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Short communication

Long-term impact of the 2011 Great East Japan Earthquake and tsunami on functional disability among older people: A 3-year longitudinal comparison of disability prevalence among Japanese municipalities

Yasutake Tomata [a, *], Yoshinori Suzuki [b], Miyuki Kawado [c], Hiroya Yamada [c], Yoshitaka Murakami [d], Makiko Naka Mieno [e], Yosuke Shibata [f], Toshiyuki Ojima [f], Shuji Hashimoto [c], 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 Health and Nutrition, Faculty of Human Sciences, Sendai Shirayuri Women's College, Sendai, Japan
[c] Department of Hygiene, Fujita Health University School of Medicine, Toyoake, Japan
[d] Departmant of Medical Statistics, Toho University, Ota-ku, Tokyo, Japan
[e] Department of Medical Informatics, Center for Information, Jichi Medical University, Shimotsuke, Japan
[f] Department of Community Health and Preventive Medicine, Hamamatsu University School of Medicine, Hamamatsu, Japan

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ABSTRACT

It has been unclear whether the prevalence of disability is higher in an area affected by natural disaster than in other areas even if more than one year has passed since the disaster. The aim of this ecological study was to examine whether the rate of increase in disability prevalence among the older population was higher in disaster-stricken areas during the 3 years after the Great East Japan Earthquake (GEJE) and tsunami. This analysis used public Long-term Care Insurance (LTCI) data covering 1570 municipalities. "Disaster areas" were considered to be the three prefectures most affected by the earthquake and tsunami: Iwate, Miyagi, and Fukushima. The outcome measure was the number of aged people (≥65 years) with LTCI disability certification. Rates of change in disability prevalence from January 2011 to January 2014 were used as the primary outcome variable, and compared by analysis of covariance between "coastal disaster areas", "inland disaster areas" and "non-disaster areas". The mean rate of increase in disability prevalence in coastal (14.7%) and inland (10.0%) disaster areas was higher than in non-disaster areas (6.2%) ($P < 0.001$). During the 3 years after the earthquake, the increase of disability prevalence from before the GEJE continued to be higher in the disaster-stricken areas.

1. Introduction

Natural disasters affect functional status among older people. The Great East Japan Earthquake (GEJE) and tsunami on March 11, 2011, directly caused more than 15,000 deaths, but also affected the functional status of older survivors (Ishigaki et al., 2013). Our previous study showed that the prevalence of functional disability increased steeply during the one year after the GEJE, especially in the coastal disaster areas most severely affected by the disaster (Tomata et al., 2014).

Currently, even 3 years after the GEJE, about 315,000 people still remain at evacuation sites (Ishigaki et al., 2013). Previous studies have indicated that such relocated individuals tend to have psychological morbidity and physical inactivity (Murakami et al., 2014; Uscher-Pines, 2009). Therefore, there has been some concern that disability prevalence will continue to increase in the disaster-stricken areas. However, to our knowledge, no study has yet reported this long-term impact of the GEJE.

The aim of this ecological study was to test the hypothesis that the increase in the rate of disability prevalence among the older

* Corresponding author. Division of Epidemiology, Department of Health Informatics and Public Health, Tohoku University School of Public Health, Graduate School of Medicine, 2-1, Seiryo-machi, Aoba-ku, Sendai, Miyagi 980-8575, Japan.
E-mail address: y-tomata@med.tohoku.ac.jp (Y. Tomata).

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population was higher in the disaster-stricken areas than in other areas of Japan, after more than one year had passed after the GEJE. For this purpose, we analyzed Japanese national statistical data covering a period of 3 years after the disaster.

2. Methods

2.1. Study design

The authors performed an ecological study using data from the Report on the Status of the Long-term Care Insurance (LTCI) Project, issued by the Ministry of Health, Labour and Welfare of Japan (Ministry of Health). The Report on the Status of the (LTCI) Project is based on a routine survey conducted on data from all Japanese municipalities.

To confirm whether the changes that occurred in the 3-year period after the GEJE were particularly bigger than those that had occurred in the one-year period before it, statistical data for the 50 months from January 2010 to February 2014 were collected. These data included the status of municipalities at the end of each month.

2.2. Outcome

Functional disability was defined according to disability certification in the LTCI system. Disability prevalence (%) in each municipality every month was calculated as the "number of persons who were certified for LTCI/number of insured elderly population aged ≥65 years".

The LTCI is a mandatory form of social insurance designed to assist the frail elderly in their daily activities (Tsutsui and Muramatsu, 2005). Every person aged >65 years is eligible for formal caregiving services. A person must be certified according to the nationally uniform standard to receive caregiving services through the LTCI system.

2.3. Statistical analysis

All municipalities in Japan which were included in the LTCI system as of February 2014 (n = 1579) were defined as the study subjects.

In the present study, "disaster areas" were defined as municipalities in the prefectures of Iwate, Miyagi, and Fukushima, which were extensively damaged by the GEJE (Ishigaki et al., 2013). Furthermore, the disaster areas were classified into "coastal disaster areas" (municipalities bordering the Pacific coast) and "inland disaster areas" for assessing the damage caused by the tsunami, in common with the previous study (Tomata et al., 2014). Additionally, "non-disaster areas" were defined as the municipalities in the other 44 prefectures in Japan.

The municipalities were excluded if any data necessary for the main analysis were missing because the damage caused by the GEJE was particularly great and no statistical information was available because regional government offices were temporarily non-functional (n = 7. These municipalities included 13,621 insured elderly persons [0.05% of all insured elderly persons in all the municipalities]). As a result, a total of 1572 municipalities were included in the main analysis.

Because these excluded municipalities did not meet this exclusion criterion when we used only two data points (January 2011 and January 2014), we also conducted sensitivity analysis using all of the municipalities (n = 1579).

The primary outcome was the annual rate of change in disability prevalence from January 2011 to January 2014.

To check whether the degree of increase in the prevalence of disability was higher in the disaster-stricken areas at each point, we compared the rates of change in disability prevalence for every one-year period between each of the years.

3. Results

3.1. Baseline characteristics

The baseline characteristics in January 2011 were as follows (Table 1). The mean number of insured elderly persons aged ≥65 years was 19,346 in the coastal disaster areas, 9787 in the inland disaster areas, and 18,969 in the non-disaster areas (P = 0.135 by ANOVA). The mean disability prevalence was 16.0% in the coastal disaster areas, 16.5% in the inland disaster areas, and 16.7% in the non-disaster areas (P = 0.399 by ANOVA).

3.2. Three-year change in disability prevalence

As shown in Table 2, the mean rate of increase in disability prevalence differed significantly among the area groups at 2 years and 3 years later ($P < 0.001$). In the 3 years after the GEJE, the rate of increase in disability prevalence was significantly higher in coastal (14.7%) and inland (10.0%) disaster areas than in non-disaster areas (6.2%) (post-hoc univariate analysis by Dunnett's t test; $P < 0.001$).

We compared the rates of change in disability prevalence for every one-year period between each of the years, and the differences between groups (F-value) decreased with each passing year (Table S1). The rate of increase in coastal disaster areas tended to be higher than in non-disaster areas at each point, but the mean rates between January 2013 and January 2014 did not differ significantly (post-hoc univariate analysis by Dunnett's t test; $P = 0.176$).

Because the excluded municipalities did not meet this exclusion criterion when we used only two data points (January 2011 and January 2014), we also conducted sensitivity analysis using all of the municipalities (n = 1579). In the 3 years after the GEJE, the rate of increase in disability prevalence in coastal disaster areas was 18.5% (Table S2).

3.3. Fifty-month change in disability prevalence

Disability prevalence increased in each region between January 2010 and February 2014 (Fig. 1). In this analysis, the sample size was n = 1526 municipalities (among 1572 municipalities, some were excluded if: 1) any data from January 2010 to February 2014 had been rendered unavailable [n = 8]; 2) data had been recorded using the classification system employed before April 2006 [n = 2]; or 3) the outcome variable [mild disability or moderate to severe disability] when stratified by the age structure of the population [65–74 years or ≥75 years] was 0% at any point, because it was a village with a particularly small population [n = 36]).

Even more than one year after the disaster, disability prevalence in coastal disaster areas tended to increase.

4. Discussion

The aim of this ecological study was to examine whether the increase in the rate of disability prevalence among the older population during the 3 years after the GEJE was higher in the disaster-stricken areas, relative to other areas of Japan. This analysis showed that disability prevalence in disaster-stricken areas increased more markedly during the 3 years after the GEJE, especially in coastal disaster areas where the damage due to the tsunami had been especially serious. However, the difference in the degree of increase in disability prevalence between the disaster-stricken and non-disaster areas tend to shrink year by year (Table S1).