

Partners' Ongoing Treatment for Chronic Disease and the Risk of Psychological Distress after the Great East Japan Earthquake

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Several studies have reported that not only patients with chronic diseases but also their partners are likely to face major psychosocial problems. This study examined the association between a partner's ongoing treatment for chronic disease and the risk of psychological distress after the Great East Japan Earthquake (GEJE). In 2012, a questionnaire was distributed as part of a cross-sectional study of participants aged 20 years or older living in a municipality that had been severely inundated by the tsunami following the GEJE. We identified couples using the household numbers of the municipality and collected self-reported information on ongoing chronic disease treatment for stroke, cancer, myocardial infarction, and angina. Psychological distress was evaluated using the Kessler 6 scale (K6) and was defined as a score $\geq 5/24$ points. Among 1,246 couples (2,492 participants) thus identified, 2,369 completed the K6. The number of participants whose partners were under treatment for chronic diseases was 209 (9%). Overall, participants with partners who were receiving treatment for chronic diseases (odds ratio [OR] = 1.3, 95% confidence interval [CI] = 0.95-1.8, $P = 0.09$) did not show a significantly higher risk of psychological distress using logistic regression analysis. Women, but not men, whose partners were receiving treatment for chronic diseases, had a higher risk of psychological distress (women: OR = 1.6, $P = 0.02$; men: OR = 1.0, $P = 0.92$). After the GEJE, only in women the presence of partners under treatment for chronic diseases appears to be a risk factor for psychological distress.

Keywords: chronic diseases; cross-sectional study; medical treatment; partner; psychological distress

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Introduction

It has been more than two decades since House et al. (1988) first reported that chronic diseases affected not only patients but also their closest relatives. The mechanism of this effect may involve several interacting pathways. The event may cause stress in the partner; might deprive the partner of emotional, social, and economic support; and can influence the daily life and behavior of the partner (House et al. 1988; Berkman and Kawachi 2000). Caregivers, including partners or family members, of patients with chronic diseases experience increased fatigue (Fletcher et al. 2008). Previous studies have reported that the partners of patients with chronic diseases can develop major psychosocial problems, including depression. Such studies have focused on chronic diseases such as stroke (Berg et al. 2005), cancer (Nakaya et al. 2010; Sjövall et al. 2009), and

myocardial infarction (Fosbøl et al. 2013). Serious adverse psychosocial problems are a concern not only for patients with chronic diseases but also for their partners, and this is especially true in post-disaster settings, considering evidence that disasters increase the prevalence of chronic diseases, including stroke (Nozaki et al. 2013; Omama et al. 2013), cancer (Zeig-Owens et al. 2011; Kleinman et al. 2015), and myocardial infarction (Tanaka et al. 2015; Swerdel et al. 2014).

The mechanism responsible for the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress might arise from a lack of emotional, social, or economic support and might be influenced by the daily life and behavior of the partner (House et al. 1988; Berkman and Kawachi 2000). Caregivers, including partners or family members, of patients with chronic diseases have increased fatigue (Fletcher et al.

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2008).

On March 11, 2011, the northeastern coast of Japan was devastated by the magnitude-9.0 Great East Japan Earthquake (GEJE) and the tsunami that followed. As of July 10, 2015, a total of 18,466 people were recorded as dead or missing because of the GEJE (National Police Agency 2011). A catastrophe of this magnitude greatly affects mental (Nakaya et al. 2015, 2016a; Matsubara et al. 2014) and physical health (Nakamura et al. 2014; Inoue et al. 2014) as well as employment (Nakaya et al. 2016b) in the affected communities, resulting in major concern for post-disaster public health.

People with psychological distress might be aggravated when they receive additional stressors. This study focused on the participants whose partners had chronic diseases after the natural disaster. Ongoing treatment for a partner's chronic disease might exacerbate psychosocial problems after the post-disaster setting. In a cross-sectional study based on GEJE data, we carefully examined the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress one year after the GEJE.

Methods

This study was part of a project called the Shichigahama Health Promotion Project, which was conducted in cooperation with Tohoku University and Shichigahama Town, Miyagi, northeastern Japan (Nakaya et al. 2015, 2016a) (Fig. 1). The project includes health promotion activities, health surveys, and the provision of health support to people in the aftermath of the GEJE. The survey aimed to evaluate the current overall health and life status of all community members regardless of the level of house damage in the five most severely devastated coastal areas of Shichigahama Town in September of 2012. In these areas, 10% of all households were largely or totally destroyed by the earthquake and resulting tsunami. The definition of large-scale damage was based on the "largely or totally destroyed" criterion from the building damage assessment conducted by the local Shichigahama



Fig. 1. Location of Shichigahama town at Miyagi prefecture, Japan.

government according to the criteria issued by the Cabinet Office; small-scale damage constituted "minimal or no damage" resulting from the disaster.

The survey teams visited all households in the target area to ask for participation in the survey. An informed consent form and questionnaire were handed directly to residents willing to participate and were subsequently collected. First, in October 2012, there was a survey for residents whose houses suffered large-scale damage, subsequently, we conducted a survey of residents whose houses had small-scale damage in December 2012. The study protocol was reviewed and approved by the Ethics Committee of Tohoku University Graduate School of Medicine.

Study population

From the study population of 7,036 participants (2,910 with large-scale damage and 4,126 with small-scale damage to their houses), 6,840 (97%) were contacted by the survey teams, and 4,949 (70%) of these completed and returned the questionnaire with the written informed consent form. We defined partners with the following criteria: (1) confirmation of the household number in Shichigahama Town for each person, (2) at least two persons of the opposite sex living in the household, (3) age ≥ 20 years, (4) maximum age difference of 15 years, and (5) living at the same address with no other adults in residence. We identified 1,246 pairs (2,492 participants), and 2,369 participants (34%) responded to the psychological distress questions measured using the Kessler-6 (K6) scale (1,182 men and 1,187 women); this sample was used in the following analyses. Since we included all the participants with available K6 scores in the analyses, even if scores for their partners were not available, the numbers of men and women differed.

Partners under treatment for chronic diseases

Information about selected chronic diseases was collected using a self-administered questionnaire asking whether the participants were under treatment for any of the following eight chronic diseases: stroke, myocardial infarction or angina pectoris, cancer, kidney disease, liver disease, hypertension, diabetes mellitus, and hyperlipidemia. We focused on ongoing medical treatment for three chronic diseases (stroke, cancer, and myocardial infarction or angina), which are the main causes of death in Japan (Nakaya et al. 2016b).

Psychological distress

The K6 was used as an indicator of psychological distress (Kessler et al. 2003). The respondents were asked about their mental status over the previous month using six questions, to which they responded by selecting one of five options: "all of the time" (4 points), "most of the time" (3 points), "some of the time" (2 points), "a little of the time" (1 point), or "none of the time" (0 points). Total scores ranged from 0 to 24. The questions asked were as follows: "Over the last month, how often have you felt the following: [i] nervous, [ii] hopeless, [iii] restless or fidgety, [iv] so sad that nothing could cheer you up, [v] that everything was an effort, or [vi] worthless?" The K6 is based on modern psychometric theory and has been shown to outperform other scales (Kessler et al. 2002; Kessler 2003). The Japanese version of the K6 was developed recently using the standard back-translation method, and its applicability has been validated (Furukawa et al. 2003). As suggested by Kessler et al., we classified individuals in the community sample with scores of $\geq 5/24$ points as having psychological distress (Schulz and Beach 1999).

However, as some studies have used a cutoff score of $\geq 13/24$ points to indicate psychological distress (Nakaya et al. 2014; Kuriyama et al. 2009), we conducted analyses using both cutoff points (5/24 or 13/24) (Nakaya et al. 2016a).

Other information

Basic individual information (sex, age, income, current smoking status, current alcohol drinking, time spent walking, and chronic disease of their own) was collected using the questionnaire. In this study, current alcohol consumption was divided into four categories: nondrinker, < 2 go/day, ≥ 2 go/day, unknown, where 22.8 g of alcohol amounts to 1 go or a traditional unit of sake (180 mL), which also approximates two glasses of wine (200 mL) or beer (500 mL) in terms of alcohol content. A chi-squared test was used to examine whether a partner's ongoing treatment for a chronic disease was asso-

ciated with the abovementioned variables. Multiple logistic regression analyses were conducted to evaluate the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress. We adjusted the analysis according to sex, age (≤ 64 , 65-74, ≥ 75 years), income (easy to live, no problem to live, difficult to live, unknown), current smoking status (non-smoking, current smoking, unknown), current alcohol consumption (non-drinking, current drinking [< 2 go/day, ≥ 2 go/day], unknown), time spent walking (< 0.5 hours/day, ≥ 0.5 hours/day, unknown), chronic disease of their own, and degree of housing damage (large-scale, small-scale). Furthermore, since an earlier study showed that women have a greater risk of major depressive disorder than men (Kessler 2003), our study focused on gender differences in the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress (K6 score ≥ 5). The presence or absence of a partner who

Table 1. Demographics, lifestyle, and socioeconomic characteristics according to the presence of a partner under treatment for a chronic disease (n = 2,369).

Characteristics	Total no. of participants	No. of participants whose partners were under treatment for chronic diseases (%)		P-value for chi-squared test
		Absent (n = 2,160)	Present* (n = 209)	
Sex				
Male	1,182	1,101 (51)	81 (39)	< 0.01
Female	1,187	1,059 (49)	128 (61)	
Age at baseline, in years				
< 65	1,551	1,483 (69)	68 (33)	< 0.01
65-74	519	432 (20)	87 (42)	
≥ 75	299	245 (11)	54 (26)	
Income				
Easy to live	122	111 (5)	11 (5)	0.35
No problem to live	1,173	1,061 (49)	112 (54)	
Difficult to live	1,047	965 (45)	82 (39)	
Unknown	27	23 (1)	4 (2)	
Current smoking status				
Non-smoking	1,596	1,449 (67)	147 (70)	< 0.01
Smoking	609	570 (26)	39 (29)	
Unknown	164	141 (7)	23 (11)	
Current drinking status				
Non-drinking	734	657 (30)	77 (37)	< 0.01
Current drinking, < 2 go/day [†]	562	528 (24)	34 (16)	
Current drinking, ≥ 2 go/day [†]	412	386 (18)	26 (12)	
Unknown	661	589 (27)	72 (34)	
Time spent walking				
Less than 0.5 hours/day	1,632	1,491 (69)	141 (67)	0.11
≥ 0.5 hours/day	713	650 (30)	63 (30)	
Unknown	24	19 (1)	5 (2)	
Under treatment for chronic disease of their own[‡]				
None	2,167	2,000 (93)	167 (80)	< 0.01
Present	202	160 (7)	42 (20)	
Degree of housing damage				
Large-scale destruction	867	785 (36)	82 (39)	0.41
Small-scale destruction	1,502	1,375 (64)	127 (61)	

*Combination of medical treatments for chronic diseases (stroke, cancer, or myocardial infarction or angina).

[†]22.8 g of alcohol equals 1 go or a traditional unit of sake (180 ml), which also approximates two glasses of wine (200 mL) or beer (500 mL) in terms of alcohol content.

[‡]Combination of medical treatments for chronic diseases (stroke, myocardial infarction or angina, cancer, kidney disease, liver disease, hypertension, diabetes mellitus, or hyperlipidemia).

was under treatment for a chronic disease and sex were treated as interaction terms in a multiple logistic regression model. Finally, we conducted additional analyses using a partner's ongoing treatment for each chronic disease (stroke, cancer, or myocardial infarction or angina pectoris) as exposures in the model. Data were analyzed using the SAS 9.4 (SAS Institute, Cary, NC, USA) with a significance level of $P < 0.05$.

Results

Table 1 summarizes the demographic characteristics, socioeconomic statuses, lifestyles, ongoing treatments for chronic diseases of their own, and degrees of housing damage in terms of the partner's ongoing treatment for a chronic disease. The number of participants whose partners were under treatment for chronic diseases was 209 (9%); the remaining 2,160 (91%) did not have partners who were under treatment for chronic diseases. Participants whose partners were under treatment for chronic diseases tended to be older and were more likely to be under treatment for chronic diseases of their own. No difference in the degrees of damage to their houses was seen according to the presence or absence of a partner who was under treatment for a chronic disease ($P = 0.41$).

Table 2 shows the adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for psychological distress according to the partner's ongoing treatment for a chronic disease. Participants whose partners were under treatment for chronic diseases (OR = 1.5, 95% CI = 0.8-2.8, $P = 0.16$) did not show a significantly higher risk for psychological distress (K6 score ≥ 13). Our results did not change even after

we applied a different cutoff level for psychological distress (K6 score ≥ 5) (OR = 1.3, 95% CI = 0.95-1.8, $P = 0.09$).

We further evaluated the sex difference in the association between a partner's ongoing treatment for a chronic disease and the risk for psychological distress (K6 score ≥ 5) (Table 3). Women whose partners were under treatment for chronic diseases showed a statistically significant higher risk of psychological distress than those participants whose partners were not under treatment for chronic diseases (OR = 1.6, 95% CI = 1.1-2.4, $P = 0.02$). On the other hand, men whose partners were under treatment for chronic diseases did not have a significant risk of psychological distress (OR = 1.0, 95% CI = 0.6-1.6, $P = 0.92$). The interaction between sex and a partner's ongoing treatment for a chronic disease did not reach statistical significance ($P = 0.33$). We excluded the participants under treatment for chronic diseases of their own ($n = 202$, men = 121; women = 81) and found similar associations (data not shown).

We also performed the same analyses for each chronic disease (stroke, cancer, or myocardial infarction or angina pectoris). The multiple logistic regression models detected a significant association between a partner's ongoing treatment and psychological distress only for myocardial infarction or angina pectoris (OR=1.6, 95% CI=1.1-2.3, $P=0.03$). Individuals with partners under treatment for cancer were at a higher risk of psychological distress (OR=1.5, 95% CI=0.9-2.5, $P = 0.12$), but the association did not reach statistical significance (Table 4).

Table 2. Multivariate adjusted odds ratio (OR) and 95% confidence interval (CI) for "psychological distress (K6 score ≥ 5 or K6 score ≥ 13)" according to the presence of a partner under treatment for a chronic disease ($n = 2,369$).

	Partner under treatment for a chronic disease	
	Absent	Present*
No. of participants	2,160	209
No. of participants with K6 score ≥ 13	223	34
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.5 (0.8-2.8)
P-value	–	0.16
No. of participants with K6 score ≥ 5	709	92
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.3 (0.95-1.8)
P-value	–	0.09

The multivariate adjusted odds ratios (ORs) have been adjusted for gender; age in years old (< 64 , 65-74, > 75); income (easy to life, no problem to life, difficult to life, unknown); current smoking status (non-smoking, current smoking, unknown); current alcohol consumption (non-drinking, current drinking, [< 2 go/day, ≥ 2 go/day][†], unknown); time spent walking (< 0.5 hours/day, ≥ 0.5 hours/day, unknown); chronic disease of their own[‡]; degree of housing damage (large-scale, small-scale).

*Combination of medical treatments for chronic diseases (stroke, cancer, or myocardial infarction or angina).

[†]22.8 g of alcohol equals 1 go or a traditional unit of sake (180 ml), which also approximates two glasses of wine (200 mL) or beer (500 mL) in terms of alcohol content.

[‡]Combination of medical treatments for chronic diseases (stroke, myocardial infarction or angina, cancer, kidney disease, liver disease, hypertension, diabetes mellitus, or hyperlipidemia).

Table 3. Multivariate adjusted odds ratio (OR) and 95% confidence interval (CI) for "psychological distress (K6 score ≥ 5)" according to the presence of a partner under treatment for a chronic disease stratified according to sex (n = 2,369).

	Partner under treatment for a chronic disease	
	Absent	Present*
Men	1,101	81
No. of participants with K6 score ≥ 5	321	28
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.0 (0.6-1.6)
P-value	–	0.92
Women	1,059	128
No. of participants with K6 score ≥ 5	388	64
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.6 (1.1-2.4)
P-value	–	0.02

The multivariate adjusted odds ratios (ORs) were adjusted for age in years (≤ 64 , 65-74, ≥ 75); income (easy to live, no problem to live, difficult to live, unknown); current smoking status (non-smoking, current smoking, unknown); current alcohol consumption (non-drinking, current drinking, [< 2 go/day, ≥ 2 go/day][†], unknown); time spent walking (< 0.5 hours/day, ≥ 0.5 hours/day, unknown); chronic disease of their own[‡]; and degree of housing damage (large-scale, small-scale).

*Combination of medical treatments for chronic diseases (stroke, cancer, or myocardial infarction or angina).

[†]22.8 g of alcohol equals 1 go or a traditional unit of sake (180 ml), which also approximates two glasses of wine (200 mL) or beer (500 mL) in terms of alcohol content.

[‡]Combination of medical treatments for chronic diseases (stroke, myocardial infarction or angina, cancer, kidney disease, liver disease, hypertension, diabetes mellitus, or hyperlipidemia).

Discussion

In the cross-sectional data collected from victims of the GEJE, the participants whose partners were under treatment for chronic diseases did not have a significantly higher risk for psychological distress. Only in women (OR = 2.6), and not in men (OR = 1.0) did the presence of a partner who was under treatment for a chronic disease appear to be a risk factor of psychological distress.

Several earlier studies have reported that individuals whose partners had chronic diseases were more likely to develop depression (Berg et al. 2005; Nakaya et al. 2010; Sjövall et al. 2009; Fosbøl et al. 2013). Our results supported these results, and, in particular, our results indicated an association for women but not for men (Table 3). The interaction between sex and a partner's ongoing treatment for a chronic disease did not reach statistical significance (P = 0.33). In earlier studies, psychosocial problems, including the depression of a partner with a chronic disease, were reported according to several chronic diseases including stroke (Berg et al. 2005), cancer (Nakaya et al. 2010; Sjövall et al. 2009), and myocardial infarction (Fosbøl et al. 2013), regardless of sex. Among these previous studies, one showed that the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress was stronger for women than for men (Berg et al. 2005). This female-specific effect observed in the

current study agrees with the findings of a previous study, which indicated that women were at a greater risk of major depressive disorder than were men (Kessler et al. 2002). Therefore, the association between a partner's ongoing treatment for a chronic disease and the risk of psychological distress might be stronger in women than in men. On the other hand, the psychological distress experienced by men whose partners were under treatment for chronic diseases might have been affected by stress arising from the earthquake disaster.

As for disease-specific risk in our study, a significant association was shown between a partner's ongoing treatment for myocardial infarction or angina pectoris and the risk of psychological distress (OR = 1.6). Furthermore, a partner's ongoing treatment for cancer tended to be associated with a higher risk of psychological distress (OR = 1.5) (Table 4). Thus, the presence of a partner with a serious chronic disease, including myocardial infarction or angina pectoris, was associated with a higher risk of psychological distress.

The association between a partner's ongoing treatment for chronic diseases and the risk of psychological distress might be attributed to lack of psychosocial support, behavioral change (House et al. 1988; Berkman and Kawachi 2000), and/or caregiver burdens (Fletcher et al. 2008). Our findings indicated that psychological support is needed for women whose partners are receiving treatment for chronic

Table 4. Multivariate adjusted odds ratio (OR) and 95% confidence interval (CI) for “psychological distress (K6 score ≥ 5)” according to the presence of a partner under treatment for each chronic disease (stroke, cancer, or myocardial infarction or angina pectoris) ($n = 2,369$).

	Partner under treatment for each chronic disease	
	Absent	Present
Stroke	2,346	23
No. of participants with K6 score ≥ 5	794	7
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	0.5 (0.2-1.3)
P-value	–	0.20
Cancer	2,297	72
No. of participants with K6 score ≥ 5	769	32
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.5 (0.9-2.5)
P-value	–	0.12
Myocardial infarction or angina pectoris	2,245	124
No. of participants with K6 score ≥ 5	769	61
Multivariate adjusted OR (95% CI)	1.0 (Ref.)	1.6 (1.1-2.3)
P-value	–	0.03

The multivariate adjusted odds ratios (ORs) were adjusted for gender, age in years (≤ 64 , 65-74, ≥ 75); income (easy to live, no problem to live, difficult to live, unknown); current smoking status (non-smoking, current smoking, unknown); current alcohol consumption (non-drinking, current drinking, [< 2 go/day, ≥ 2 go/day]*, unknown); time spent walking (< 0.5 hours/day, ≥ 0.5 hours/day, unknown); chronic disease of their own[†]; and degree of housing damage (large-scale, small-scale).

*22.8 g of alcohol equals 1 go or a traditional unit of sake (180 ml), which also approximates two glasses of wine (200 mL) or beer (500 mL) in terms of alcohol content.

[†]Combination of medical treatments for chronic diseases (stroke, myocardial infarction or angina, cancer, kidney disease, liver disease, hypertension, diabetes mellitus, or hyperlipidemia).

diseases. Therefore, when treating men with chronic diseases, doctors and paramedics should monitor the patients' partners for psychological distress, and some type of regular screening for psychological distress should occur (Schmitz et al. 2009). Furthermore, since a high mortality rate has been reported among caregivers, not only screening for psychological distress but also regular physical examinations may be necessary (Schulz and Beach 1999).

This study had several limitations. First, this study participants included individuals experiencing damage from the GEJE. These individuals have a different background from previous study participants. It is necessary to be cautious in interpreting of our study findings. Second, our sample size may not be large enough to gain a true statistical picture of the real effect of the association between a partner's ongoing treatment for chronic diseases and the risk of psychological distress according to each chronic disease (stroke [no. of participants = 23/no. of participants with K6 score ≥ 5 = 7], cancer [72/32], or myocardial infarction or angina pectoris [124/61]). Third, the response rate (51%) was not high, so the study may be biased toward

healthier people in the community, but no such bias affected the internal validity of the association. Fourth, because of the cross-sectional design of this study, we cannot make any conclusions regarding the causal relationship between a partner's ongoing treatment for a chronic disease and the risk of psychological distress. Fifth, this study focused on the partner's ongoing treatment for chronic diseases, but we did not have any detailed information on disease severity or symptoms. Therefore, the association between the severity or symptoms of chronic diseases and the risk of psychological distress remains unclear. In addition, we did not have any information on the medications being used by the study participants including antidepressants or anti-anxiety agents. Therefore, our estimates might be underestimated, and we could not consider the above medications as covariates. Lastly, we defined a pair of partners using the following criteria: (1) confirmation of the household number in Shichigahama Town for each person, (2) at least 2 persons of the opposite sex living in the household, (3) age ≥ 20 years, (4) maximum age difference of 15 years, and (5) living at the same address. If a participant could be paired

with more than two family members, all were excluded from the analyses. Since we defined the pairs who met all the above criteria as "married couples," some opposite-sex siblings or common-law couples may have been included in the analyses while some real married couples with age differences of ≥ 16 years may have been excluded.

In this cross-sectional study, only women with partners under treatment for chronic diseases showed a statistically significant higher risk of psychological distress at one year after the earthquake. When treating men with chronic diseases, doctors and paramedics should also monitor partners for psychological distress, and some type of regular screening for psychological distress should exist for these partners.

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Conflict of Interest

The authors declare no conflict of interest.

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