


ORIGINAL ARTICLE

Increase in the number of admissions to psychiatric hospitals immediately after the Great East Japan Earthquake

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Abstract

Introduction: Major natural disasters have a significant impact on the mental health of survivors in affected communities. Although it has been speculated that the number of survivors requiring admission to psychiatric hospital increases immediately after a major disaster, few studies have examined the issue.

Methods: On March 11, 2011, the Great East Japan Earthquake and subsequent tsunami devastated the relatively isolated city of Kesenuma. We therefore compared the weekly number of patients admitted to 2 psychiatric hospitals in Kesenuma in the 4 weeks immediately after the earthquake with those in the 4 weeks immediately preceding the earthquake. We also made comparisons between this 8-week period and the corresponding 8-week periods in 2009, 2010, and 2012.

Results: The number of patients admitted to the 2 psychiatric hospitals increased in 4 weeks after the disaster in 2011, with a weekly median (range) of 13 (9-16), compared with 6 (5-9) in the preceding 4 weeks in 2011. The corresponding figures were 5.5 (2-10) in 2009, 6.5 (5-9) in 2010, and 4 (3-7) in 2012 ($P = .01$, $H = 13.05$). By diagnostic category, admissions for schizophrenia spectrum disorder and neurotic stress-related disorder increased significantly following the disaster.

Discussion: Demands for inpatient psychiatric treatment increased immediately after the Great East Japan Earthquake. Government officials and mental health professionals must strengthen support for survivors with mental illness, especially those with schizophrenia spectrum disorder. This should include support for mental health authorities and medical staff in the affected community.

KEYWORDS

disaster medicine, natural disaster, patient admission, psychiatric hospitals, schizophrenia spectrum and other psychotic disorders

1 | INTRODUCTION

Major natural disasters significantly impact survivors living in affected communities. When living with serious life-threatening experiences and life stressors, the number of survivors with mental illness might be expected to increase in those communities (Galea et al., 2007; Kessler, Galea, Jones, & Parker, 2006; Van Griensven et al., 2006). Therefore, it is plausible to assume that the number of survivors requiring admission

to psychiatric hospitals should increase in the affected region, especially in the immediate aftermath.

However, few studies have examined this issue, and where they have, the findings have been inconsistent (Katz, Pellegrino, Pandya, Ng, & DeLisi, 2002; Person & Fuller, 2007). In the Chi-Chi earthquake that hit Taiwan on September 21, 1999, admissions for schizophrenia increased by 11.0% and 21.6% in the first and second years, respectively, after the earthquake, compared to the previous 3 years (Tseng,

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Hemenway, Kawachi, Subramanian, & Chen, 2010). By contrast, in the Christchurch earthquake in New Zealand on February 22, 2011, total bed occupancy fell from 94% to 79% in the first year after the disaster, and daily admission fell by 20% in the 30 days following the earthquake (Beaglehole, Bell, Beveridge, & Frampton, 2015).

The Great East Japan Earthquake (GEJE) affected northeastern Japan on March 11, 2011. The earthquake and subsequent tsunami resulted in more than 18 000 casualties and the destruction of more than 400 000 houses. Kesennuma, a small city with a population of 73 000 in the northeastern part of Miyagi prefecture, was among the cities hardest hit by the GEJE. Kesennuma is in the ria coast region, and the complicated local coastline and nearby mountains isolate the city from the inland and other nearby cities. Therefore, most medical services are provided inside the area (Shibahara et al., 2013). In total, 1359 citizens (1.9%) lost their lives, 15 819 houses were destroyed, and 17 000 people needed to be evacuated to shelters (<http://www.city.kesennuma.lg.jp/www/contents/1300452011135/>).

We hypothesized that admission to psychiatric hospitals would increase immediately after a major natural disaster because survivors with mental illness experience new stressors, including change in living situations, stress from living in sheltered accommodation, bereavement, limited hospital access, and/or discontinuation of medicine. Particularly, we were interested in the initial 4 weeks after disaster because this period is important for disaster relief operation; the United Nations Disaster Assessment and Coordination (<https://www.unocha.org/legacy/what-we-do/coordination-tools/undac/overview>) assumes first 3 to 4 weeks as the initial response phase, and the Japanese Guideline for Local Mental Health Care Activities after a Disaster (Kim, 2011) defines the first month as the initial response period. To test our hypothesis, we retrospectively examined the number of admissions to psychiatric hospitals in Kesennuma in the 4 weeks after the GEJE with admissions at other times.

2 | METHODS

This was a retrospective chart review without personal information. Therefore, informed consent was not obtained. The protocol was approved by the ethics committee of Tohoku University Graduate School of Medicine. We collected information about the age, sex, and diagnosis of patients admitted to the 2 hospitals from 4 weeks before to 4 weeks after the GEJE (ie, from February 12 to April 7, 2011). We also obtained the corresponding data for 2009, 2010, and 2012.

In Kesennuma, psychiatric services were covered by 1 private outpatient clinic and 2 psychiatric hospitals (Mitsumine Hospital and Hikarigaoka-Hoyouen Hospital) at the time of the GEJE. The Hikarigaoka-Hoyouen Hospital, which is located in a seaside area, was seriously hit by the tsunami, and all inpatients were temporarily forced to evacuate to a nearby shelter. Although flooding reached the second floor of the 3-story building, most of the damage was limited to the ground floor, allowing the hospital to return to providing inpatient and outpatient services on the upper floors. The Mitsumine Hospital, by contrast, is located in an upland area and only sustained minimal damage and interruption to inpatient and outpatient services. The only private outpatient clinic in the area was destroyed by the

tsunami, and outpatient services have since stopped. We could therefore use the full medical records of the Mitsumine Hospital but could only use an electronic database for the Hikarigaoka-Hoyouen Hospital, because their medical records were lost to the tsunami. Only limited information was available in the electronic database.

Diagnoses were based on the International Classification of Diseases Tenth Revision (ICD-10), Classification of Mental and Behavioral Disorders, following interview by senior psychiatrists in each hospital (S.R. and T.S.). The patients were categorized into 6 groups: (1) organic, including symptomatic, mental disorders (F0); (2) mental and behavioral disorders due to psychoactive substance use (F1); (3) schizophrenia, schizotypal, and delusional disorders (F2); (4) mood (affective) disorders (F3); (5) neurotic, stress-related, and somatoform disorders (F4); and (6) others. Because the medical records of the Hikarigaoka-Hoyouen Hospital were lost to the tsunami, a retrospective chart review was only conducted for patients admitted to the Mitsumine Hospital following the earthquake in 2011. This was to elucidate the characteristics of patients hospitalized following the disaster and included the following information: number of prior hospitalizations; living situation before the earthquake; and reasons for aggravation, which included discontinuation of medication, stress from living in a shelter, or bereavement from losing a family member.

2.1 | Statistical analysis

The weekly number of patients admitted to the 2 hospitals in the 4 weeks immediately after the earthquake in 2011 (post-4w-2011) was compared with those in the 4 weeks prior to the earthquake (pre-4w-2011) and the corresponding 8-week periods in 2009 (8w-2009), 2010 (8w-2010), and 2012 (8w-2012). On the basis of the method used to investigate number of admission after disaster in patients with epilepsy (Shibahara et al., 2013) and cardiomyopathy (Watanabe et al., 2005), Kruskal-Wallis test was used because the weekly number of patients admitted to the psychiatric hospitals was not normally distributed and comprised a dependent sample. Differences in demographic characteristics (eg, sex and age) were examined between the groups by chi-square tests and 1-way analysis of variance, as appropriate. Statistical analyses were performed using EZR (ver. 1.20, Saitama Medical Center, Jichi Medical University, Saitama, Japan) (Kanda, 2013), which is a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). The level of statistical significance was defined as $P < .05$ (2-tailed).

3 | RESULTS

In total, 216 patients were admitted to the 2 psychiatric hospitals in Kesennuma in 8w-2009, 8w-2010, pre-4w-2011, post-4w-2011, and 8w-2012 (Table 1). Gender ($P = .161$, $T = 6.65$) and age ($P = .324$, $F = 1.17$) of those admitted between periods did not differ.

The number of patients admitted to the psychiatric hospitals increased in post-4w-2011 ($P = .01$, $H = 13.05$), with a weekly median (range) of 13 (9-16), compared with 6 (5-9) in pre-4w-2011, 5.5 (2-10) in 8w-2009, 6.5 (5-9) in 8w-2010, and 4 (3-7) in 8w-2012 (Figure 1; Table 1). By diagnostic category, the number of patients admitted with ICD-10 F2 and ICD-10 F4 increased significantly in post-4w-2011

TABLE 1 Sex, age, and median (range) of patients admitted to psychiatric hospitals in each period

	2009	2010	2011 pre-GEJE	2011 post-GEJE	2012	P value	F
Sex							
	N (%)						
Male	21 (48.8)	35 (61.4)	9 (34.6)	28 (54.9)	24 (61.5)		
Female	22 (51.2)	22 (38.6)	17 (65.4)	23 (45.1)	15 (38.5)		
Total	43	57	26	51	39	.161	6.6
Age	Mean (SD)						
Male	61.8 (3.8)	63.2 (2.68)	56.8 (21.9)	54.1 (16.7)	62.6 (3.4)		
Female	62.1 (4.8)	46.6 (3.4)	59.1 (22.5)	58.3 (19.0)	62.7 (5.2)		
Total	61.9 (3.1)	56.8 (2.3)	58.3 (21.8)	56.0 (17.7)	62.7 (2.8)	.324	1.2
ICD-10	Median (range)						
F0	2 (0-5)	1 (1-4)	2 (1-3)	3.5 (3-4)	2 (0-3)	.212	5.8
F1	1 (0-2)	1 (0-3)	0 (0-2)	0.5 (0-1)	0 (0-2)	.377	4.2
F2	0 (0-4)	2 (0-4)	3 (2-4)	4 (2-8)	1.5 (0-3)	.03*	10.7
F3	1 (0-2)	1 (0-3)	1 (0-1)	1.5 (0-2)	0.5 (0-1)	.608	2.7
F4	0 (0-1)	0 (0-1)	0 (0-0)	1.5 (1-4)	0 (0-1)	.003**	16.1
Others	0 (0-1)	1 (0-2)	0 (0-1)	1 (0-2)	0 (0-2)	.546	3.1
Total	5.5 (2-10)	6.5 (5-9)	6 (5-9)	13 (9-16)	4 (3-7)	.011*	13.0

Abbreviations: F0, organic, including symptomatic, mental disorders; F1, mental and behavioral disorders due to psychoactive substance use; F2, schizophrenia, schizotypal, and delusional disorders; F3, mood (affective) disorders; F4, neurotic, stress-related, and somatoform disorders; GEJE, Great East Japan Earthquake.

*P < .05.

**P < .01.

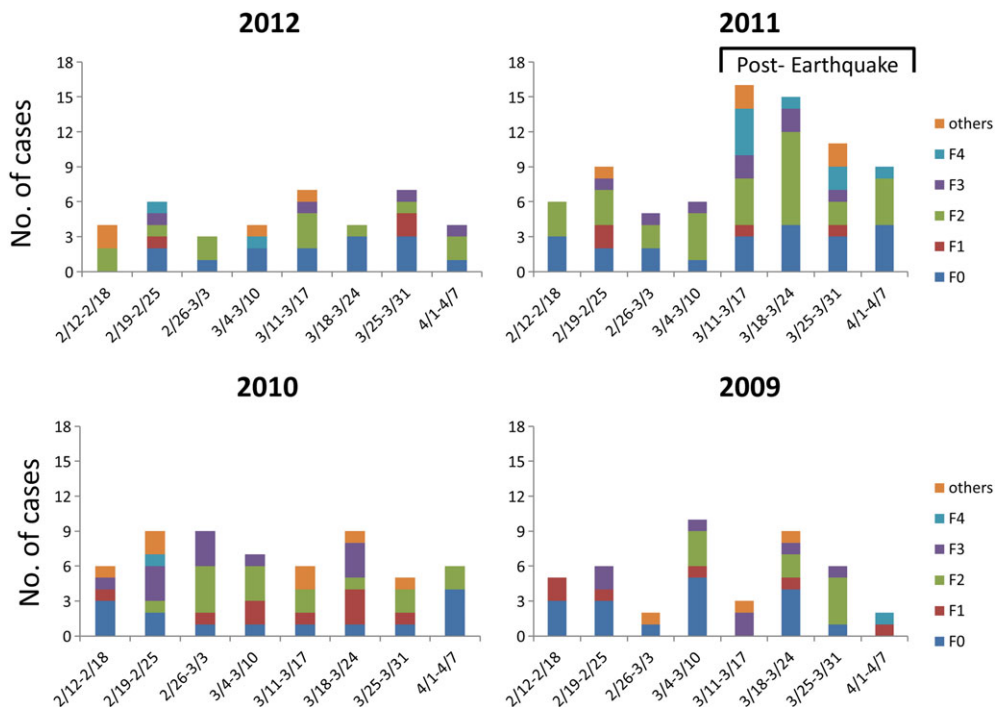


FIGURE 1 Graphs of the number of patients admitted each week during 8-week periods (February 12 to April 7) in 2011, 2009, 2010, and 2012. F0, organic, including symptomatic, mental disorders; F1, mental and behavioral disorders due to psychoactive substance use; F2, schizophrenia, schizotypal, and delusional disorders; F3, mood (affective) disorders; F4, neurotic, stress-related, and somatoform disorders

compared with that in the other periods (Table 1). There was no difference in weekly median admission rates for patients with ICD-10 F0, F1, F3, and other diagnoses in post-4w-2011 compared with those in the other periods. Of the 51 patients admitted in post-4w-2011, 43

(84.3%) were admitted to the Mitsumine Hospital (Table 2). All patients with ICD-10 F2 had a history of admission to psychiatric hospitals, whereas 6 of the 7 patients with ICD-10 F4 diagnoses had no prior history of admission to psychiatric hospitals.

TABLE 2 Characteristics of patients admitted to the Mitsumine Hospital in the 4 weeks immediately after the Great East Japan Earthquake in 2011

	Total (N = 43)	F0 (n = 11)	F1 (n = 2)	F2 (n = 14)	F3 (n = 4)	F4 (n = 7)	Others (n = 5)
Prior hospitalization	N (%)						
0	17 (39.5)	8 (72.7)	1 (50)	0 (0)	1 (25)	6 (85.7)	1 (20)
1	7 (16.3)	2 (18.2)	1 (50)	3 (21.4)	0 (0)	0 (0)	1 (20)
2-4	5 (11.6)	1 (9.1)	0 (0)	3 (21.4)	0 (0)	1 (14.3)	0 (0)
5 or more	9 (20.9)	0 (0)	0 (0)	6 (42.7)	2 (50)	0 (0)	1 (20)
Not available	5 (11.6)	0 (0)	0 (0)	2 (14.3)	1 (25)	0 (0)	2 (40)
Living situation							
Living alone	2 (4.7)	1 (9.1)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)
Living with family	35 (81.4)	6 (54.5)	2 (100)	13 (92.9)	3 (75)	7 (100)	4 (80)
Living in nursing home	5 (11.6)	3 (27.3)	0 (0)	1 (7.1)	0 (0)	0 (0)	1 (20)
Not available	1 (2.3)	1 (9.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Reasons for the aggravation							
Stress in shelter	22 (51.2)	9 (81.8)	0 (0)	8 (57.1)	1 (25)	1 (14.3)	3 (60)
Bereavement of losing family member(s)	3 (7.0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (42.9)	0 (0)
Medication discontinuation	8 (18.6)	2 (18.2)	0 (0)	5 (35.7)	0 (0)	0 (0)	1 (20)
Others	4 (9.3)	0 (0)	1 (50)	1 (7.1)	0 (0)	1 (14.3)	1 (20)
Not available	6 (14.0)	0 (0)	1 (50)	0 (0)	3 (75)	2 (28.6)	0 (0)

The main reason for deterioration among patients in most diagnostic categories was stress from living in a shelter. However, for those in the ICD-10 F4 category, the most prevalent reason was bereavement from the loss of a family member. Eight patients (19%) discontinued medication after the earthquake, and 4 (9%) of those could not continue their therapy because it was swept away by the tsunami. Most patients were living with family members.

4 | DISCUSSION

This is the first study showing that inpatient admission to psychiatric hospital increased during the acute phase of a major natural disaster. The number of patients admitted was highest in the first week following the disaster, and admission was for either schizophrenia spectrum disorders or neurotic stress-related disorders.

The present finding conflicts with the report by Beaglehole et al. (2015), who stated that there was a 20% reduction in admissions to acute inpatient psychiatric services in the 30 days following an earthquake in Christchurch, New Zealand. A potential reason for the conflicting findings is the difference in mental health service provision between Japan and New Zealand. Previous studies indicate that, in the immediate postdisaster period, continued community outreach psychiatric services, such as assertive community treatment, may prevent exacerbation or admission in patients with mental illness (Lachance, Santos, & Burns, 1994; McMurray & Steiner, 2000). In Japan, psychiatric services have been overly dependent on inpatient psychiatric care for decades, and there are relatively poorly developed community care services and social resources for people with mental illness, especially in rural areas (Tsuchiya & Takei, 2004). This relative lack of community mental health provision might result in more admissions for inpatient care. Another reason may be the difference in the magnitude of damage to the psychiatric services in the studies. In Kesenuma, the only

outpatient clinic was totally swept away by the tsunami and 1 of the 2 psychiatric hospitals was seriously damaged, significantly affecting the ability of staff to provide services. Because the outpatient facilities of the hospital were flooded, outpatient services were drastically cut when the comparison was made in the acute period after the disaster. Given that the capacity to provide outpatient psychiatric services was significantly reduced, there may have been a compensatory increase in the number of admissions.

In this study, we showed that survivors with schizophrenia spectrum disorders were at heightened risk of admission immediately after the natural disaster. A similarly heightened risk of admission for schizophrenia spectrum disorders was observed after the Christchurch earthquake (Beaglehole et al., 2015). Although the mean number of total admissions fell from 3.1 admissions per day in the 30 days preceding the earthquake to 2.5 admissions per day in the 30 days after the earthquake, that of the ICD-10 F2 category showed a small but non-significant increase from the mean of 0.9 admission per day before the earthquake to 1.0 admission per day after the earthquake. A similar increase in admission for schizophrenia was also reported after the Chi-Chi earthquake (Tseng et al., 2010), although this was reported for the first and second years after the earthquake.

Together with previous findings, our results indicate that the heightened risk of admission among survivors with schizophrenia spectrum disorder may continue from the acute period to the mid- and long-term after a disaster. In the present study, all patients admitted with schizophrenia spectrum disorders to Mitsumine Hospital had a prior history of admission to psychiatric hospitals, and most were admitted because of symptom deterioration related to the stress of living in a shelter or because of enforced medication discontinuation (ie, through loss and lack of access to replacement). Overall, individuals with schizophrenia spectrum disorders were more vulnerable in the postdisaster period compared with the other diagnostic groups. The importance of medical support for chronic patients with physical

disorders, including diabetes, cardiovascular disease, and renal failure, was noted in the acute phase of a disaster (Chan & Sondorp, 2007; Miller & Arquilla, 2012), wherein the rescue and life support particularly for the casualties and acute patients draw more attention. Similarly, we emphasize the importance of medical support for chronic patients with mental disorders, including schizophrenia spectrum disorder, and recommend maintaining and enhancing the support offered to such survivors in the acute phase of a disaster.

There was also an increase in the admission of survivors with neurotic stress-related and somatoform disorders in this study. In contrast to the patients with schizophrenia spectrum disorders, 6 of 7 admitted patients with stress-related disorders had no prior history of admission to psychiatric services, and 3 were admitted because of severe bereavement reactions (ie, loss of family members). Acute stress reactions associated with the disaster experience might be responsible for the increase in admission rates in this patient group. Therefore, being prepared for treating not only chronic but also acute new cases with mental disorders was necessary.

Although the increment of admission of survivors with organic disorders (mostly dementia) was not significant, we should note that more than 70% (8 of 11) of them were admitted in the first time and most were deteriorated because of the stress in shelter. Given an increasing number of elderly population and patients with dementia in Japan, arrangement of specially designed shelter for elderly survivors with dementia in the acute phase of a disaster seems to be an urgent issue to be addressed.

This study showed that demands for inpatient admission to psychiatric hospital increase in the acute phase after a major natural disaster. In Kesenuma, inpatient admission was only possible in 1 hospital because the other psychiatric hospital was seriously damaged by the tsunami. However, even the relatively preserved hospital suffered from a shortage of water, food, and medicine for inpatients. Many hospital staff also experienced psychological and material damage as a result of the disaster, including loss of family members and/or friends, and damage to their homes. Under these strained postdisaster conditions, it is challenging for local mental health services to meet increased psychiatric needs, and there is an increased risk of mental health problems for the local medical staff (Johal, Mounsey, Brannelly, & Johnston, 2016; Sakuma et al., 2015). Therefore, effective support from outside sources is needed until local clinics and hospitals regain function, which may include the provision of care for survivors with mental illness, and support for service providers and local mental health authorities. It is essential to have better provisions in place for this support before future disasters. In the GEJE, although "Kokoro no Care" mental health services and psychosocial support teams were dispatched to regions affected by the disaster, support was mostly provided in shelters (Kim, 2011), with limited support offered to psychiatric hospitals (Matsumoto, 2014).

Given the apparent limitations of inpatient services to meet the increasing demands on mental health services following a large-scale natural disaster, it seems prudent that we expand and enhance community mental health and outreach services in nondisaster times. It is also imperative that we consider and implement measures to support disaster survivors who have preexisting mental illness, especially those with schizophrenia spectrum disorders living in the community. The lack of a clear framework to support psychiatric hospitals in the acute phase of a

disaster also seems to be an area where we need to focus our efforts. Indeed, government officials and mental health professionals should collaborate to allow for the possibility that inpatient admission to psychiatric hospitals can increase following major natural disasters and revise the disaster response plan accordingly for mental health.

Several limitations of our study must be noted. First, the generalizability of the findings is poor because the data were retrospectively obtained from a small sample of only 2 hospitals in an isolated region. Second, immediately after the GEJE, patients in need of inpatient treatment for physical illness were transported to hospitals inland of the area affected by the tsunami (Satomi, 2011); therefore, it is possible that some patients with mental illnesses were transported to inland psychiatric hospitals, suggesting that our study might have underestimated the need for psychiatric admission. Third, because diagnoses and reasons for admission were determined by retrospective chart review, they cannot be relied upon to examine the causal relationship between disaster-related experiences and psychiatric admission in each case. Lastly, we only investigated number of admission in the acute phase of disaster and did not address an issue of the effect on a longer period. Future studies must investigate the impact of disaster on psychiatric admission in both the acute and later phase of a disaster.

In conclusion, our study showed that demands for inpatient admission to psychiatric hospitals increased in a coastal region of Japan immediately after the GEJE. Government officials and mental health professionals must consider the need to implement measures to support survivors with mental illness, especially those with schizophrenia spectrum disorder.

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DISCLOSURE

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

All authors contributed in concept and designing of the study. A.S., I.U., S.R., and T.S. collected the data. A.S., I.U., and K.M. performed the statistical analysis. A.S. and K.M. drafted the manuscript. All authors contributed in interpretation of the data and revision of the manuscript. All authors read and approved the final manuscript.

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