



# Longitudinal association between time-varying social isolation and psychological distress after the Great East Japan Earthquake



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## ABSTRACT

**Background:** The association between social isolation and psychological distress among disaster survivors is inconclusive. In addition, because these previous studies were cross-sectional in design, the longitudinal association between time-varying social isolation and psychological distress was not clear. The present study examined the longitudinal association between social isolation and psychological distress after the Great East Japan Earthquake.

**Methods:** We analyzed longitudinal data for 959 adults who had responded to the self-report questionnaires about Lubben Social Network Scale-6 (LSNS-6) and K6 in both a community-based baseline survey (2011) and a follow-up survey (2014) after the disaster. Participants were categorized into four groups according to changes in the presence of social isolation (<12/30 of LSNS-6) at two time points (2011 and 2014): “remained socially isolated”, “became not socially isolated”, “remained not socially isolated”, and “became socially isolated”. We defined a K6 score of  $\geq 10/24$  as indicating the presence of psychological distress. We used multiple logistic regression analysis to estimate the adjusted odds ratios (ORs) and 95% confidence intervals (CIs) to indicate how the change in social isolation was related to changes in psychological distress over 3 years.

**Results:** Among the participants who had not shown psychological distress at the baseline, the rates of deterioration of psychological distress were significantly lower in participants who “became not socially isolated” (multivariate OR = 0.26, 95% CI = 0.08–0.70) and “remained not socially isolated” (multivariate OR = 0.49, 95% CI = 0.27–0.91), compared with participants who “remained socially isolated”. Among the participants who had psychological distress at the baseline, the rate of improvement of psychological distress was significantly higher in participants who “remained not socially isolated” (multivariate OR = 2.61, 95% CI = 1.08–6.44).

**Conclusion:** The present findings suggest that prevention of social isolation may be an effective public health strategy for preventing psychological distress after a natural disaster.

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## 1. Introduction

The Great East Japan Earthquake (GEJE) and associated tsunami struck the northeastern coast of Japan on March 11, 2011, leaving 18,550 persons dead or missing (Ishigaki et al., 2013). Previous studies have reported that the estimated prevalence of

psychological distress after the GEJE was 42.6–48.0% (Niitsu et al., 2014; Sugimoto et al., 2015; Yokoyama et al., 2014), and that the prevalence of psychological distress among disaster survivors decreased steadily after the earthquake (Nakamura et al., 2014). However, there appears to have been considerable individual variation in psychological recovery, and the factors contributing to this variation have remained unclear.

Social isolation is associated with a higher risk of poor mental health, including depression (Cacioppo et al., 2010; Chou et al., 2011; Dorfman et al., 1995; Teo et al., 2013). Survivors from the

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GEJE were at high risk of social isolation due to the death of family or friends and evacuation from their home community. A previous study has demonstrated an association between social network disruption and psychological distress as a result of evacuation (Bland et al., 1997). Therefore, these environmental changes resulting from disasters create the potential for social isolation and a higher risk of psychological distress.

Previous studies have examined the association between social isolation and psychological distress in community-dwelling populations (Kuriyama et al., 2009; Phongsavan et al., 2006; Zhang and Chen, 2014), and reported that social isolation is significantly associated with an increased risk of psychological distress. However, this association among disaster survivors is inconclusive. Some studies have indicated that social isolation is significantly associated with psychological distress, whereas others have denied any such association (Koyama et al., 2014; Oyama et al., 2012; Sugimoto et al., 2015; Teramoto et al., 2015; Yokoyama et al., 2014). In addition, because these previous studies were cross-sectional in design, the longitudinal association between time-varying social isolation and psychological distress was not clear.

The present study examined the longitudinal association between social isolation and psychological distress after a major disaster. For this purpose, we followed up about 1000 survivors for more than 3 years after the GEJE.

## 2. Methods

### 2.1. Study design and participants

Baseline health examinations and questionnaire surveys were conducted from June to November, 2011. The aim of the survey was to evaluate mental and physical functional status. The study population comprised residents aged 18 years or older who were included in the Residential Registry for Ajishima, Ogatsu, and Oshika, Ishinomaki City, Miyagi Prefecture, and residents who were living in prefabricated temporary housing in Wakabayashi-ku, Sendai City, Miyagi Prefecture. These health surveys were repeated about every 6 months. The first three surveys involved health examinations and questionnaires, and thereafter questionnaire surveys were conducted four times. The study protocol was reviewed and approved by the Ethics Committee of Tohoku University Graduate School of Medicine.

We linked two datasets: one from questionnaire surveys conducted between June and November 2011, and another from questionnaire surveys conducted between June and August 2014. Of the 6501 study population (Ajishima; 460, Ogatsu; 1708, Oshika; 3357, and Wakabayashi-ku; 976), 1936 (29.8%) participated in the baseline health examination and questionnaire surveys (2011). Of the participants, 1180 responded to the follow-up survey (2014), and were thus eligible for analysis. We excluded 221 participants who had not entered any response to the questions about Lubben Social Network Scale-6 (LSNS-6), K6, economic status, alcohol consumption, smoking status, and self-rated health. Consequently, our final analysis included 959 participants.

### 2.2. Measurements

The questionnaire requested the following information from each participant: age, sex, economic status, history of disease, body weight and height, alcohol consumption, smoking status, self-rated health, sleeping condition, social network (LSNS-6) (Kurimoto et al., 2011; Lubben et al., 2006; Lubben and Gironde, 2003), psychological distress (K6) (Furukawa et al., 2003; Kessler et al., 2002, 2003), physical activity, and information about personal experience of the GEJE (evacuation, presence of post-traumatic stress disorder,

change in job or income, degree of destruction of the dwelling, and dead or missing family members). In this study, alcohol consumption was divided into 3 categories (non-drinking, <2 go/day, and  $\geq 2$  go/day), where 22.8 g of alcohol amounts to 1 go, a traditional unit of sake (180 ml), which also approximates to two glasses of wine (200 ml) or beer (500 ml) in terms of alcohol content.

The LSNS-6 was used as an indicator of social isolation (Lubben et al., 2006; Lubben and Gironde, 2003). The reliability and validity of the Japanese version of the LSNS-6 have been confirmed (Kurimoto et al., 2011). This measure is constructed from a set of 3 questions that evaluate family ties and a comparable set of 3 questions that evaluate friendship ties. The LSNS-6 includes the following six items: [1] "How many relatives do you see or hear from at least once a month?" [2] "How many relatives do you feel close to such that you could call on them for help?" [3] "How many relatives do you feel at ease with that you can talk about private matters?" [4] "How many of your friends do you see or hear from at least once a month?" [5] "How many friends do you feel close to such that you could call on them for help?" or [6] "How many friends do you feel at ease with that you can talk about private matters?" The possible responses and their scores were: "none" (0 point), "one" (1 point), "two" (2 points), "three or four" (3 points), "five to eight" (4 points), and "nine or more" (5 points). The total scores ranged from 0 to 30. As suggested by Lubben et al., we classified individuals with scores of <12/30 points as being socially isolated. The participants were then classified into the following 4 groups: "remained socially isolated" (socially isolated in both 2011 and 2014), "became not socially isolated" (socially isolated in 2011 and not socially isolated in 2014), "remained not socially isolated" (not socially isolated in both 2011 and 2014), and "became socially isolated" (not socially isolated in 2011 and socially isolated in 2014).

The K6 was used to assess psychological distress (Kessler et al., 2002, 2003). The Japanese version of the K6 has been validated previously (Furukawa et al., 2003). The K6 consists of six questions about how often an individual has felt the following in the last month: [1] nervous, [2] hopeless, [3] restless or fidgety, [4] so sad that nothing could cheer you up, [5] everything is an effort, or [6] worthless. The possible responses and their scores were as follows: "all of the time" (4 points), "most of the time" (3 points), "some of the time" (2 points), "little of the time" (1 point), and "none of the time" (0 point). The total K6 score for the six questions was 24 (0 indicating no psychological distress and 24 indicating severe psychological distress). In a previous study, a cut-off point of  $\geq 10/24$  has been used to screen for psychological distress (Suzuki et al., 2014). We classified respondents with scores of  $\geq 10/24$  as having a higher degree of psychological distress.

### 2.3. Statistical analyses

First, to test whether the changes in social isolation was associated with changes in psychological distress (K6 in 2014 minus K6 in 2011), we used a linear mixed model with a random intercept including the study region (Ajishima, Ogatsu, Oshika, or Wakabayashi-ku). We also stratified the participants by their degree of psychological distress at the baseline (those with no psychological distress; those with psychological distress).

Second, we conducted cross-sectional analysis to evaluate the association between social isolation and psychological distress at the baseline (2011). The dependent variable was psychological distress. The independent variable was social isolation (socially isolated; not socially isolated). Multiple logistic regression analysis was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) for higher psychological distress according to the categories for social isolation (socially isolated; not socially isolated).

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