "non-suicidal group," 7.1% of the evacuees had suicidal ideation, which was lower than that in the survey conducted in Miyagi. Potential reasons for this could be that Miyagi was more severely affected by the GEJE, with about six times as many deaths as occurred in Fukushima, and that our survey was conducted two years later.

Risk factors for psychological symptoms in evacuees outside Fukushima

Risk of major depressive disorder: Tang et al. (2014) indicated the following risk factors for depression caused by disasters: being female, not married, holding religious beliefs, having poor education, prior trauma, experiencing fear, and injury and/or bereavement during the disaster. The current study examined sex, educational background, injuries, and bereavement resulting from the disaster, and the results suggest that the main risk factor for major depressive disorder was injury caused by the disaster. According to the Fukushima Health Management Survey (Kunii et al. 2016) conducted the year after the earthquake, the risk factors for major depressive disorder were a history of mental illness, being female, experience of the nuclear power plant accident, living in a rented house, loss of close relatives, and unemployment. Although a simple comparison cannot be made between our findings and those of previous studies because of the difference in the items surveyed, our results show that the only risk factor related to earthquake damage was injury or illness caused by the disaster, and, therefore, the direct effects of the earthquake on the depressive symptoms of the evacuees, such as the experience of the nuclear accident, loss of close relatives, and unemployment, were not significant over time. Worries about the hometown and receiving or not receiving compensation were risk factors characteristic to evacuees living outside of Fukushima.

Risk of PTSD: Previous studies have indicated the following factors for the onset of PTSD risk: the degree of exposure to the disaster, not receiving social support after the disaster (or the feeling of lacking social support), being female, and secondary stress factors (Katz et al. 2002). A survey conducted in the year after the disaster of evacuees to Saitama Prefecture reported that the predictors of PTSD were chronic physical diseases, chronic mental disorders, worries about livelihood, the loss of a job or social ties, and having concerns about compensation (Tsujiuchi et al. 2016). There were no significant differences for PTSD in the current survey based on losing a job or not receiving compensation for damages. Over the years, employment and financial problems may have become smaller risk factors for PTSD. Our results indicate that neighborhood problems, as well as harmful rumors and family separation or discord caused by the disaster, are risk factors. Evacuees outside of Fukushima have left their hometowns and evacuated to distant locations and are thus cut off from their pre-disaster local ties and community organizations. It is assumed that this makes them more prone to isolation and reduced social support.

Risk of committing suicide: Risk factors for suicidal ideation following a disaster have been reported to include major depression, psychiatric disorders such as PTSD (Caldera et al. 2001; Chou et al. 2007; Wagenaar et al. 2012), low income, disaster-related stress (Kessler et al. 2008), and the female sex (Suzuki et al. 2011; Stratta et al. 2012). Our results also showed that being in the high-risk groups for depression or PTSD was both risk factors for suicidal ideation. The odds ratio for the high-risk group for PTSD was higher than that for the high-risk group for depression. According to Xu et al. (2018), a survey of evacuees living in temporary housing conducted three years after the GEJE revealed that the risk factors for suicidal ideation were being unmarried, being injured in the disaster, and subjective physical ill-health. "Getting injured or ill" was also indicated in the present study as a risk factor for suicidal ideation. In the survey conducted in Miyagi men-

Table 1. Levels of depressive symptoms, PTSD symptoms, and suicidal ideation depending on the participants' attributes.

		Depressive symptoms			PTSD symptoms			Suicidal ideation over past 30 days		
		K6 ≥ 13 n (%)	K6 < 13 n (%)	p-value	IES-R ≥ 25 n (%)	IES-R < 25 n (%)	p-value	Suicidal n (%)	Not suicidal n (%)	p-value
Total		51 (16.5)	236 (76.1)		121 (39.0)	146 (47.1)		61 (19.7)	236 (76.1)	
Age	20-49	14 (27.5)	69 (29.2)	0.159	35 (28.9)	43 (29.5)	< 0.05	21 (34.4)	63 (26.7)	0.102
	50-59	11 (21.6)	47 (19.9)		30 (24.8)	26 (17.8)		16 (26.2)	42 (17.8)	
	60-69	10 (19.6)	75 (31.8)		26 (21.5)	54 (37.0)		11 (18.0)	76 (32.2)	
	≥ 70	16 (31.4)	45 (19.1)		30 (24.8)	23 (15.8)		13 (21.3)	55 (23.3)	
Sex	Male	22 (43.1)	123 (52.3)	0.233	65 (53.7)	71 (49.0)	0.44	26 (42.6)	125 (53.2)	0.141
	Female	29 (56.9)	112 (47.7)		56 (46.3)	74 (51.0)		35 (57.4)	110 (46.8)	
Educational background										
Elementary/junior high school		5 (10.0)	21 (9.0)	0.1	13 (10.8)	10 (6.9)	0.699	8 (13.1)	21 (9.1)	0.904
Senior high school		28 (56.0)	132 (56.4)		67 (55.8)	84 (57.9)		33 (54.1)	132 (57.1)	
Vocational/junior college		13 (26.0)	45 (19.2)		25 (20.8)	30 (20.7)		12 (19.7)	46 (19.9)	
University/graduate school		1 (2.0)	31 (13.2)		12 (10.0)	19 (13.1)		6 (9.8)	26 (11.3)	
Place of residence before the disaster										
Difficult-to-return zone		16 (32.0)	77 (33.0)	0.959	41 (34.5)	48 (33.1)	0.349	21 (36.2)	77 (32.8)	0.823
Restricted residence zone		11 (22.0)	58 (24.9)		27 (22.7)	37 (25.5)		13 (22.4)	58 (24.7)	
Zones preparing to lift evacuation orders		13 (26.0)	55 (23.6)		33 (27.7)	29 (20.0)		12 (20.7)	59 (25.1)	
Other		10 (20.0)	43 (18.5)		18 (15.1)	31 (21.4)		12 (20.7)	41 (17.4)	
Causes of damage										
Earthquake	Yes	43 (84.3)	185 (78.4)	0.342	101 (83.5)	113 (77.4)	0.215	51 (83.6)	186 (78.8)	0.406
	No	8 (15.7)	51 (21.6)		20 (16.5)	33 (22.6)		10 (16.4)	50 (21.2)	
Tsunami	Yes	5 (9.8)	29 (12.3)	0.619	11 (9.1)	19 (13.0)	0.312	6 (9.8)	30 (12.7)	0.54
	No	46 (90.2)	207 (87.7)		110 (90.9)	127 (87.0)		55 (90.2)	206 (87.3)	
Nuclear accident	Yes	48 (94.1)	219 (92.8)	0.737	114 (94.2)	137 (93.8)	0.897	56 (91.8)	221 (93.6)	0.609
	No	3 (5.9)	17 (7.2)		7 (5.8)	9 (6.2)		5 (8.2)	15 (6.4)	
Harmful rumors	Yes	11 (21.6)	35 (14.8)	0.234	29 (24.0)	16 (11.0)	< 0.01	15 (24.6)	32 (13.6)	< 0.05
	No	40 (78.4)	201 (85.2)		92 (76.0)	130 (89.0)		46 (75.4)	204 (86.4)	

The Kessler Psychological Distress Scale (K6) is a scale for assessing the degree of depression and anxiety. The cut-off value for predicting mood or anxiety disorders with this scale is a score of 13 points. The Impact of Events Scale-Revised (IES-R) is composed of three symptoms, Intrusion, Avoidance, and Hyperarousal. The cut-off value for predicting of PTSD is regarded as a score of 25 points.

Table 2. Levels of depressive symptoms, PTSD symptoms, and suicidal ideation depending on the damage conditions and causes of stress in the past month.

		Depressive symptoms			PTSD symptoms			Suicidal ideation over past 30 days		
		K6 ≥ 13 n (%)	K6 < 13 n (%)	p-value	IES-R ≥ 25 n (%)	IES-R < 25 n (%)	p-value	Suicidal n (%)	Not suicidal n (%)	p-value
Composition of damage										
Own injuries/illness	Yes	17 (33.3)	22 (9.3)	< 0.01	26 (21.5)	11 (7.5)	< 0.01	19 (31.1)	24 (10.2)	< 0.01
	No	34 (66.7)	214 (90.7)		95 (78.5)	135 (92.5)		42 (68.9)	212 (89.8)	
Death/missing of family members or friends										
	Yes	11 (21.6)	43 (18.2)	0.579	34 (28.1)	22 (15.1)	< 0.01	17 (27.9)	42 (17.8)	0.079
	No	40 (78.4)	193 (81.8)		87 (71.9)	124 (84.9)		44 (72.1)	194 (82.2)	
Complete destruction of one's house										
	Yes	5 (9.8)	24 (10.2)	0.937	13 (10.7)	11 (7.5)	0.361	7 (11.5)	23 (9.7)	0.689
	No	46 (90.2)	212 (89.8)		108 (89.3)	135 (92.5)		54 (88.5)	213 (90.3)	
Partial destructions of one's house										
	Yes	19 (37.3)	91 (38.6)	0.862	45 (37.2)	59 (40.4)	0.591	19 (31.1)	94 (39.8)	0.213
	No	32 (62.7)	145 (61.4)		76 (62.8)	87 (59.6)		42 (68.9)	142 (60.2)	
Losing a job	Yes	14 (27.5)	95 (40.3)	0.088	48 (39.7)	57 (39.0)	0.917	25 (41.0)	86 (36.4)	0.513
	No	37 (72.5)	141 (59.7)		73 (60.3)	89 (61.0)		36 (59.0)	150 (63.6)	
Family separation/discord	Yes	21 (41.2)	97 (41.1)	0.992	60 (49.6)	49 (33.6)	< 0.01	31 (50.8)	91 (38.6)	0.083
	No	30 (58.8)	139 (58.9)		61 (50.4)	97 (66.4)		30 (49.2)	145 (61.4)	
Number of times evacuated	1-3	27 (54.0)	99 (42.5)	0.137	56 (46.7)	61 (42.1)	0.453	27 (45.0)	104 (44.6)	0.96
	≥ 4	23 (46.0)	134 (57.5)		64 (53.3)	84 (57.9)		33 (55.0)	129 (55.4)	
Compensation for damages										
Receiving		33 (75.0)	205 (90.7)	< 0.01	98 (87.5)	124 (89.2)	0.674	39 (72.2)	206 (91.6)	< 0.01
Not receiving		11 (25.0)	21 (9.3)		14 (12.5)	15 (10.8)		15 (27.8)	19 (8.4)	
Causes of stress in the past month										
Economic problems										
Yes		13 (25.5)	42 (17.8)	0.206	30 (24.8)	22 (15.1)	< 0.05	15 (24.6)	41 (17.4)	0.199
No		38 (74.5)	194 (82.2)		91 (75.2)	124 (84.9)		46 (75.4)	195 (82.6)	
Work-related problems										
Yes		17 (33.3)	35 (14.8)	< 0.01	29 (24.0)	18 (12.3)	< 0.05	17 (27.9)	35 (14.8)	< 0.05
No		34 (66.7)	201 (85.2)		92 (76.0)	128 (87.7)		44 (72.1)	201 (85.2)	
Neighborhood problems										
Yes		14 (27.5)	35 (14.8)	< 0.05	36 (29.8)	12 (8.2)	< 0.01	19 (31.1)	31 (13.1)	< 0.01
No		37 (72.5)	201 (85.2)		85 (70.2)	134 (91.8)		42 (68.9)	205 (86.9)	
Worries about one's hometown										
Yes		41 (80.4)	108 (45.8)	< 0.01	88 (72.7)	51 (34.9)	< 0.01	43 (70.5)	114 (48.3)	< 0.01
No		18 (29.5)	122 (51.7)		33 (27.3)	95 (65.1)		18 (29.5)	122 (51.7)	

The Kessler Psychological Distress Scale (K6) is a scale for assessing the degree of depression and anxiety. The cut-off value for predicting mood or anxiety disorders with this scale is a score of 13 points. The Impact of Events Scale-Revised (IES-R) is composed of three symptoms, Intrusion, Avoidance, and Hyperarousal. The cut-off value for predicting of PTSD is regarded as a score of 25 points.

Table 3. Logistic regression analysis of characteristics of the evacuees and depressive symptoms.

	p-value	OR	95% CI	
Age (ref. 20-49)				
50-59	0.358	1.69	0.55	5.16
60-69	0.361	1.77	0.52	6.00
≥ 70	0.074	2.93	0.90	9.52
Sex (ref. Male)				
Female	0.115	1.88	0.86	4.13
Own injuries/illnesses caused by the disaster	0.000	5.49	2.21	13.63
Not receiving compensation for damages	0.020	3.59	1.23	10.51
Work-related problems	0.003	4.67	1.71	12.75
Neighborhood problems	0.165	1.89	0.77	4.65
Worries about one's hometown	0.001	4.41	1.86	10.91

OR, odds ratio; CI, confidence interval.

Table 4. Logistic regression analysis of characteristics of the evacuees and PTSD symptoms.

	p-value	OR	95% CI	
Age (ref. 20-49)				
50-59	0.753	1.15	0.49	2.67
60-69	0.407	0.69	0.28	1.67
≥ 70	0.182	1.93	0.74	5.67
Sex (ref. Male)				
Female	0.710	0.89	0.47	1.67
Harmful rumors because of the disaster	0.012	2.73	1.25	5.96
Own injuries/illnesses caused by the disaster	0.005	3.58	1.48	8.62
Death/missing of family members or friends because of the disaster	0.435	1.34	0.64	2.79
Family separation/discord because of the disaster	0.031	1.99	1.07	3.72
Economic problems	0.292	1.49	0.71	3.13
Work-related problems	0.379	1.48	0.62	3.54
Neighborhood problems	0.001	3.86	1.73	8.60
Worries about one's hometown	0.000	3.85	2.11	7.03

OR, odds ratio; CI, confidence interval.

Table 5. Logistic regression analysis of characteristics of the evacuees and suicidal ideation.

	p-value	OR	95% CI	
Age (ref. 20-49)				
50-59	0.416	1.48	0.58	3.79
60-69	0.477	0.69	0.24	1.94
≥ 70	0.501	0.70	0.25	1.98
Sex (ref. Male)				
Female	0.218	1.57	0.77	3.19
Harmful rumors because of the disaster	0.178	1.79	0.77	4.19
Own injuries/illnesses caused by the disaster	0.000	4.56	1.99	10.45
Not receiving compensation for damages	0.001	4.40	1.79	10.81
Work-related problems	0.181	1.82	0.76	4.40
Neighborhood problems	0.168	1.78	0.78	4.03
Worries about one's hometown	0.009	2.64	1.27	5.49

OR, odds ratio; CI, confidence interval.

tioned above, it was reported that job loss at the time of the survey was a risk factor for suicidal ideation (Morishima et al. 2019). Although unemployment was not a risk factor in our study, another financial problem related to the disaster, the failure to receive compensation for damages, was a risk factor for committing suicide. It was suggested that while psychological stress and PTSD symptoms might be caused by daily stress, suicidal ideation might be more affected by stress relevant to the disaster that destroyed a person's life, rather than by daily stress.

Provision of long-term care: In the Chernobyl nuclear accident, approximately 20% of the victims showed maladaptation even six years after the accident. Moreover, this percentage had not changed 11 years later – 'Chernobyl has broken my entire life' (Baloga et al. 2011). The lives of evacuees outside of Fukushima were also destroyed by the earthquake, tsunami, and Fukushima Daiichi nuclear accident. Many of the victims are still unable to establish a new life. The types of long-term care required by evacuees in the future, based on the above findings, are discussed below.

Firstly, since evacuees who have been injured or become ill due to the disaster are at high risk of mental disorders, it is suggested that home visits should be provided proactively for them by public health nurses, and psychiatric treatment should be offered when necessary.

Secondly, improving problems in social relationships is essential for improving PTSD symptoms. In Japan, personal information is strictly protected, and evacuees have little information about where former members of their community are living, which can deteriorate social support networks. Therefore, it is suggested that a system should be developed for evacuees from Fukushima to facilitate contacting others from the same town to develop new relationships.

Thirdly, the national and local governments have already taken countermeasures against harmful rumors related to the nuclear accident (Fukushima Prefecture 2019b; Reconstruction Agency 2013). However, South Korea has prohibited the import of crops from Fukushima based on rumors (Nikkei 2019). Therefore, harmful rumors not only have a negative effect on industry but also cause problems related to bullying at schools. Children who have evacuated to Chiba Prefecture were abused by being told that they might infect others with radiation (Chiba Nippo 2017). Therefore, it is suggested that educational activities for the purpose of providing correct information about radiation should be promoted.

Finally, "Not receiving compensation for damages" was a common risk factor for major depressive disorder and suicidal ideation in the present survey, even though "economic problems" were not identified as a risk factor. There is a wide gap in compensation for evacuees depending on whether the central government has issued evacuation orders. In other words, in areas where evacuation orders have been issued, compensation for evacuation (e.g., psychological impact, impairment of daily living, etc.), evacuation costs (e.g., travel, accommodations, etc.), and loss of income have been provided to some extent. On the other hand, in the absence of evacuation orders, compensation is either not provided at all or is extremely inadequate (Tanba and Shimizu 2019). Evacuees that are unable to receive compensation for different reasons might feel intense stress about being different from the people receiving compensation. It has been pointed out that the amount of compensation differs depending on whether an area is classified as a difficult-to-return area or a restricted-residence area, creating a serious division among residents (Tanba and Shimizu 2019). It is necessary to develop a fairer compensation system to decrease the psychological burden of disaster evacuees.

"Worries about the hometown" was a common risk factor for major depressive disorder, PTSD symptoms, and suicidal ideation. In October 2016, when the present survey was conducted, evacuation orders in many areas had started to be lifted. However, the results of the current survey suggest that this has not positively affected the psychological conditions of the victims. Five years of long-term evacuation has changed their houses and towns and destroyed their hometown community. They might have conflicted feelings about returning to their hometown because of the above situation, which has led to psychological distress. The psychological state of evacuees may change in the future as a result of the major change in the lifting of the evacuation orders. It seems to be necessary to continue longitudinal investigations in the future.

Limitations

There are several limitations in this study. Firstly, the study was a cross-sectional study conducted in 2016. Therefore, the results of the study, including the mental state of the participants, may be different in 2021. Secondly, because the study was cross-sectional, the causality between the core outcomes and the independent variables used in the analysis remains unclear. Thirdly, the response rate for the study was rather low, at 21.1%. Therefore, the proportion of people with symptoms in this study should be carefully evaluated. In the blank section of our questionnaire, where people could freely write their own comments, there was an answer of "I don't want to answer any more because I feel like I will have a flashback to that time." The response rate may have been low because people wanted to avoid recalling the painful events of the disaster. Finally, respondents were limited to one person that was randomly selected from each household. Therefore, people having severe psychological symptoms or feelings of resistance to getting support might have been excluded from responding. Also, it is possible that only the people who were interested in the psychological and social problems of evacuation participated in the survey.

Conclusion

This study demonstrated that long-term evacuees living outside of Fukushima were still suffering from mental disorders five years after the disaster. Physical injuries and diseases caused by the disaster were medium- to long-term risk factors for mental disorders. Moreover, worries about the hometown, which is an issue characteristic of evacuees living outside of Fukushima, were highly related to participants' psychological disorders. Furthermore, suicidal ideation was mainly affected by disaster-related stress rather than daily-life stress. It is suggested that longitudinal surveys of long-term evacuees outside of Fukushima should be conducted in the future. Also, increased mental health care, improved social support, correct information, and continuous compensation in a fair manner should be provided to long-term evacuees living outside of Fukushima.

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Conflict of Interest

The authors declare no conflict of interest.

References

Asukai, N., Kato, H., Kawamura, N., Kim, Y., Yamamoto, K., Kishimoto, J., Miyake, Y. & Nishizono-Maher, A. (2002) Reliability and validity of the Japanese-language version of the impact of event scale-revised (IES-R-J): four studies of different traumatic events. *J. Nerv. Ment. Dis.*, **190**, 175-182.

Baloga, V. I., Kholosha, V. I., Evdin, O. M. & Perepelyatnykova, L. V. (2011) Twenty-five Years after Chernobyl Accident: Safety for the Future. National Report of Ukraine. https://inis.iaea.org/search/search.aspx?orig_q=RN:52029712 [*Accessed:* September 30, 2021].

Caldera, T., Palma, L., Penayo, U. & Kullgren, G. (2001) Psychological impact of the hurricane Mitch in Nicaragua in a one-year perspective. *Soc. Psychiatry Psychiatr. Epidemiol.*, **36**, 108-114.

Chiba Nippo (2017) "Infected by radiation" children of three households were bullied at elementary and junior high schools in Chiba Prefecture. https://www.chibanippo.co.jp/news/national/382645 [*Accessed*: September 30, 2021].

Chou, F.H.C., Wu, H.C., Chou, P., Su, C.Y., Tsai, K.Y., Chao, S.S., Chen, M.C., Su, T.T.P., Sun, W.J. & Ou-Yang, W.C. (2007) Epidemiologic psychiatric studies on post-disaster impact among Chi-Chi earthquake survivors in Yu-Chi, Taiwan. *Psychiatry Clin. Neurosci.*, **61**, 370-378.

Creamer, M., Bell, R. & Failla, S. (2003) Psychometric properties of the Impact of Event Scale - Revised. *Behav. Res. Ther.*, **41**, 1489-1496.

DiGrande, L., Perrin, M.A., Thorpe, L.E., Thalji, L., Murphy, J., Wu, D., Farfel, M. & Brackbill, R.M. (2008) Posttraumatic stress symptoms, PTSD, and risk factors among lower Manhattan residents 2-3 years after the September 11, 2001 terrorist attacks. *J. Trauma. Stress*, **21**, 264-273.

Fukushima Prefecture (2018) Number of evacuees outside Fukushima Prefecture. http://www.pref.fukushima.lg.jp/site/portal/ps-kengai-hinansyasu.html [*Accessed*: September 30, 2021].

Fukushima Prefecture (2019a) Fukushima Revitalization Station. http://www.pref.fukushima.lg.jp/site/portal-english/en03-08.html [*Accessed*: September 30, 2021].

Fukushima Prefecture (2019b) Strategies to deal with harmful rumors and to stop the memory of the disaster from being forgotten. https://www.pref.fukushima.lg.jp/uploaded/attachment/263746.pdf [*Accessed:* September 30, 2021].

Furukawa, T.A., Kawakami, N., Saitoh, M., Ono, Y., Nakane, Y., Nakamura, Y., Tachimori, H., Iwata, N., Uda, H., Nakane, H., Watanabe, M., Naganuma, Y., Hata, Y., Kobayashi, M., Miyake, Y., et al. (2008) The performance of the Japanese version of the K6 and K10 in the World Mental Health Survey Japan. *Int. J. Methods Psychiatr. Res.*, **17**, 152-158.

Havenaar, J., Rumyantzeva, G., Kasyanenko, A., Kaasjager, K., Westermann, A., van den Brink, W., van den Bout, J. & Savelkoul, J. (1997) Health effects of the Chernobyl disaster: illness or illness behavior? A comparative general health survey in two former Soviet regions. *Environ. Health Perspect.*, **105** Suppl 6, 1533-1537.

Horowitz, M., Wilner, N. & Alvarez, W. (1979) Impact of event scale: a measure of subjective stress. *Psychosom. Med.*, **41**, 209-218.

Katz, C.L., Pellegrino, L., Pandya, A., Ng, A. & DeLisi, L.E. (2002) Research on psychiatric outcomes and interventions subsequent to disasters: a review of the literature. *Psychiatry Res.*, **110**, 201-217.

Kawakami, N. (2007) National survey of mental health measured by K6 and factors affecting mental health status (in Japanese) in Research on Applied Use of Statistics and Information. *Health Labour Sciences Research Grant Report* 2006/2007.

Kessler, R.C., Barker, P.R., Colpe, L.J., Epstein, J.F., Gfroerer, J.C., Hiripi, E., Howes, M.J., Normand, S.L.T., Manderscheid, R.W., Walters, E.E. & Zaslavsky, A.M. (2003) Screening for serious mental illness in the general population. *Arch. Gen. Psychiatry*, **60**, 184-189.

Kessler, R.C., Galea, S., Gruber, M.J., Sampson, N.A., Ursano, R.J. & Wessely, S. (2008) Trends in mental illness and suicidality after Hurricane Katrina. *Mol. Psychiatry*, **13**, 374-384.

Kukihara, H., Yamawaki, N., Uchiyama, K., Arai, S. & Horikawa, E. (2014) Trauma, depression, and resilience of earthquake/tsunami/nuclear disaster survivors of Hirono, Fukushima, Japan. *Psychiatry Clin. Neurosci.*, **68**, 524-533.

Kunii, Y., Suzuki, Y., Shiga, T., Yabe, H., Yasumura, S., Maeda, M., Niwa, S., Otsuru, A., Mashiko, H. & Abe, M.; Mental Health Group of the Fukushima Health Management Survey (2016) Severe psychological distress of evacuees in evacuation zone caused by the Fukushima Daiichi Nuclear Power Plant accident: the Fukushima Health Management Survey. *PLoS One*, **11**, e0158821.

Morishima, R., Ando, S., Araki, T., Usami, S., Kanehara, A., Tanaka, S. & Kasai, K. (2019) The course of chronic and delayed onset of mental illness and the risk for suicidal ideation after the Great East Japan Earthquake of 2011: a community-based longitudinal study. *Psychiatry Res.*, **273**, 171-177.

National Police Agency (2021) Measures taken by the National Police Agency and damage conditions of the 2011 Tohoku earthquake and tsunami. https://www.npa.go.jp/news/other/earthquake2011/pdf/higaijokyo.pdf [*Accessed*: September 30, 2021].

Neria, Y., Nandi, A. & Galea, S. (2008) Post-traumatic stress disorder following disasters: a systematic review. *Psychol. Med.*, **38**, 467-480.

Nikkei (2019) South Korea wins WTO appeal on Fukushima seafood ban. https://www.nikkei.com/article/DGXMZO43651130S9A410C1MM8000/

[*Accessed*: September 30, 2021].

Oe, M., Fujii, S., Maeda, M., Nagai, M., Harigane, M., Miura, I., Yabe, H., Ohira, T., Takahashi, H., Suzuki, Y., Yasumura, S. & Abe, M. (2016) Three-year trend survey of psychological distress, post-traumatic stress, and problem drinking among residents in the evacuation zone after the Fukushima Daiichi Nuclear Power Plant accident [The Fukushima Health Management Survey]. *Psychiatry Clin. Neurosci.*, **70**, 245-252.

Ohto, H., Maeda, M., Yabe, H., Yasumura, S. & Bromet, E.E. (2015) Suicide rates in the aftermath of the 2011 earthquake in Japan. *Lancet*, **385**, 1727.

Orui, M., Suzuki, Y., Maeda, M. & Yasumura, S. (2018) Suicide rates in evacuation areas after the Fukushima Daiichi Nuclear disaster. *Crisis*, **39**, 353-363.

Reconstruction Agency (2013) Measure package for impacts including reputational damage from nuclear disaster. http://www.reconstruction.go.jp/topics/20130402_fuhyogaiyo.pdf
[*Accessed*: September 30, 2021].

Reconstruction Agency (2016) The number of evacuees in Japan. https://www.reconstruction.go.jp/topics/main-cat2/sub-cat2-1/20161028_hinansha.pdf
[*Accessed*: September 30, 2021].

Reconstruction Agency (2018) Change in the number of evacuees. https://www.reconstruction.go.jp/topics/main-cat2/sub-cat2-1/20181228_hinansha_suii.pdf
[*Accessed*: September 30, 2021].

Sato, S., Ishida, I., Hattori, K. & Ota, M. (2016) The psychiatric characteristics of evacuees from Fukushima prefecture in Kitaibaraki city after the Great East Japan Earthquake. *Japanese Journal of Clinical Psychiatry*, **45**, 1457-1464.

Silove, D., Steel, Z. & Psychol, M. (2006) Understanding community psychosocial needs after disasters: implications for mental health services. *J. Postgrad. Med.*, **52**, 121-125.

Stein, D.J., Chiu, W.T., Hwang, I., Kessler, R.C., Sampson, N., Alonso, J., Borges, G., Bromet, E., Bruffaerts, R., de Girolamo, G., Florescu, S., Gureje, O., He, Y., Kovess-Masfety, V., Levinson, D., et al. (2010) Cross-national analysis of the associations between traumatic events and suicidal behavior: findings from the WHO World Mental Health Surveys. *PLoS One*, **5**, e10574.

Stratta, P., Capanna, C., Riccardi, I., Carmassi, C., Piccinni, A., Dell'Osso, L. & Rossi, A. (2012) Suicidal intention and negative spiritual coping one year after the earthquake of L'Aquila (Italy). *J. Affect. Disord.*, **136**, 1227-1231.

Suzuki, Y., Tsutsumi, A., Fukasawa, M., Honma, H., Someya, T. & Kim, Y. (2011) Prevalence of mental disorders and suicidal thoughts among community-dwelling elderly adults 3 years after the Niigata-Chuetsu earthquake. *J. Epidemiol.*, **21**, 144-150.

Tanba, F. & Shimizu, A. (2019) Double track reconstruction from the Fukushima nuclear disaster, Minerva Shobo, Kyoto, Japan.

Tang, B., Liu, X., Liu, Y., Xue, C. & Zhang, L. (2014) A meta-analysis of risk factors for depression in adults and children after natural disasters. *BMC Public Health*, **14**, 623.

The Nippon Foundation (2017) The Nippon Foundation Suicide Awareness Survey. https://www.nippon-foundation.or.jp/app/uploads/2018/12/wha_pro_sui_mea_05.pdf
[*Accessed*: August 2, 2022].

Tsujiuchi, T., Yamaguchi, M. & Masuda, K. (2012) From a survey in Saitama Prefecture. *Depress. Front.*, **10**, 21-31.

Tsujiuchi, T., Yamaguchi, M., Masuda, K., Tsuchida, M., Inomata, T., Kumano, H., Kikuchi, Y., Augusterfer, E.F. & Mollica, R.F. (2016) High prevalence of post-praumatic stress symptoms in relation to social factors in affected population one year after the Fukushima Nuclear Disaster. *PLoS One*, **11**, e0151807.

Wagenaar, B.H., Hagaman, A.K., Kaiser, B.N., McLean, K.E. & Kohrt, B.A. (2012) Depression, suicidal ideation, and associated factors: a cross-sectional study in rural Haiti. *BMC Psychiatry*, **12**, 149.

Weiss, D.S. (2004) The Impact of Event Scale-Revised, Second ed., edited by Wilson, J.P. & Keane, T.M. The Guilford Press, New York, NY, pp. 168-189.

Xu, Q., Fukasawa, M., Kawakami, N., Baba, T., Sakata, K., Suzuki, R., Tomita, H., Nemoto, H., Yasumura, S., Yabe, H., Horikoshi, N., Umeda, M., Suzuki, Y., Shimoda, H., Tachimori, H., et al. (2018) Cumulative incidence of suicidal ideation and associated factors among adults living in temporary housing during the three years after the Great East Japan Earthquake. *J. Affect. Disord.*, **232**, 1-8.

Yabe, H., Suzuki, Y., Mashiko, H., Nakayama, Y., Hisata, M., Niwa, S., Yasumura, S., Yamashita, S., Kamiya, K. & Abe, M.; Mental Health Group of the Fukushima Health Management Survey (2014) Psychological distress after the Great East Japan Earthquake and Fukushima Daiichi Nuclear Power Plant accident: results of a mental health and lifestyle survey through the Fukushima Health Management Survey in FY2011 and FY2012. *Fukushima J. Med. Sci.*, **60**, 57-67.