



Research paper

Psychological distress and the incident risk of functional disability in elderly survivors after the Great East Japan Earthquake



Fumiya Tanji^{a,*}, Yumi Sugawara^a, Yasutake Tomata^a, Takashi Watanabe^a, Kemmyo Sugiyama^a, Yu Kaiho^a, Hiroaki Tomita^b, Ichiro Tsuji^a

^a Division of Epidemiology, Department of Health Informatics and Public Health, Tohoku University School of Public Health, Graduate School of Medicine, Sendai, Japan

^b Department of Disaster Psychiatry, International Research Institute of Disaster Science, Tohoku University, Sendai, Japan

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ABSTRACT

Background: We conducted a prospective cohort study to investigate whether psychological distress would have increased the incident risk of functional disability after the 2011 Great East Japan Earthquake.

Methods: First phase data pertaining to psychological distress and other lifestyle factors were collected from 1037 subjects aged ≥ 65 years, from June to December 2011, in four affected areas of Miyagi prefecture in Japan. Psychological distress was measured by the Kessler 6-item psychological distress scale (K6), and classified into three categories (K6 score ≤ 9 , 10–12, ≥ 13). Outcome data on functional disability were collected from the public Long-term Care Insurance database. Participants were followed up for about 2.6 years. The Cox model was used to calculate the multivariate hazard ratios (HRs) and 95% confidence intervals (CIs).

Results: During the follow-up period, 118 participants were certified as incident disability (43.8 disability events per 1000 person-years). Compared with the lowest category (K6 score ≤ 9), participants in the highest category (K6 score ≥ 13) had a significantly higher risk of functional disability (HR = 2.65, 95% CI = 1.35–5.18, $p = 0.002$). In order to consider reverse causality, we conducted analysis excluding all incidents and deaths that occurred within the first year of follow-up, but our findings remained unchanged.

Limitations: We did not consider all potential confounders and use of appropriate medication.

Conclusions: The present study has demonstrated that psychological distress was associated with an increased risk of functional disability among elderly survivors of a natural disaster.

1. Introduction

The Great East Japan Earthquake (GEJE) and tsunami on March 11, 2011, not only took the lives of more than 15,000 people (National Police Agency, 2016), but also affected the health and physical function of elderly survivors (Ishiki et al., 2016; Ohira et al., 2015; Sato et al., 2015; Tanisho et al., 2016; Tomata et al., 2014, 2015). Our previous study had shown that the prevalence of functional disability, defined as having disability certification by the Japanese Long-Term Care Insurance (LTCI) system, among the elderly increased sharply after the GEJE (Tomata et al., 2015). The rate of increase in disability prevalence during the 3 years after the GEJE was higher in coastal (14.7%) and inland (10.0%) disaster areas than in non-disaster areas (6.2%).

Psychological distress was assumed to be one of the risk factors for increased disability prevalence, because previous studies targeting the general elderly population have reported that psychological ill-health is a major risk factor for functional disability (Gallagher et al., 2016;

Iwasa et al., 2009; Ohmori-Matsuda et al., 2010; Stuck et al., 1999; Yamazaki et al., 2012). The prevalence of psychological distress among GEJE survivors is reported to be higher than in the general population (Sugimoto et al., 2015; Yokoyama et al., 2014). One suggested mechanism for this association is that people with depression have low levels of physical activity and high levels of sedentary behavior (Schuch et al., 2017). Additionally, it has been reported that physical activity among survivors of the GEJE living in temporary housing was decreased for a year after the disaster (Murakami et al., 2014). Therefore, increased prevalence of psychological distress may be a cause of increased disability prevalence in disaster areas.

To our knowledge, however, no previous study of a prospective design has examined the association between psychological distress and the incident risk of functional disability among natural disaster survivors. Therefore, we hypothesize that psychological distress increases the incident risk of functional disability in elderly survivors of natural disasters. If this is indeed the case, then this would help to explain the

* Correspondence to: Division of Epidemiology, Tohoku University School of Public Health, Graduate School of Medicine, 2-1, Seiryō-machi, Aoba-ku, Sendai, Miyagi 980-8575, Japan.
E-mail address: ftanji-thk@umin.ac.jp (F. Tanji).

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increase in disability prevalence after the GEJE, and facilitate better planning for disability prevention after natural disasters.

The aim of the present study was to examine whether psychological distress would have increased the incident risk of functional disability among elderly survivors after the GEJE, using a prospective cohort data.

2. Methods

2.1. Study cohort

The design of this cohort study has been described in detail elsewhere (Hagiwara et al., 2016; Sone et al., 2016). In brief, we conducted questionnaire surveys of residents aged 18 years or older who were included in the Residential Registry for Ogatsu, Oshika and Ajishima, Ishinomaki City, Miyagi Prefecture, and whose houses were largely or totally destroyed by the earthquake and tsunami in Shichigahama Town, Miyagi Prefecture. We conducted baseline surveys from June to December 2011, and then followed up participants for information on the date of incident disability (LTCI certification), death, or emigration (between the baseline and July 1, 2014).

At the baseline survey, 3467 (41.7%) out of 8317 eligible subjects participated. Of these subjects, 1584 were aged 65 years and older. We excluded 384 persons who did not provide written consent for review of their LTCI information, 110 persons who had already been certified as having disability by the LTCI, 2 persons who had moved, and 51 persons who provided incomplete answers about psychological distress measured by the Kessler 6-item psychological distress scale (K6) (Kessler et al., 2002). Thus, a total of 1037 persons formed the cohort under study.

2.2. Exposure data

The main exposure was psychological distress, as measured by the K6 (Kessler et al., 2002). The Japanese version of the K6 has been validated previously (Furukawa et al., 2008). 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 was an effort, and 6) worthless. The total K6 score ranged from 0 to 24. In previous studies, two cut-off points of 10 and 13 has been commonly used to screen for psychological stress (Fushimi et al., 2012; Sone et al., 2016; Watanabe et al., 2016; Yokoyama et al., 2014). Thus, we classified participants into three groups according to their K6 score (low: 0–9, moderate: 10–12, high: 13–24).

2.3. Covariates

We regarded the following variables as potential confounders: age (continuous variable), sex, past medical history (cancer, stroke, or myocardial infarction), smoking status (currently smoking, or non-smoking), drinking status (currently drinking, or non-drinking), walking time (< 0.5, 0.5–1, or ≥ 1 h/day), residence (same house as that before the earthquake, or others including temporary housing, rental housing, house of a family member, relative or friend, and evacuation site), residential area (Ogatsu, Oshika, Ajishima, or Shichigahama), and subjective economic status [normal, slightly severe, or severe (very severe or severe)].

Social networks were evaluated using the Lubben Social Network Scale-6 (LSNS-6), which consists of 6 questions designed to screen for social isolation among community-dwelling older adult populations (Kurimoto et al., 2011; Lubben et al., 2006). Total point scores ranged from 0 to 30. We classified individuals with scores of ≤ 11 as having weak ties and those with scores of ≥ 12 as having strong ties (Lubben et al., 2006).

2.4. Follow-up and case details

The primary endpoint was incident functional disability, which was defined as newly qualifying for LTCI certification, regardless of certification level, up to July 1, 2014. LTCI certification in Japan has used a nationally uniform standard of functional disability. LTCI is a mandatory form of social insurance aimed at assisting activities of daily living (ADL) in the frail and elderly (Ikegami, 1997; Imai et al., 2008; Ministry of Health; Tsutsui and Muramatsu, 2005). Everyone aged 40 years or older pays premiums, and people aged 65 years or older are eligible for formal caregiving services. When the elderly require assistance with ADL, they apply to the municipal government for benefits, and undergo assessment of their degree of functional disability by care managers using a questionnaire developed by the Ministry of Health, Labor and Welfare. Then, the municipal government calculates the standardized scores for physical and cognitive impairment on the basis of the questionnaire and physician's judgment report. Subsequently, the Municipal Certification Committee assesses whether the applicant is eligible for LTCI benefits. If a person is judged to be thus eligible, the Municipal Certification Committee decides on one of seven levels of support, ranging from Support Level 1, Support Level 2, and Care Level 1 to Care Level 5. In brief, LTCI certification levels are defined as follows. Support Level 1: "limited in instrumental activities of daily living but independent in basic activities of daily living (ADLs)"; Care Level 2: "requiring assistance in at least one basic ADL task"; Care Level 5: "requiring care in all ADL tasks". A community-based study has shown that levels of LTCI certification are well correlated with ability to perform activities of daily living, and with Mini-Mental State Examination scores (Arai et al., 2003). LTCI certification has already been used in many studies as a measure of incident functional disability in the elderly (Chou et al., 2014; Kanamori et al., 2014).

All participants were followed up by reviewing information on the date of LTCI certification, death or emigration from Ishinomaki City and Shichigahama Town Government. All data were transferred from each government under the agreement related to Epidemiologic Research and Privacy Protection.

2.5. Ethical issues

We received written consent along with the questionnaires from participants for both participation in the study and having their own LTCI certification information reviewed for study. The Ethics Committee of Tohoku University Graduate School of Medicine reviewed and approved the study protocol.

2.6. Statistical analysis

The person-years of follow-up were counted from the first date of the baseline survey at each site (Ogatsu: June 24, 2011, Oshika: August 7, 2011, Ajishima: September 10, 2011, Shichigahama: November 18, 2011) until the date of incident functional disability, date of emigration from each area, date of death, or the end of the study period (July 1, 2014), whichever occurred first.

We used the Cox proportional hazards model to calculate the hazard ratios (HRs) and 95% confidence intervals (CIs) for incident functional disability according to each category of K6, treating the lowest category as the reference category, and to adjust for the confounding variables. For cases where values for a confounding variable were missing, we created a separate missing category and included this in the model. We also calculated multivariate HRs and p values for trend by using the K6 category variables.

Additionally, to examine possible reverse causality, we repeated the analyses after excluding all deaths without disability and incident functional disability that occurred within the first year of follow-up. Furthermore, we employed a competing risk model (Berry et al., 2010; Fine and Gray, 1999; Xue et al., 2008) and did not treat deaths

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