



# Do community- and individual-level social relationships contribute to the mental health of disaster survivors?: A multilevel prospective study after the Great East Japan Earthquake



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## ABSTRACT

Disasters greatly threaten the health and lives of people all over the world. Japan experienced severe damage following the Great East Japan Earthquake on March 11, 2011, and some survivors continue to live in prefabricated temporary housing, built collectively in damaged areas. Previous studies have shown that social relationships in such communities have the potential to protect the mental health of disaster survivors. We examined the association between survivors' social support and social participation in 2012 and their psychological distress in 2013 using the K6 scale. Self-reported questionnaires were distributed to all 15,979 households in prefabricated temporary housing in eight municipalities in Miyagi prefecture in 2012, and 19,284 adults from 9366 (58.6%) households responded. One year later, 10,880 adults responded to a follow-up survey. Multivariate multilevel linear regression analyses with multiply imputed datasets showed that survivors' psychological distress at follow-up significantly differed between communities (community-level variance [standard error] = 0.38 [0.13]). The variance was reduced to 0.25 [0.09] after considering individual demographic characteristics and psychological distress at baseline. Individual- and community-level social relationships of 7.1% and 15.8%, respectively, explained the difference. After adjusting for covariates including K6 scale at baseline, individual-level social support, community-level social support, and individual-level social participation were significantly associated with low psychological distress at follow-up (coefficients [95% confidence intervals] were:  $-0.54$  [ $-0.79, -0.30$ ];  $-0.43$  [ $-0.72, -0.14$ ]; and  $-0.22$  [ $-0.40, -0.04$ ], respectively). Community-level social participation was not significantly associated with psychological distress. The present study showed that: 1) survivors' psychological distress varied between temporary housing communities in 2013; 2) individual- and community-level social relationships contributed to the difference; and 3) individual- and community-level social relationships in 2012 were protectively associated with survivors' psychological distress in 2013. Promoting social relationships in communities after disasters might decrease disaster survivors' psychological distress.

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## 1. Introduction

The recent increase in disasters has threatened the health and

lives of people all over the world. Although the number of deaths caused by disasters has decreased, the number of people affected has increased (EM-DAT, 2011). On March 11, 2011, the Great East Japan Earthquake and subsequent tsunami caused significant damage to Japanese society, both locally and nationally. Over 18,470 people died or are still unaccounted for, and more than 400,000 buildings were destroyed (National Police Agency, 2014). About 350,000 survivors were forced to relocate, and over 220,000 of these still live in prefabricated temporary housing three years after

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the catastrophe (Reconstruction Agency, 2014). These survivors are now struggling to rebuild normal lives.

Previous studies have shown that disaster survivors are vulnerable in terms of their mental health (Kawachi and Subramanian, 2006; Lê et al., 2013; North and Pfefferbaum, 2013; Tang et al., 2014; Tuerk et al., 2013; Uscher-Pines, 2009). For instance, among survivors of the 2003 Bam earthquake in Iran, the prevalence of severe psychological distress was 58%, three times higher than that of the general population (Najafi et al., 2009). Post-traumatic stress disorder (PTSD) was found in 62.8% of survivors from the 2008 Wenchuan earthquake in China (Wang et al., 2011). After the Great East Japan Earthquake, the prevalence of moderate and severe psychological distress was, respectively, 42.6% and 6.2% (Yokoyama et al., 2014), higher than representative Japanese studies (Fukuda and Hiyoshi, 2012; Kuriyama et al., 2009; Sakurai et al., 2011). Japan faces great challenges in recovering from the damage, both financially and psychosocially (Kako et al., 2014).

Moreover, the speed of recovery from a disaster differs between communities. Social capital, defined as “resources that are accessed by individuals as a result of their membership of a network or a group” (Kawachi, 2014), is considered an important determinant of speed of recovery (Aldrich, 2012). Social relationships, one of the resources of social capital, have been considered a key element of mental health recovery after disasters (Hobfoll et al., 2007). Previous studies have reported significant associations between social relationships and mental health after disasters. Social support (North and Pfefferbaum, 2013; Uscher-Pines, 2009) and social networks (Oyama et al., 2012; Yokoyama et al., 2014) were associated with better mental health.

Some survivors of the Great East Japan Earthquake have lived in prefabricated temporary housing, built collectively in some regions of damaged areas. Therefore, each prefabricated temporary housing site is regarded as a community of earthquake survivors. Social relationships in prefabricated temporary housing communities are likely to differ because relocation following a disaster disrupts pre-disaster social relationships (Uscher-Pines, 2009), with some survivors having to live in new communities. This difference in social relationships might contribute to differences across communities in the speed of recovery of mental health. However, comparing differences in mental health recovery between different communities is difficult because most previous studies were conducted in small areas. In addition, a few studies have simultaneously investigated the effects of community- and individual-level social relationships on mental health after disasters, although both types of social relationships could be associated with survivors' mental health. A multilevel study after a flood in Morpeth, England, in 2008, reported that community-level social capital was protectively associated with individual post-traumatic stress (Wind and Komproe, 2012). However, the study's causal inferences are limited because the study design was cross-sectional. Thus, we conducted a prospective cohort study, using large-scale panel data, with two aims: 1) to investigate whether disaster survivors' psychological distress differs between prefabricated temporary housing communities, and 2) to investigate prospective associations between individual- and community-level social relationships and disaster survivors' psychological distress.

## 2. Methods

### 2.1. Study design

Conducting a prospective cohort study, we examined associations between survivors' individual- and community-level social relationships at a baseline survey (conducted from September to December 2012, approximately 1.5 years after the disaster) and

their mental health after 1 year at a follow-up survey (conducted from September to November 2013, approximately 2.5 years after the disaster) considering their mental health at baseline.

### 2.2. Study area

The study area was Miyagi prefecture, which is located in northeast Japan and was the closest prefecture to the epicenter of the Great East Japan Earthquake. Damage in the prefecture was huge; there were 10,487 deaths (Miyagi prefecture government, 2014) and the total number of people directly affected was over 120,000. Evacuees numbered 87,000 as of 2014 (Reconstruction Agency, 2014).

### 2.3. Survey and participants

We conducted a secondary analysis using data from the first and second waves of the Health Survey of Residents in Prefabricated Temporary Housing in Miyagi prefecture: a large-scale ongoing panel survey conducted by the Miyagi prefectural government and municipal governments in Miyagi prefecture. The survey's purpose was to follow survivors' longitudinal health status after the disaster. Although the survey targeted all residents living in temporary housing communities in municipalities, we used only data of participants aged 18 years or older because only their questionnaires included questions about mental health. Eight municipalities in the prefecture participated in both surveys, which had 306 groups of prefabricated temporary housing communities. We considered each group a “community,” because people there had worked together in a group since the disaster. The first survey was conducted from September to December 2012. Administrative officers distributed self-administered questionnaires to all 15,979 households in the 306 prefabricated temporary housing communities. Study participants returned questionnaires by mail or gave them to administrative officers who visited to collect questionnaires. Among the 15,979 households, 19,284 participants (aged 18 years or older) responded from 9366 households (household-based response rate of the survey = 58.6%). An individual-based response rate is not available in the present survey because the questionnaires were sent to each household, not to every resident. The reasons for non-response are also not available. The second survey was conducted from September to November 2013, with the same procedure, and 10,880 participants responded from 5501 households (household-based follow-up rate of the survey = 58.7%; individual-based follow-up rate = 56.4%).

### 2.4. Outcome: psychological distress at follow-up

To evaluate survivors' psychological distress, we used the K6 scale developed by Kessler et al. (Kessler et al., 2002, 2003). The K6 scale consists of six questions that measure nonspecific psychological distress. Each question asks respondents to rate on a five-point scale the frequency of psychological symptoms experienced during the past 30 days. Thus, total scores can range from zero (“no distress”) to 24 (“maximum distress”). The K6 was administered at baseline and follow-up. The K6 score at follow-up was used as the outcome variable, whereas the K6 score at baseline was used as a covariate. The K6 scores were used as continuous variables.

### 2.5. Predictor: individual- and community-level social support and social participation

Our predictors were individual-level social support, individual-level social participation, community-level social support, and community-level social participation, all of which were assessed at

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