

# Functional impairment in outpatients with mental disorders after the 2011 Great East Japan Earthquake

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## Abstract

**Background** : It is generally accepted that functional impairments are found in the course of patients with mental disorders who have exhibited vulnerability to a disaster. However, there has been no study examining post-disaster functional changes among them. The aim of the present study is to evaluate functional changes related to the 2011 Great East Japan Earthquake among patients with mental disorders living in the peripheral area of the earthquake zone, i.e., Tochigi Prefecture just adjacent to Fukushima Prefecture.

**Methods** : A total of 612 outpatients with schizophrenic disorders (n = 163), mood disorders (n = 299), and neurotic disorders (n = 150) were evaluated in terms of their post-disaster functional changes using the function subscale of the Global Assessment of Functioning (GAF-F) assessed before and after the 2011 Great East Japan Earthquake.

**Results** : Seventeen percent of the subjects showed a decline of their GAF-F scores after the disaster, compared to those before the disaster. The frequencies of the declined GAF-F score were 22% for the patients with neurotic disorders, 19% for those with mood disorders, and 7% for those with schizophrenic disorders with a significant difference among the 3 diagnostic groups. In 102 subjects who showed a decline of their GAF-F scores after the disaster, the net changes of the decline of the GAF-F scores after the disaster in patients with mood disorders and those with neurotic disorders were significantly greater than those in patients with schizophrenic disorders, respectively. The multivariate logistic regression analysis revealed that patients with mood disorders (F3) (OR = 4.28, 95% CI = 2.03-9.02) and those with neurotic disorders (F4) (OR = 4.56, 95% CI = 2.09-9.95) were more than 4 times as likely to decline their GAF-F scores after the disaster than those with schizophrenic disorders (F2).

**Conclusion** : We found that in the peripheral area of the earthquake zone 17% of the outpatients with mood disorders, neurotic disorders and schizophrenic disorders developed a significant functional decline after the 2011 Great East Japan Earthquake. Patients with mood disorders and neurotic disorders were more vulnerable to the disaster, compared to those with schizophrenic disorders. Close monitoring of the psychiatric conditions of individuals with mental disorders, in particular mood disorders and neurotic disorders, may be of critical importance after a major disaster.

(**Key words** : 2011 Great East Japan Earthquake, functional impairment, mood disorders, neurotic disorders, schizophrenia)

## Introduction

Disasters are traumatic life events that may result in a wide range of psychiatric conditions such as posttraumatic stress disorder (PTSD)<sup>1,4</sup>, and produce different degrees of impairment of social and occupational functioning<sup>5-7</sup>.

Nonetheless, a few studies of any general population have focused on functional impairment after a disaster<sup>8</sup>.

A history of mental illnesses in itself has been identified as one of the risk factors for post-disaster PTSD<sup>9,10</sup>. One study after the 9/11 Terrorist Attacks suggested that patients

with mental disorders were more vulnerable to develop posttraumatic stress symptoms compared to patients with other medical disorders<sup>11</sup>. However, to the best of our knowledge, there has been no study examining functional impairment in patients with mental disorders after a major disaster, as well as the possible differences in vulnerability to traumatic events depending on the different diagnostic groups of mental disorders.

On March 11, 2011, the 9.0-magnitude the 2011 Great East Japan Earthquake, which severely affected the eastern half of the main island of Japan was followed by a massive tsunami that caused widespread destruction along the northeastern coast. Together the earthquake and tsunami killed more than 19,000 people and led to severe nuclear reactor accidents in the Fukushima Nuclear Power Plant, which released a large amount of radioactive material into the atmosphere with a consequent spreading of soil contamination in the direction of neighboring communities. Due to the enormous complex disaster consisting of the earthquake and the nuclear accident, a number of the residents in the eastern half of Japan are still facing prolonged psychological distress, even two years after the 2011 Great East Japan Earthquake.

The aim of the present study was to examine functional change after the 2011 Great East Japan Earthquake by comparing data of social functioning before the disaster from outpatients with mental disorders and to identify any differences in functional change after the disaster among patients with different mental disorders.

## Methods

The study was conducted in Tochigi Prefecture : a community located approximately 100–200 km southwest/inland from the Fukushima Nuclear Power Plant. In Tochigi Prefecture, the earthquake's seismic intensity was 5+ to 6+ on the Japan Meteorological Agency Seismic Intensity Scale (maximum seismic intensity = 7), with 75,000 buildings damaged and over 5,000 aftershocks<sup>12</sup>. There was no tsunami in this area.

### Participants

The eligible patients for this study were individuals who from before September 11, 2010 (i.e., 6 months before the earthquake) had continued to regularly visit (i.e., majority : from once a month to once every two months) the outpatient psychiatric clinic of Jichi Medical University Hospital. The inclusion criteria of the study were that the individual was aged 16–85 yrs, lived in the Tochigi area (i.e., within a 50-km radius of the facility), visited the outpatient psychiatric clinic continuously between April 11 and July 11 2011, and had the capacity to give written informed consent. In order to make our study sample as homogeneous as possible and to allow us to highlight those outpatients maintaining relatively stable mental states, we excluded the patients (n = 73) who

exhibited an exacerbation of mental states that were NOT considered due to the 2011 Great East Japan Earthquake in the survey period, that is between April 11 and July 11 2011 and the patients (n = 64) who had experienced remarkable life events in addition to the earthquake such as death of a family member, divorce or job change based on the axis IV "Severity of Psychosocial Stressors" of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Text Revision (DSM-IV-TR)<sup>13</sup>. In this context, we have also excluded new patients (n = 82) as well as patients who had to be hospitalized in the period of the survey (n = 50).

Among the 938 individuals who met the inclusion criteria, 701 patients were recruited for this study, and the response rate was 74.7%. All patients were Japanese. Each of the patients completed a structured interview using the Mini-International Neuropsychiatric Interview (MINI) Japanese version<sup>14</sup> based on the International Classification of Diseases–Tenth Revision (ICD-10)<sup>15</sup> as a screening for any past and/or present mental illness. We adopted only the main diagnosis of the patients in the present study if the patients had comorbid mental disorders. All patients were given a complete description of the study, and written informed consent was obtained from all participants prior to being surveyed in the study. Approval for the present study was acquired from the ethics committee of Jichi Medical University.

Concerning demographic differences between the participants and the non-participants in this study, there was no significant difference in age ( $t = -0.695$ ,  $df = 936$ ,  $p = 0.49$ ), in gender ( $\chi^2 = 0.004$ ,  $df = 1$ ,  $p = 0.95$ ), or in distribution of mental disorders (F2 : schizophrenic disorders, F3 : mood disorders, F4 : neurotic disorders and others) ( $\chi^2 = 0.784$ ,  $df = 3$ ,  $p = 0.85$ ).

### Measures

The main assessment measure of our study was the function subscale of the Global Assessment of Functioning (GAF-F), through which as described below, we assessed social functioning in patients with mental disorders before and after the earthquake to evaluate changes of social functioning due to the disaster.

We determined the patients' background information including age, gender, education, occupation, marital status and duration of illness at the point of time when they visited the outpatient unit during the period of the survey (i.e., between April 11 and July 11 2011) based on chart review.

### GAF-F

The GAF is a 100-point scale assessed by clinicians for evaluating psychological, social, and occupational functioning and constitutes axis V of DSM-IV-TR<sup>13</sup>. The most severe dysfunction on any of the three dimensions (psychological, social, and occupational) constitutes the appropriate overall score. Higher scores on the GAF indicate better psychosocial functioning.

There have been strong criticisms of the GAF concerning the use of one single scale to evaluate both psychological symptoms and socio-occupational functioning<sup>16-18</sup>, in so far as the GAF reflects mainly psychological domain severity and therefore, is highly correlated with the condition of mental disorders rather than social function<sup>18-21</sup>. Thus, the split version of the GAF has been proposed in a way that the GAF scale was divided into one symptom (GAF-S) and one function score (GAF-F)<sup>22</sup>. The reliability and validity of the 2 GAF dimensions have been confirmed<sup>17, 21, 23, 24</sup>.

Given this account, GAF-F was used in the present study. Pre-disaster GAF-F scores, which reflect social functioning at the point of patients' latest visits before the earthquake, were assessed by chart review and information from the treating psychiatrists of the patients. On the other hand, post-disaster GAF-F scores, which reflect social functioning at the point of patients' visits during the period of the survey (i.e., between April 11 and July 11 2011), were assessed in the same way as pre-disaster GAF-F.

GAF assessments were carried out by well-trained psychiatrists (the first and second authors). We evaluated GAF-F scores as discrete values from 1 to 100, such as 1, 9, 10, ..., 91, 99, 100 based on the algorithms of DSM-IV-TR. The intraclass correlation coefficient (ICC) of their evaluation was as high as 0.928.

### Statistical analyses

Chi square tests were performed to compare categorical variables, and an analysis of variance (ANOVA) was performed to compare continuous variables. Differences of decline of the GAF-F score among patients with different mental disorders were examined using an analysis of covariance (ANCOVA) adjusted for covariate (potential confounding variables), i.e., age, gender, education, marital status, duration of illness, pre-disaster GAF-F score, and economic losses due to the earthquake/nuclear disaster. We performed binary and multivariate logistic regression analyses to identify factors associated with GAF-F scores declined by 1 or greater after the disaster.

All statistical analyses were performed using IBM SPSS Statistics version 20.0 (IBM, Armonk, NY, USA). Significance was accepted at  $p$ -values < 0.05. When significant differences were identified, post hoc pair-wise comparisons were conducted with Bonferroni correction.

## Results

### Characteristics of the Patients

Seven hundred and one patients with mental disorders were enrolled. The breakdown of primary diagnostic categories shortly before the disaster based on ICD-10 within the study sample was as follows : F0 : organic, including symptomatic, mental disorders (n = 38) ; F1 : mental and behavioral disorders due to psychoactive substance use (n = 2) ; F2 : schizophrenic disorders (n

= 163) ; F3 : mood disorders (n = 299) ; F4 : neurotic disorders (n = 150). Among patients with neurotic disorders, no patient was diagnosed with acute stress reaction and PTSD ; F5 : behavioral syndromes associated with physiological disturbances and physical factors (n = 9) ; F6 : disorders of adult personality and behavior (n = 15) ; F7 : mental retardation (n = 15) ; F8 : disorders of psychological development (n = 6) ; and F9 : behavioral and emotional disorders with onset usually occurring in childhood and adolescence (n = 4). Given the findings that the sum of the patients with schizophrenic disorders (F2), mood disorders (F3) and neurotic disorders (F4) constituted the majority of the study sample, that is 87.3%, statistical analyses were applied to the data from these three diagnostic groups.

The characteristics of the patients in the total of the three diagnostic groups (F2, F3, and F4) are shown in Table 1. The mean age (standard deviation, or SD) was 49.2 (15.6) yrs. The proportion of female patients was 57.5%. The proportions of patients who reported economic losses due to the earthquake and the nuclear disaster were 22.5% and 34.0%, respectively.

**Table 1. Characteristics of patients with schizophrenic disorders, mood disorders or neurotic disorders (n = 612)**

Items	Mean (SD) or Number (%)
Diagnosis based on ICD-10	
F2 : Schizophrenic disorders, Number (%)	163 (26.6%)
F3 : Mood disorders, Number (%)	299 (48.9%)
F4 : Neurotic disorders, Number (%)	150 (24.5%)
Age, years (SD)	49.2 (15.6)
Gender	
Male, Number (%)	260 (42.5%)
Female, Number (%)	352 (57.5%)
Academic background	
Less than junior high graduate, Number (%)	96 (15.7%)
High school graduate, Number (%)	279 (48.5%)
Junior college graduate, Number (%)	106 (17.3%)
More than college graduate, Number (%)	131 (21.4%)
Marital status	
No partner, Number (%)	289 (47.2%)
With partner, Number (%)	323 (52.8%)
Duration of illness, year (SD)	9.8 (8.0)
Period between 3.11 and the survey, day (SD)	45.4 (13.9)
Economic loss due to the earthquake	
None, Number (%)	472 (77.5%)
Loss, Number (%)	137 (22.5%)
Economic loss due to the nuclear disaster	
None, Number (%)	404 (66.0%)
Loss, Number (%)	208 (34.0%)
IES-R, score (SD)	18.6 (16.7)
Fear during the earthquake, score (SD)	2.6 (1.2)
Anxiety about aftershocks, score (SD)	2.3 (1.2)
Fear of the radiation exposure, score (SD)	2.2 (1.3)

Values are expressed as the mean (SD) or the Number (%).

ICD-10 : International Classification of Diseases – Tenth Revision. GAF-F : Function subscale of Global Assessment of Functioning scale. IES-R : Impact of Event Scale-Revised.

**Table 2. Comparison of Patient Characteristics by Diagnostic Group**

	F2	F3	F4	<i>p</i> -value
Number	163	299	150	
Age, years (SD)	44.5 (13.8)	52.8 (15.7)	47.2 (15.7)	<0.001
Gender				0.29
Male, Number (%)	69 (42.3%)	135 (45.2%)	56 (37.3%)	
Female, Number (%)	94 (57.7%)	164 (54.8%)	94 (62.7%)	
Academic background				0.003
Less than junior high graduate, Number (%)	23 (14.1%)	51 (17.1%)	22 (14.7%)	
High school graduate, Number (%)	77 (47.2%)	119 (39.8%)	83 (55.3%)	
Junior college graduate, Number (%)	35 (21.5%)	46 (15.4%)	25 (16.7%)	
More than college graduate, Number (%)	28 (17.2%)	83 (27.8%)	20 (13.3%)	
Marital status				<0.001
No partner, Number (%)	115 (76.7%)	105 (35.1%)	69 (46.0%)	
With partner, Number (%)	48 (29.4%)	194 (64.9%)	81 (54.0%)	
Duration of illness, year (SD)	14.0 (9.5)	8.4 (6.8)	8.2 (6.7)	<0.001
Period between 3.11 and the survey, day (SD)	46.8 (15.5)	44.4 (13.3)	45.7 (13.4)	0.20
Economic loss due to the earthquake				0.73
None, Number (%)	127 (77.9%)	227 (75.9%)	118 (78.7%)	
Loss, Number (%)	35 (21.5%)	71 (23.7%)	31 (20.7%)	
Economic loss due to the nuclear disaster				0.58
None, Number (%)	103 (63.2%)	203 (67.9%)	98 (65.3%)	
Loss, Number (%)	60 (36.8%)	96 (32.1%)	52 (34.7%)	

Values are expressed as the mean (SD) or the number (%). *P*-values by ANOVA or Chi square tests.

F2 : Schizophrenic disorders, F3 : Mood disorders, F4 : Neurotic disorders in ICD-10.

**Table 3. The frequency of the declined GAF-F scores after the disaster**

	1 to 10		11 to 20		21 or greater		1 or greater	
	Number	%	Number	%	Number	%	Number	%
Total	42	6.9	23	3.8	37	6.0	102	16.7
F2	10	6.1	1	0.6	0	0.0	11	6.7
F3	20	6.7	12	4.0	26	8.7	58	19.4
F4	12	8.0	10	6.7	11	7.2	33	22.0

F2 : Schizophrenic disorders, F3 : Mood disorders, F4 : Neurotic disorders in ICD-10. GAF-F : Function subscale of Global Assessment of Functioning scale.

**Table 4. Pre-disaster GAF-F, post-disaster GAF-F and post-disaster decline of GAF-F scores in subjects who showed declined GAF-F after the disaster**

	Total (n = 102)		F2 (n = 11)		F3 (n = 58)		F4 (n = 33)		<i>p</i> value
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Pre-disaster GAF-F	65.2	61.9-68.6	54.2	42.6-65.7	66.9	62.2-71.6	66.0	61.0-71.6	0.07
Post-disaster GAF-F	42.5	39.7-45.3	44.3	33.8-54.7	41.5	38.2-44.8	43.7	37.9-49.4	0.7
Decline of GAF-F	22.2	19.4-24.9	9.9	7.9-11.9	24.4	20.6-28.1	22.3	17.4-27.2	0.006
Adjusted decline of GAF-F*	19.4	16.5-22.4	12.4	4.7-20.0	24.3	21.2-27.4	21.6	17.5-25.8	0.02

*P*-values by ANOVA or ANCOVA. \* : Scores estimated by adjusting for potential confounding variables, i.e., age, gender, academic background, marital status, duration of illness, pre-disaster GAF-F, economic losses due to the earthquake and the nuclear disaster on ANCOVA.

F2 : Schizophrenic disorders, F3 : Mood disorders, F4 : Neurotic disorders in ICD-10. GAF-F : Function subscale of Global Assessment of Functioning scale.

**Comparison of Patient Characteristics by Diagnostic Group**

Comparison of the demographic and clinical variables of the patients by diagnostic groups is shown in Table 2. The mean age of the patients with mood disorders (F3) was significantly older than those of the other two groups

(one way ANOVA and Bonferroni,  $F(2, 609) = 17.638$ ,  $p < 0.001$ ; F2-F3 :  $p < 0.001$ , F2-F4 :  $p = 0.324$ , F3-F4 :  $p = 0.001$ ). The gender breakdown among the three groups did not show a significant difference ( $\chi^2 = 2.500$ ,  $df = 2$ ,  $p = 0.29$ ), whereas education ( $\chi^2 = 20.008$ ,  $df = 6$ ,  $p = 0.003$ )

**Table 5. Factors associated with GAF-F scores declined by 1 or greater after the disaster**

Factors	Crude OR	95% CI	Adjusted OR	95% CI
F3	1.47	0.96-2.26	4.28***	2.03-9.02
F4	1.61*	1.01-2.55	4.56***	2.09-9.95
Age	0.99	0.97-1.001	0.99	0.98-1.01
Gender	1.51	0.97-2.36	1.59	0.99-2.56
Academic background	0.97	0.79-1.21	1.00	0.79-1.28
Marital status	0.84	0.55-1.28	0.73	0.44-1.23
Duration of illness	0.95**	0.92-0.98	0.97	0.94-1.01
Pre-disaster GAF-F	0.99*	0.98-0.9998	0.98*	0.97-0.996
Economic losses due to the earthquake	1.30*	0.80-2.12	1.45	0.86-2.44
Economic losses due to the nuclear disaster	1.45	0.94-2.24	1.45	0.91-2.29

Crude ORs (Odds ratios) were obtained by binary logistic regression analyses. The ORs were adjusted for other factors presented in the table by the multivariate logistic regression analysis to obtain Adjusted ORs.

\* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$

F2 : Schizophrenic disorders, F3 : Mood disorders, F4 : Neurotic disorders in ICD-10. GAF-F: Function subscale of Global Assessment of Functioning scale.

**Table 6. Pre-disaster GAF-F, post-disaster GAF-F and post-disaster decline of GAF-F scores in all the subjects**

	Total (n = 612)		F2 (n = 163)		F3 (n = 299)		F4 (n = 150)		p value
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Pre-disaster GAF-F	68.4	67.0-69.8	60.1	57.5-62.7	71.8	69.9-73.7	70.8	68.0-73.5	<0.001
Post-disaster GAF-F	64.6	63.1-66.2	59.4	56.4-62.4	66.9	64.6-69.1	65.9	62.7-69.0	<0.001
Decline of GAF-F	3.7	2.9 - 4.5	0.7	-0.9 - 2.2	4.7	3.6 - 5.9	4.9	3.3 - 6.5	<0.001
Adjusted decline of GAF-F*	3.4	2.5 - 4.2	0.4	-1.3 - 2.1	5.0	3.9 - 6.2	4.6	3.0 - 6.3	<0.001

P-values by ANOVA or ANCOVA. \*: Scores estimated by adjusting for potential confounding variables, i.e., age, gender, academic background, marital status, duration of illness, pre-disaster GAF-F, economic losses due to the earthquake and the nuclear disaster on ANCOVA.

F2 : Schizophrenic disorders, F3 : Mood disorders, F4 : Neurotic disorders in ICD-10. GAF-F : Function subscale of Global Assessment of Functioning scale.

and marital status ( $\chi^2 = 53.267$ ,  $df = 2$ ,  $p < 0.001$ ) showed significant differences by Chi-square tests. The duration of illness of the schizophrenic patients (F2) was significantly longer than that of the other groups (one way ANOVA and Bonferroni,  $F(2, 609) = 33.930$ ,  $p < 0.001$ ; F2-F3 :  $p < 0.001$ , F2-F4 :  $p < 0.001$ , F3-F4 :  $p = 1.000$ ). The mean interval from March 11, 2011 to the date of data acquisition for each patient was not significantly different among the three groups (one way ANOVA,  $F(2, 609) = 1.620$ ,  $p = 0.119$ ). The economic losses due to the earthquake ( $\chi^2 = 0.620$ ,  $df = 2$ ,  $p = 0.733$ ) or the nuclear disaster ( $\chi^2 = 1.081$ ,  $df = 2$ ,  $p = 0.583$ ) were also not significantly different among the three groups.

**Functional impairment**

No patient showed improvement of the GAF-F scores after the disaster. Seventeen percent of the total of the three diagnostic groups (n = 612) showed a decline of the GAF-F scores. Regarding the differences among the three diagnostic groups, 22% of patients with neurotic disorders (F4) (n = 150), 19% of patients with mood disorders (F3) (n = 299), and 7% of patients with schizophrenic disorders (F2) (n = 163) showed a decline of GAF-F scores after the disaster respectively, as shown in Table 3. The

frequency of the declined GAF-F after the disaster among the three diagnostic groups showed significant differences by Chi-square test ( $\chi^2 = 16.223$ ,  $df = 2$ ,  $p < 0.001$ ). Post hoc analyses revealed that the group of patients with neurotic disorders (F4) and mood disorders (F3) had a significantly higher frequency of a declined GAF-F compared to the schizophrenic patients (F2) (Fisher's exact tests,  $p < 0.001$  [both F4-F2 and F3-F2] ; a p-value of less than 0.016 was considered significant, according to the Bonferroni correction).

Mean decline of the GAF-F scores of the patients who showed a decline of GAF-F scores (n = 102) after the disaster was 22.2 (Table 4). The decline of the GAF-F score of patients with neurotic disorders (F4) and mood disorders (F3) was significantly greater than that of patients with schizophrenic disorders (F2) ( $F(2, 99) = 5.383$ ,  $p = 0.006$ ,  $\eta_p^2 = 0.098$ ). After adjustment for potential confounding factors, i. e., age, gender, academic background, marital status, duration of illness, pre-disaster GAF-F, economic losses due to the earthquake and the nuclear disaster by ANCOVA, the difference remained significant ( $F = 3.938$ ,  $df = 2$ ,  $p = 0.02$ ,  $\eta_p^2 = 0.080$ ). There was no significant

difference between neurotic disorders (F4) and mood disorders (F3) based on ANOVA ( $p = 1.00$ ) and ANCOVA ( $p = 0.97$ ).

Findings from the multivariate logistic regression analysis for GAF-F scores declined by 1 or greater after the disaster confirmed the results described above (Table 5). Patients with mood disorders (F3) were more than 4 times as likely to decline their GAF-F scores after the disaster than those with schizophrenic disorders (F2) (odds ratio [OR] = 4.28, 95% confidence interval [CI] = 2.03-9.02). Similarly, patients with neurotic disorders (F4) were more than 4 times as likely to decline their GAF-F scores after the disaster than those with schizophrenic disorders (F2) (OR = 4.56, 95% CI = 2.09-9.95). Lower pre-disaster GAF-F scores slightly increased the odds of the post-disaster decline of GAF-F scores (OR = 0.98, 95% CI = 0.97-0.9996). Duration of illness and economic losses due to the earthquake did not significantly affect the likelihood of the post-disaster decline of GAF-F scores, when other factors were taken into account.

Mean decline of the GAF-F scores of all the subjects ( $n = 612$ ) after the disaster was presented in Table 6. The decline of the GAF-F score of patients with neurotic disorders (F4) and mood disorders (F3) was significantly greater than that of patients with schizophrenic disorders (F2) ( $F(2,609) = 10.419, p < 0.001, \eta_p^2 = 0.081$ ). After adjustment for potential confounding factors, i.e., age, gender, academic background, marital status, duration of illness, pre-disaster GAF-F, economic losses due to the earthquake and the nuclear disaster by ANCOVA, the difference remained significant ( $F = 9.530, df = 2, p < 0.001, \eta_p^2 = 0.031$ ). There was no significant difference between neurotic disorders (F4) and mood disorders (F3) based on ANOVA ( $p = 1.00$ ) and ANCOVA ( $p = 1.00$ ).

## Discussion

### *Findings in the peripheral area of the 2011 Great East Japan Earthquake zone*

It is important to note that 17% of the outpatients with mental disorders showed clinically significant functional deterioration, i.e., a mean decline of 22 on the GAF-F scores in the peripheral area of the earthquake zone.

Although several studies examining the psychiatric impact on individuals in the aftermath of the 2011 Great East Japan Earthquake, subjects of these studies were recruited from the general population that was living in the most severely affected area (i.e., Fukushima, Miyagi, Iwate Prefecture) or from the volunteers deployed to these area immediately after the disaster<sup>25-29</sup>. To the best of our knowledge, this study is the first report examining the psychiatric sequel to the disaster among the psychiatric population in the area just lying adjacent to the most severely affected zone. Further, this is also the first study evaluating differences in

functional impairment after a disaster among patients with different mental disorders.

### *Difference of functional decline in different diagnostic groups*

In the present study, patients with mood disorders (F3) and neurotic disorders (F4) showed a significantly higher frequency of a declined post-disaster GAF-F than those with schizophrenic disorders (F2). The post-disaster decline of GAF-F scores of patients with mood disorders (F3) and neurotic disorders (F4) were also greater than that of patients with schizophrenic disorders (F2), even after adjustment for the potential confounding factors, as described above. Moreover, the multivariate logistic regression analysis revealed that patients with mood disorders (F3) (OR = 4.28, 95% CI = 2.03-9.02) and those with neurotic disorders (F4) (OR = 4.56, 95% CI = 2.09-9.95) were more than 4 times as likely to decline their GAF-F scores after the disaster than those with schizophrenic disorders (F2). These results indicate that patients with mood disorders and neurotic disorders were significantly more vulnerable to the disaster than those with schizophrenic disorders.

This finding might reflect the clinical realities as follows : patients with mood disorders are more likely to show overwhelming empathy for the victims facing the disaster by way of identifying themselves with the victims. On the other hand, patients with neurotic disorders are predisposed to fear and anxiety concerning the disaster in such a way that any anticipatory anxiety persists. Possible explanations for the increased sensitivity to the disaster in the patients with mood disorders or neurotic disorders are that such patients exhibit these patterns of reaction, i.e., overwhelming empathy for the victims or anticipatory anxiety, resulting in a greater functional decline as opposed to patients with schizophrenic disorders. Concerning the finding of less functional decline among patients with schizophrenic disorders, such common negative symptoms of these disorders as a blunted affect and emotional withdrawal would be factors contributing to a decreased sensitivity to the disaster<sup>30, 31</sup>.

In this study, it is found that no patient was diagnosed with acute stress reaction as well as PTSD. The possible reasons for this result are considered as follows : first of all, this study was conducted in the peripheral area of the 2011 Great East Japan Earthquake and no participant experienced the death of a family member. Secondly, this study was conducted 1 to 4 months after the earthquake. Indeed, concerning PTSD, it is amply conceivable that patients with PTSD would emerge after the interview period.

### *Contribution to cohort study*

We would like to mention briefly the positive implication of our result for cohort study. It was reported that in 29 countries in Europe, the 12-month frequency of mental

disorders was over 38% of the general population<sup>32</sup>. According to this report, the most prevalent 12-month disorders were neurotic disorders (26.5%). Mood disorders were the second most frequent group of disorders (7.8%). In the U.S., the 12-month frequency of mental disorders was estimated at approximately 26%<sup>33</sup>. Anxiety disorders were the most prevalent class (18.1%), followed by mood disorders (9.5%). Given that the investigation in the U.S. did not include dementia, schizophrenia and developmental disorders, the frequency of mental disorders would be much higher than was reported. Although there has been no such investigation in Japan, it might be expected that frequency similar to that reported in Europe and the U.S. would be obtained. It is possible to say that outpatients with mental disorders, who constitute the great majority of patients with mental disorders, account for an important percentage of the general population. Moreover, among the general population, it could be postulated that there are many people whose personalities have an affinity with mood disorders as well as neurotic disorders and schizophrenic disorders. In this regard, the results of the present study based on our outpatients are considered to have a more or less important role to contribute to the cohort study of disaster psychiatry.

#### Limitations

The present results should be interpreted carefully in the context of the following limitations. First, a selection bias of the sampling may have been inevitable, since the study was conducted at one facility. Second, there is a possibility that the nature of mood disorders have a characteristic to exacerbate spontaneously<sup>34, 35</sup>. Third, we examined the psychiatric impacts of the 2011 complex disaster without separately taking into account the aspects of the earthquake and the nuclear disaster. Fourth, the present results are not indicative of the long-term effects of the disasters : in so far as the data were obtained 1 to 4 months after the earthquake. These limitations lead to further studies to test and expand on the present study's findings.

#### Conclusion

Seventeen percent of the outpatients with mental disorders located at the periphery of the 2011 Great East Japan Earthquake zone showed a clinically significant post-disaster functional decline. Patients with mood disorders and neurotic disorders were revealed to be more vulnerable to the disaster compared to patients with schizophrenic disorders. Our findings indicate the importance of the close monitoring of the psychiatric conditions of individuals with mental disorders after a major disaster, particularly mood disorders and neurotic disorders.

#### Declaration of interest

All authors declare no competing interest.

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# 精神障害をもつ外来患者における東日本大震災後の社会機能障害

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## 要 約

**背景：**一般に精神疾患罹患者は経過中に社会機能障害を来し災害に脆弱である。しかし精神疾患罹患者を対象に災害後の社会機能の変化を調べた研究はない。本研究の目的は、辺縁被災地である栃木県に居住する精神疾患罹患者において東日本大震災後の社会機能の変化を評価することである。

**方法：**統合失調症性障害患者163名，気分障害患者299名，神経症性障害患者150名の計612名の患者における東日本大震災前後のGAF-F（Global Assessment of Functioningの社会的・職業的機能に関するサブスケール）を評価した。

**結果：**全精神疾患罹患者の17%，疾患別では神経症性障害患者の22%，気分障害患者の19%，統合失調症性障害患者の7%において震災前のGAF-Fに比べ震災後のGAF-Fが低下していた。GAF-Fの低下量は神経症性障害患者および気分障害患者において統合失調症性障害患者よりも有意に大きかった。

**結語：**精神疾患罹患者，特に気分障害および神経症性障害患者の災害後の社会機能障害に注意が必要である。

（キーワード：東日本大震災，社会機能障害，気分障害，神経症性障害，統合失調症）