


Adherence to outpatient care among individuals with pre-existing psychiatric disorders following the 2024 Noto Peninsula Earthquake: A retrospective study

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None

Abstract

Aim: The study aim was to investigate the effect of the 2024 Noto Peninsula earthquake on regular psychiatric outpatient check-ups at Kanazawa Medical University Hospital, Japan.

Methods: We retrospectively collected electronic medical records from January 4 to January 17, 2024, and analyzed data from 656 patients. χ^2 was used to analyze the association between adherence to scheduled visits and related factors, and the association between inability to attend scheduled visits and self-reported earthquake-related reasons among 84 nonadherent patients. A geographical information system was used to analyze geographic characteristics, such as municipality of residence and seismic intensity distribution.

Results: Of the 656 patients, 572 (87.2%) adhered to their scheduled visits. The failure to keep appointments was significantly associated with residence in areas with a seismic intensity of ≥ 6 ($n = 21$, 35.6%; $p < 0.001$). Among the 84 patients who failed to keep appointments, the inability to keep appointments owing to earthquake-related reasons was significantly associated with residence in areas with a seismic intensity of ≥ 6 ($n = 16$, 76.2%; $p < 0.001$) and presence of an F3 main disease code: Mood (affective) according to the *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision ($n = 12$, 60.0%; $p = 0.034$).

Conclusion: Patients in areas with higher seismic intensity were more likely to miss appointments, probably because of factors such as infrastructure damage and personal losses. Among patients who missed appointments, those with F3 diagnoses were more likely to cite earthquake-related reasons. However, the high overall appointment adherence rate despite the effects of a major earthquake warrants further study.

Yuri Nakai was affiliated with affiliation 3 at the time of writing.

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KEYWORDS

appointment adherence, Japan, mood/affective disorders, 2024 Noto Peninsula earthquake, psychiatric disorder

INTRODUCTION

On January 1, 2024, a magnitude 7.6 earthquake struck the Noto Peninsula in Japan, triggering large-scale crustal deformation and a tsunami and causing substantial damage to the region.¹ The tsunami spread along the coastlines of Ishikawa, Toyama, and Niigata prefectures, which face the Sea of Japan, causing extensive damage to coastal communities and infrastructure.² As of July 1, 2024, the earthquake had resulted in 333 fatalities, including disaster-related deaths, and three missing persons. Currently, 191 evacuation centers remain open, and 2086 people in Ishikawa Prefecture are still displaced.³

Kanazawa Medical University Hospital (KMUH) is located in Uchinada at the entrance to the Noto Peninsula. It is the university hospital closest to the earthquake site, and its psychiatric department provides mental healthcare to the Noto region. In addition to providing in-hospital medical care, KMUH is actively engaged in community medical care, such as promoting mental health among the region's older residents, disseminating information about dementia and providing dementia care, and encouraging volunteers.⁴ The effects of the earthquake in the areas near KMUH included collapsed buildings, water shortages, power outages, and liquefaction.³ However, the damage to KMUH itself was minor; therefore, immediately after the disaster, the hospital provided its usual outpatient clinic services as well as providing disaster-related medical care.^{5,6}

Previous studies on patients with psychiatric disorders (PPDs) during disasters have generally shown that disaster exposure increases the prevalence of mental disorders and exacerbates symptoms in people with pre-existing mental disorders.⁷⁻⁹ According to Keya et al., who conducted a systematic review and meta-analysis of mental disorders brought on by major disasters, the main mental disorders that can be attributed to such disasters are general anxiety disorder, depression, substance use, adjustment disorder, and post-traumatic stress disorder. They found that the presence of psychiatric disorders, combined with post-disaster displacement and disruption of essential services, worsen mental health and increase mortality rates.¹⁰ For individuals with pre-existing mental health conditions who are receiving home care, major earthquakes and extreme weather events related to climate change pose substantial threats. The decline in regional infrastructure caused by disasters and substance use disorder comorbidity increase the risks for people with mental illnesses.¹¹ Individuals with pre-existing mental health conditions are more likely to be inadequately prepared for disasters.¹² In the aftermath of Hurricane Katrina in 2005, mental healthcare was disrupted and there was a failure to initiate treatment for people with new onset of mental health disorders.¹³ Furthermore, individuals who rely on the health system for medical monitoring and ongoing interventions are at risk in the event of infrastructure damage or

delays in pharmaceutical supply chains.¹¹ A large proportion of frequent emergency department visitors have psychiatric disorders, highlighting the need to strengthen mental health measures during normal times.^{14,15}

Several studies have reported that earthquakes have a substantial effect on the mental health of the general population.¹⁶⁻¹⁹ However, there is a relative dearth of research investigating the effects of earthquakes on individuals with pre-existing mental health conditions.^{20,21} For instance, the 2009 L'Aquila earthquake in Italy had detrimental effects on cognitive function and positive symptoms in patients with first-episode psychosis, but not in those with chronic schizophrenia.²² Furthermore, among mental health patients who experienced both the 2009 L'Aquila earthquake and the 2016 Central Italy earthquake, those with anxiety disorders were reported to be more sensitive to trauma.²³ In 2020, a magnitude 5.6 earthquake in Croatia caused extensive damage during the COVID-19 pandemic. A study examining the concurrent effects of these biological and seismic disasters found that individuals with depression or anxiety disorders, as well as those with no mental health problems, reported a greater fear of earthquakes than of the pandemic. However, no such difference was observed among individuals with schizophrenia spectrum disorders.²⁴

A 2023 study conducted in Ecuador identified a strong correlation between earthquake intensity and mental health outcomes among individuals with pre-existing mental health disorders. However, short-term assessments of the effects of the earthquake indicated that it did not necessarily exacerbate mental health conditions, with reports of reduced hospitalization rates and an initial reduction in suicide rates.²⁰ Studies on the coping responses of individuals with schizophrenia during and after a disaster have shown substantial variability in the types of stressful events experienced, as well as in individuals' coping abilities and strategies.²⁵ These findings suggest that the effect of earthquakes on individuals with mental illness can be multifaceted and highly variable.

However, there are no reports on the outpatient visit behaviors of psychiatric patients receiving home care immediately after a major disaster. Considering that continuous medical monitoring and medication are essential for psychiatric patients receiving home care, and that the interruption of these can affect the outcome of psychiatric disorders, it is extremely important to examine the effect of major disasters on psychiatric outpatient visits.

The aim of this study was to clarify the effect of the 2024 Noto Peninsula earthquake (NPE) on outpatient visit adherence among PPDs who require regular visits to KMUH. The analysis of PPD outpatient visit behaviors immediately after a major earthquake could contribute to a deeper understanding of the needs and barriers faced by PPDs in Ishikawa in the immediate aftermath of a major earthquake. The findings could help to strengthen future disaster response and preparedness and contribute to the construction of a more flexible healthcare system.

METHODS

Setting and participants

KMUH is located in Ishikawa Prefecture, which had a population of 1,101,105 as of April 1, 2024²⁶ (Figure 1).

The study participants were PPDs who were receiving treatment at KMUH. The local government district in which KMUH is located was subject to liquefaction, building collapses, power outages, and water shortages following the earthquake.²⁷ However, KMUH remained structurally sound and was not affected by water or power outages. As a result, it was able to quickly resume medical operations as the closest university hospital to the epicenter.²⁸ In Japan, January 1–3 are national holidays, so outpatient treatment began on January 4. Outpatient visit adherence data for PPDs who had scheduled appointments from January 4 to January 17, 2024, were retrospectively collected from electronic medical records. January 8 (“Coming of Age Day”) was a national holiday in Japan. On regular weekdays, the KMUH outpatient clinic hours are 8:30 a.m. to 4:00 p.m.; on Saturdays, they are 8:30 a.m. to 12:00 p.m.

Survey content

Data for this study were collected from the electronic medical records of PPDs on the following variables: sex, age, main disease (categorized according to the *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision [ICD-10] codes), area of residence, scheduled appointment date, and whether or not the scheduled appointment was kept. Reasons for missed appointments, as self-reported by PPDs and documented in the electronic medical records, were also collected.

Analytical methods

Descriptive statistics were calculated for age, including mean, standard deviation, and frequency distribution by age group. The numbers and percentages of male and female participants were calculated. The primary diagnosis was categorized according to ICD-10 codes, and the frequency distribution of each diagnosis was calculated. The daily number of scheduled appointments was counted, and the proportion of appointments kept was calculated.



FIGURE 1 Location of Kanazawa Medical University Hospital.

TABLE 1 Characteristics of research participants ($n = 656$).

Variable	Category	<i>n</i>	%	
Sex	Male	266	40.5	
	Female	390	59.5	
Age, years, mean (standard deviation)	47.1 (19.9)			
Age group	<10 years	2	0.3	
	10s (10–19)	68	10.4	
	20s (20–29)	84	12.8	
	30s (30–39)	83	12.7	
	40s (40–49)	118	18.0	
	50s (50–59)	130	19.8	
	60s (60–69)	58	8.8	
	70s (70–79)	73	11.1	
	80s (80–89)	36	5.5	
	90s (90–99)	4	0.6	
Main disease (ICD-10 code)	F0–F9	635	96.8	
	F0	Organic, including symptomatic, mental disorders	25	3.8
	F1	Mental and behavioral disorders due to psychoactive substance use	6	0.9
	F2	Schizophrenia, schizotypal and delusional disorders	111	16.9
	F3	Mood (affective) disorders	202	30.8
	F4	Neurotic, stress-related and somatoform disorders	204	31.1
	F5	Behavioral syndromes associated with physiological disturbances and physical factors	25	3.8
	F6	Disorders of adult personality and behavior	7	1.1
	F7	Mental retardation	7	1.1
	F8	Disorders of psychological development	20	3.0
	F9	Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	28	4.3
		F code other than F0–F9	21	3.2
		G40	Epilepsy	10
	R46	School refusal	7	1.1
	Others	E0, E5, Z0	3	0.6

Abbreviation: ICD-10, *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision.

To evaluate appointment adherence, the number and percentage of patients who kept their appointments and those who missed their appointments were calculated. Reasons for missed appointments were categorized as earthquake-related, personal reasons, and unknown, and the frequency and percentage of each category were calculated.

To examine the associations between appointment adherence (No/Yes), reasons for missed appointments (earthquake-related vs. other reasons), and other variables, we conducted analyses by basic attributes (age, sex, main diseases), appointment date, and seismic intensity. Age was categorized into two groups: <65 years and

≥65 years. Appointment dates were categorized into two periods: January 4–10 (early period) and January 11–17 (late period). Main diseases were categorized according to their frequency distribution: neurotic disorders, stress-related disorders, and somatoform disorders (F4) versus other F codes, and mood [affective] disorders (F3) versus other F codes. Seismic intensity was categorized as ≥6 (severe damage) and <6. χ^2 tests were used to examine the associations between variables. All data analysis was performed using SPSS Ver. 29 (IBM Corporation).

The geographic distribution of PPDs' residential location was visualized using a geographic information system. To ensure

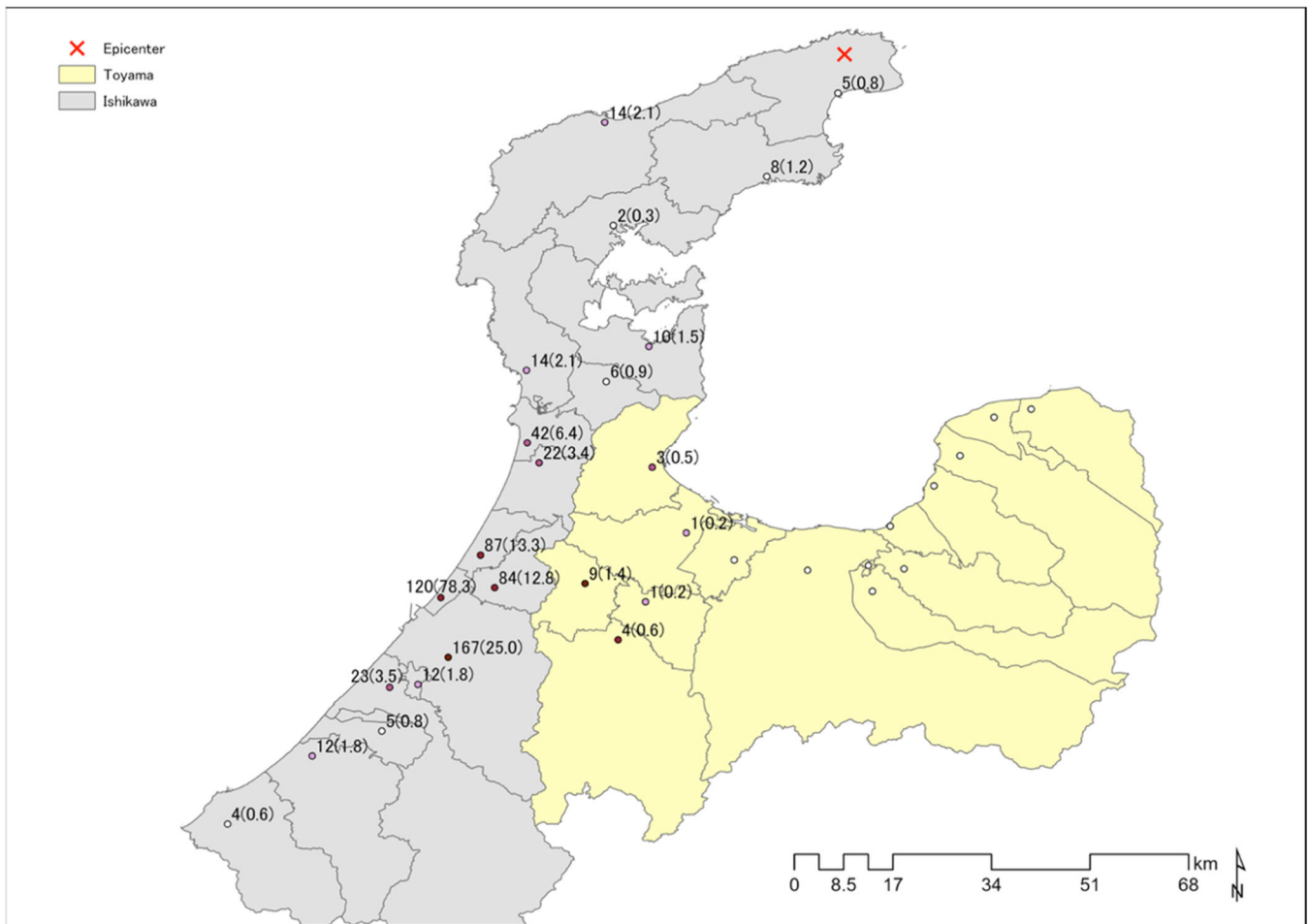


FIGURE 2 Spatial distribution of residents with psychiatric disorders by municipality ($n = 656$; n [%]). To protect participant privacy, the residential locations of patients with psychiatric disorders (PPDs) are aggregated and plotted at the level of local government districts.

participant privacy, the real residential locations were replaced with the locations of the respective local government offices.

The geographic distribution was visualized using open data and the following procedure. The administrative boundaries and locations of local government offices in Ishikawa and Toyama Prefectures were obtained from the Japanese Ministry of Land, Infrastructure, Transport and Tourism.^{29,30} Seismic intensity data at the time of the NPE were obtained from the Japan Meteorological Agency seismic intensity database, and local governments with a seismic intensity of ≥ 6 were identified.³¹ ArcGIS Pro 3.2.1 (ESRI) was used for the geographic information system analysis.

Ethical considerations

This study was conducted following the Declaration of Helsinki (1995, as revised in Seoul 2008) and carried out with the consent of the university medical research ethics review committees at the authors' universities (No. C080). Participants provided informed consent using an opt-out procedure. Informed consent documents were posted on the KMUH website and in the hospital treatment

rooms and waiting areas. The documents informed participants about the purpose and importance of the study, the research methods, the voluntary nature of participation, and the anonymity and confidentiality of their responses. The Research Ethics Committee of the College of Nursing of the co-author's university approved this study (approval number No. kan-rin, 24-4), which aimed to investigate the impact of the 2024 Noto Peninsula earthquake on regular psychiatric outpatient check-ups at Kanazawa Medical University Hospital.

RESULTS

Characteristics of PPDs

A total of 656 PPDs had scheduled appointments during the study period, of whom 266 (40.5%) were men and 390 (59.5%) were women. The mean age (standard deviation) was 47.1 years (19.9 years). The most common age group was 50s (130, 19.8%), followed by 40s (118, 18.0%), and 20s (84, 12.8%). The most common main disease (ICD-10) code was F4 (204, 31.1%), followed by F3 (202, 30.8%) and schizophrenia,

schizotypal and delusional disorders: F2 (111, 16.9%). Detailed data on participant characteristics are shown in Table 1.

Appointment adherence

Of the PPDs, 572 (87.2%) kept their scheduled appointments and 84 (12.8%) missed their appointments. The spatial distribution of PPDs in the Ishikawa and Toyama districts is shown in Figure 2. Each point represents the location of the municipalities where PPDs resided during the 2024 NPE. The map displays the number of PPDs and their respective percentages in parentheses.

Characteristics of PPDs who did not keep their scheduled appointments

Of the 84 PPDs who did not keep their scheduled appointments during the study period, 36 (42.9%) were men and 48 (57.1%) were women. The mean age (standard deviation) was 46.9 (22.7) years. A total of 12 patients (14.3%) were in their 40s, 12 (14.3%) were in their 50s, and 11 (13.1%) were in their 70s. The most common main disease ICD-10 codes were F4 (30, 35.7%), F3 (20, 23.8%), and F9 (12, 14.3%). Details are shown in Table 2.

Regarding the reasons for missed appointments, 32 patients (38.1%) reported earthquake-related reasons, 10 (11.9%) reported personal reasons, and for 42 patients (50.0%), the reasons were unknown because of the missing data. A total of 21 patients (25.0%) resided in areas with a seismic intensity of ≥ 6 , including nine (10.7%) in Wajima and six (7.1%) in Noto. The spatial distribution of the municipalities where PPDs who missed their appointments resided and the distribution of local government districts with a seismic intensity of ≥ 6 are shown in Figure 3. This figure represents the spatial overlap between municipalities that experienced a seismic intensity of ≥ 6 in the 2024 NPE and those where PPDs canceled their outpatient appointments.

Characteristics of PPDs by whether they kept their scheduled appointments and reasons for missed appointments

Table 3 presents the results of the univariate analysis on the association between keeping scheduled appointments and basic demographics, appointment date, main disease, and seismic intensity. Not keeping the scheduled appointment was significantly associated with residing in areas with a seismic intensity of ≥ 6 ($n = 21$, 35.6%; $p < 0.001$) (Tables 3 and 4).

DISCUSSION

We examined the factors affecting the outpatient visit behavior of PPDs who had scheduled appointments at KMUH in the 2 weeks after the 2024 NPE. Of the PPDs with scheduled appointments,

TABLE 2 Attributes and main diseases of patients who failed to adhere to appointments ($n = 84$).

Variable	Category	n	%
Sex	Male	36	42.9
	Female	48	57.1
Age, years, mean (standard deviation)	46.9 (22.7)		
	<10 years	0	0.0
Age group	10s (10–19)	15	17.9
	20s (20–29)	8	9.5
	30s (30–39)	10	11.9
	40s (40–49)	12	14.3
	50s (50–59)	12	14.3
	60s (60–69)	10	11.9
	70s (70–79)	11	13.1
	80s (80–89)	5	6.0
	90s (90–99)	1	1.2
Main disease (ICD-10 code)	F0 Organic, including symptomatic, mental disorders	2	2.4
	F1 Mental and behavioral disorders due to psychoactive substance use	1	1.2
	F2 Schizophrenia, schizotypal and delusional disorders	11	13.1
	F3 Mood (affective) disorders	20	23.8
	F4 Neurotic, stress-related and somatoform disorders	30	35.7
	F5 Behavioral syndromes associated with physiological disturbances and physical factors	5	6.0
	F9 Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	12	14.3
	G40 Epilepsy	2	2.4
R46 School refusal	1	1.2	

Abbreviation: ICD-10, *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision.

87.2% kept their appointments. The failure of the remaining PPDs to keep their appointments may have been because they resided in areas with a seismic intensity of ≥ 6 .

Following the disaster, numerous roads in the Noto Peninsula were closed owing to large-scale road damage and landslides,^{32,33} particularly the main road from the Noto Peninsula to Uchinada, where KMUH is located.^{34,35} This resulted in substantial delays that affected not only disaster victims but also rescue teams and relief supplies to the affected areas.³⁶ Most of the participating PPDs had

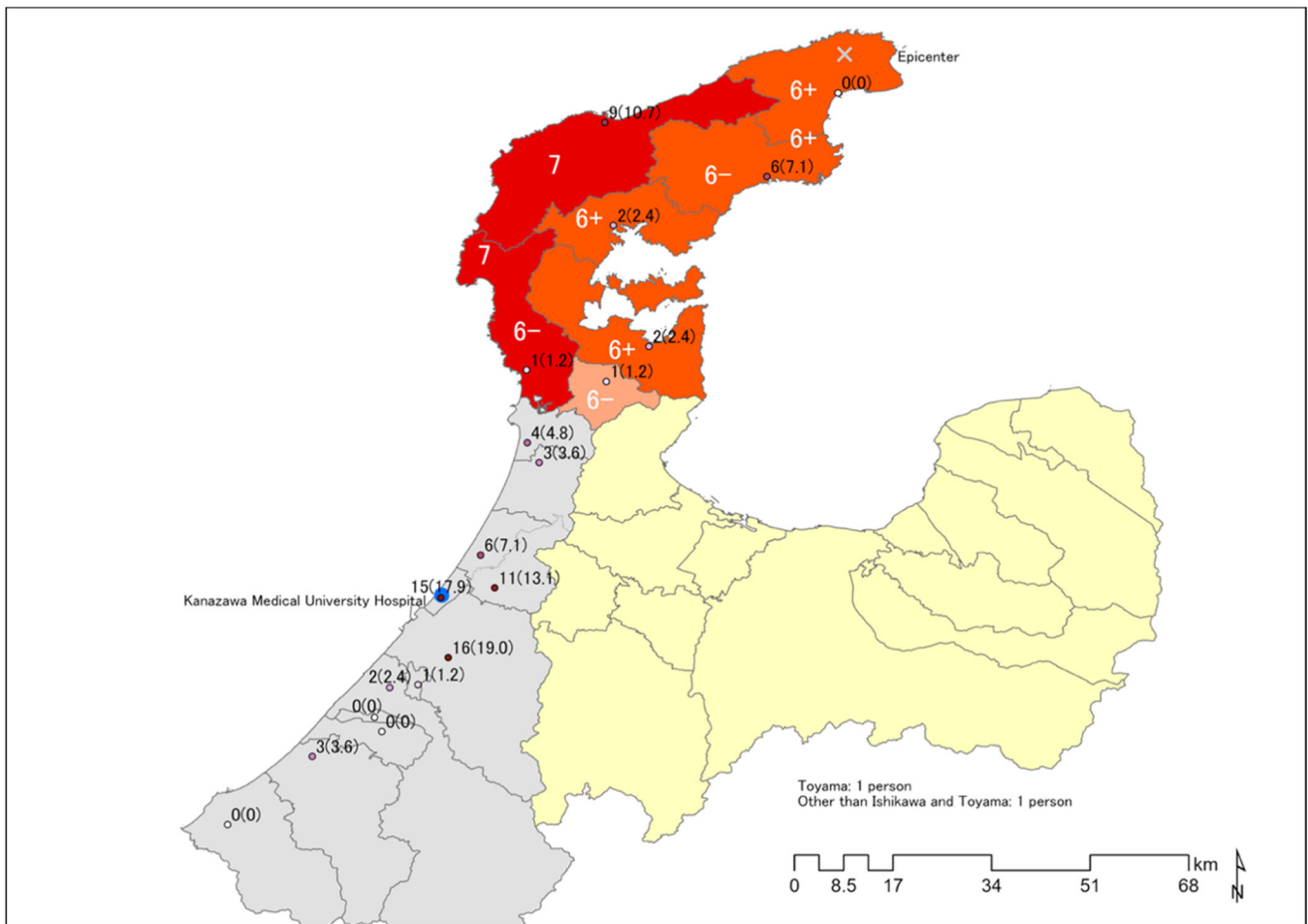


FIGURE 3 Spatial distribution of municipalities of patients with psychiatric disorders (PPDs) who missed appointments, overlaid with municipalities that had seismic intensity of ≥ 6 ($n = 84$; n [%]). To protect participant privacy, the residential locations of PPDs are aggregated and plotted at the level of local government districts.

disease codes of F4 and F3 and there was no association between the main disease and keeping scheduled appointments, which suggests that outpatient visit behavior was affected by disaster-related problems in accessing KMUH. Over 300 people died as a result of this earthquake.³ It is possible that some of the PPDs who did not keep their appointments were among those killed or seriously injured in the disaster, although this cannot be confirmed from this study.

The high rate of adherence to scheduled appointments among PPDs despite the occurrence of a major earthquake suggests that if the damage to the region's infrastructure had been less severe and the accessibility to KMUH had not been affected, then PPDs in the Noto Peninsula might have been able to maintain their regular outpatient visits.

Previous studies have shown that 20%–30% of PPDs who regularly attend outpatient clinics fail to keep their scheduled appointments owing to reasons such as forgetfulness or weak family support systems.^{37–39} This rate is reported to be approximately twice as high in psychiatry compared with other medical specialties.³⁸ Despite the challenging circumstances immediately following a major earthquake, the fact that 87.2% of PPDs in our study

kept their scheduled appointments suggests an increased need for specialized care during times of acute confusion, anxiety, and stress. However, we were unable to investigate these variables in this study. Previous studies have shown that text message reminders sent to smartphones can reduce missed appointments.^{40,41} Although KMUH implemented a similar system after the NPE, it was not in place in January 2024. Failure to keep scheduled appointments can lead to interruptions in medication. Hospitals repeatedly encourage patients to keep their scheduled appointments and provide various patient education programs to manage disease conditions. KMUH is no exception, and has been promoting regular check-ups and medication adherence. Evidence suggests that such patient education can improve medication adherence, appropriate healthcare utilization, and physical and psychological outcomes.^{42,43} The high rate of appointment adherence among PPDs who experienced the NPE could be attributed to the effectiveness of KMUH's ongoing patient education on appointment adherence. However, this could not be evaluated in the current study. Further research is needed to examine in detail the high compliance rate among PPDs who experienced the disaster.

TABLE 3 Patient characteristics by appointment adherence ($n = 656$).

Variable	Category	Total		Appointment adherence				p value
		n	%	No		Yes		
		n	%	n	%	n	%	
Age, years	Mean (standard deviation)	47.1 (19.9)						0.252
Age group	<65 years	515	78.5	62	12.0	453	88.0	0.262
	≥65 years	141	21.5	22	15.6	119	84.4	
Sex	Male	266	40.5	36	13.5	230	86.5	0.637
	Female	390	59.5	48	12.3	342	87.7	
Appointment date	Early period	268	40.9	38	14.2	230	85.8	0.381
	Late period	388	59.1	46	11.9	342	88.1	
F4 code	Other than F4	452	68.9	54	11.9	398	88.1	0.328
	F4	204	31.1	30	14.7	174	85.3	
F3 code	Other than F3	454	69.2	64	14.1	390	85.9	0.138
	F3	202	30.8	20	9.9	182	90.1	
Seismic intensity	<6	597	91.0	63	10.6	534	89.4	<0.001
	≥6	59	9.0	21	35.6	38	64.4	

Note: χ^2 test. Early period: January 4–10, 2024; late period: January 11–17, 2024. Among patients with psychiatric disorders who did not keep their scheduled appointments, those who reported earthquake-related reasons for missed appointments were significantly more likely to reside in areas with a seismic intensity of ≥ 6 ($n = 16$, 76.2%; $p < 0.001$) and to have a disease diagnosis of F3 ($n = 12$, 60.0%; $p = 0.034$) (Table 4).

TABLE 4 Patient characteristics by reason for missed appointment: earthquake-related or other ($n = 84$).

Variable	Category	Total		Reasons for missed appointments				p value
		n	%	Other reasons		Earthquake-related		
		n	%	n	%	n	%	
Age, years	Mean (standard deviation)	46.9 (22.7)						0.290
Age group	<65 years	62	73.8	37	59.7	25	40.3	0.480
	≥65 years	22	26.2	15	68.2	7	31.8	
Sex	Male	36	42.9	24	66.7	12	33.3	0.500
	Female	48	57.1	28	58.3	20	41.7	
Appointment date	Early period	38	45.2	28	73.7	10	26.3	0.043
	Late period	46	54.8	24	52.2	22	47.8	
F4 code	Other than F4	54	64.3	29	53.7	25	46.3	0.060
	F4	30	35.7	23	76.7	7	23.3	
F3 code	Other than F3	64	76.2	44	68.8	22	34.4	0.034
	F3	20	23.8	8	40.0	12	60.0	
Seismic intensity	<6	63	75.0	47	74.6	16	25.4	<0.001
	≥6	21	25.0	5	23.8	16	76.2	

Note: χ^2 test. Early period: January 4–10, 2024; late period: January 11–17, 2024.

It is essential to establish a system that allows PPDs who are unable to seek medical care owing to disaster-related issues, such as infrastructure damage, to receive treatment. Research in recent years has highlighted the effectiveness of online consultations for psychiatric patients during the COVID-19 pandemic.^{44,45} It is important to investigate the usefulness of online consultations as part of preparedness for crisis situations, such as natural disasters.

Among the 12.8% of PPDs who did not keep their scheduled appointments, the main disease codes were F4 and F3. A higher proportion of patients who reported earthquake-related reasons for missing their appointments were diagnosed with F3, suggesting a possible association. Considering that the data for earthquake-related and personal reasons were collected retrospectively through self-reports after the earthquake, it is possible that PPDs with F3 were more likely to report earthquake-related reasons for missing their appointments. Previous research has shown that patients with bipolar disorder (F3) tend to have milder cognitive dysfunction compared to those with schizophrenia.^{46,47} Additionally, studies have reported that among patients with bipolar disorder, those with greater awareness of treatment management, fewer negative perceptions of mental illness, lower perception of outcomes, and greater understanding of their disorder are more likely to adhere to treatment.⁴⁸ Considering these findings, it is possible that PPDs with F3 had a greater awareness of the importance of regular check-ups and medication adherence, and were better equipped to take coping actions.

This study had several limitations. First, the data were collected from a single medical institution. The lack of comparison with data from other medical institutions means that the results have limited generalizability. Second, the study period was short, and data were collected retrospectively from medical records. Consequently, data on socioeconomic variables and the psychological burden of the earthquake could not be collected. We were unable to investigate the effects of earthquake-related infrastructure damage or psychological factors on appointment cancellations. Therefore, the associations between the reasons for canceled appointments and the effects of the earthquake remain unclear. Moreover, although a high proportion of PPDs attended their scheduled appointments both immediately after the earthquake and in the subsequent period, it is not clear whether this was because they were less affected by the earthquake or whether it reflected factors such as healthcare accessibility or awareness. Furthermore, the long-term effects of the earthquake on patients remain to be determined. The lack of longitudinal data may have biased the results. Ideally, a regression analysis should have been used to compare outpatient adherence rates. However, the aim of this study was to promptly assess the direct effects of the earthquake, so such analyses were not conducted. To increase the generalizability of these findings, comparisons of appointment adherence rates before and after the earthquake, as well as analyses stratified by age, sex, and disease, are required. Additionally, multi-center studies with larger sample sizes from diverse medical institutions are needed. Further research is also required to conduct more detailed investigations of the effects of the reduced accessibility to

KMUH because of the earthquake, the number of injured and deceased patients who were scheduled to visit KMUH, and the long-term effects of the earthquake.

CONCLUSION

We investigated the effect of the 2024 NPE on appointment adherence among PPDs who had scheduled outpatient visits at KMUH in the 2 weeks after the disaster. We found that approximately 87% of PPDs kept their appointments. Possible reasons for missed appointments included reduced accessibility owing to extensive infrastructure damage caused by the earthquake, and injuries or fatalities. It is possible that more PPDs would have been able to keep their appointments if transportation and accessibility had not been substantially affected: the high rate of appointment adherence observed despite the earthquake warrants further investigation. Notably, PPDs with F3 as their main disease code reported a higher rate of missed appointments compared with other disease groups. Although this suggests that patients with F3 had a greater capacity to cope with the earthquake, further in-depth studies are required to substantiate this claim.

AUTHOR CONTRIBUTIONS

Yusuke Nitta, Reiko Hashimoto, Yoshihito Shimizu, Yuri Nakai, and Hisao Nakai: Methodology. **Yusuke Nitta, Reiko Hashimoto, Yoshihito Shimizu, Yuri Nakai, and Hisao Nakai:** Formal analysis. **Yusuke Nitta, Reiko Hashimoto, and Yoshihito Shimizu:** Investigation. **Yusuke Nitta, Reiko Hashimoto, and Yoshihito Shimizu:** Resources. **Yusuke Nitta, Reiko Hashimoto, Yoshihito Shimizu, Yuri Nakai, and Hisao Nakai:** Data curation. **Yusuke Nitta, Reiko Hashimoto, Yoshihito Shimizu, Yuri Nakai, and Hisao Nakai:** Writing—original draft preparation. **Yusuke Nitta, Reiko Hashimoto, Yoshihito Shimizu, Yuri Nakai, and Hisao Nakai:** Writing—review and editing. **Yusuke Nitta, Yuri Nakai, and Hisao Nakai:** Visualization. **Yusuke Nitta:** Supervision. All authors have read and agreed to the published version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Not applicable.

ETHICS APPROVAL STATEMENT

This research was conducted in accordance with the Declaration of Helsinki, 1995 (as revised in Seoul, 2008) and carried out with the consent of the university medical research ethics review committees at Kanazawa Medical University Hospital (No. C080), and the consent

of the University of Kochi Nursing Research Ethics Review Committee (No. Kan-Rin, 24-3).

PATIENT CONSENT STATEMENT

N/A

CLINICAL TRIAL REGISTRATION

N/A

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