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Original Article

Effect of evacuation on liver function after the Fukushima Daiichi Nuclear Power Plant accident: The Fukushima Health Management Survey

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ABSTRACT

Background: The Great East Japan Earthquake and subsequent Fukushima Daiichi Nuclear Power Plant accident caused residents to switch from their normal lives to lives focused on evacuation. We evaluated liver function before and after this disaster to elucidate the effects of evacuation on liver function.
Methods: This study was a longitudinal survey of 26,006 Japanese men and women living near the Fukushima Daiichi Nuclear Power Plant. This study was undertaken using data from annual health checkups conducted for persons aged 40–90 years between 2008 and 2010. Follow-up examinations were conducted from June 2011 to the end of March 2013, with a mean follow up of 1.6 years. Changes in liver function before and after the disaster were compared among evacuees and non-evacuees. We also assessed groups according to alcohol drinking status.
Results: The prevalence of liver dysfunction significantly increased in all participants from 16.4% before to 19.2% after the disaster. The incidence of liver dysfunction was significantly higher in evacuees than in non-evacuees. Multivariate logistic regression analysis showed that evacuation was significantly associated with liver dysfunction among residents.
Conclusions: This is the first study to show that evacuation due to the Fukushima Daiichi nuclear power plant disaster was associated with an increase in liver dysfunction.

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Introduction

The Great East Japan Earthquake, which occurred on March 11, 2011 in the Pacific coast of the northern area of Japan, registered a magnitude 9.0. The earthquake caused serious damage, including a subsequent tsunami and an accident at the Fukushima Daiichi Nuclear Power Plant. As a result, more than 160,000 residents in Fukushima Prefecture were forced to evacuate.

Health problems subsequent to extensive lifestyle changes are a matter of great concern worldwide. As such, the "Fukushima Health Management Survey (FHMS)" was started after the earthquake.[1] The survey was launched to monitor the long-term health of residents and comprises four detailed surveys, including a comprehensive health check for all residents from evacuation zones. Some reports have shown an increase in cardiovascular disease, stroke, and peptic ulcers after a disaster.[2–7] However, few reports have examined changes in liver function after a disaster.[8] Recently, we reported that liver dysfunction increased after the Great East Japan Earthquake in the 2011–2012 follow-up of the FHMS; however, the causes and risk factors for liver dysfunction are still unknown.[9] The goals of the present study were to elucidate effects of evacuation on changes in liver function among residents in the Fukushima Prefecture in Japan after the Great East Japan Earthquake.

Methods

Study population

We analyzed a subset of participants from FHMS. Participants were Japanese men and women living near the Fukushima Daiichi Nuclear Power Plant in the following areas of Fukushima Prefecture: Tamura City, Minamisoma City, Kawamata-machi, Hirono-machi, Naraha-machi, Tomioka-machi, Kawauchi-mura, Okuma-machi, Futaba-machi, Namie-machi, Katsurao-mura, Iitate-mura, and Date City. In 2010, the Census populations of these communities were 42,085, 71,661, 16,065, 5,495, 7927, 15,854, 3074, 11,553, 7171, 21,551, 1582, 6584, and 67,684 people, respectively (total, 278,276 people). Following the disaster, the government designated the 20-km-radius area around the Fukushima Daiichi Nuclear Power Plant as a "restricted area" with compulsory evacuation. The government subsequently designated a 20- to 30-km-radius area around the plant as an "evacuation-prepared area in case of emergency," and areas near the 30-km-radius area where high-level radiation exposure (>20 mSv/y) was expected were designated as "deliberate evacuation areas". As a result, all residents of Hirono-machi, Naraha-machi, Tomioka-machi, Kawauchi-mura, Okuma-machi, Futaba-machi, Namie-machi, Katsurao-mura, Iitate-mura, and part of Tamura City, Minamisoma City, Kawamata-machi, and Date City were forced to evacuate their homes at the direction of the government, based on increased local radiation levels after the Fukushima Daiichi Nuclear Power Plant accident (Fig. 1). In these communities, residents aged 40–74 years and the elderly aged ≥75 years (the target population for checkups consisted of 91,554 men and women in 2010) have undergone annual health checkups for insured people of the Japan's National Health Care Insures. This study limited all analyses to men and women aged 40–90 years (the census population aged 40–90 years of these communities was 164,714 in 2010). Between 2008 and 2010, 41,633 participants (18,745 men and 22,888 women; mean age, 67 years) in the communities

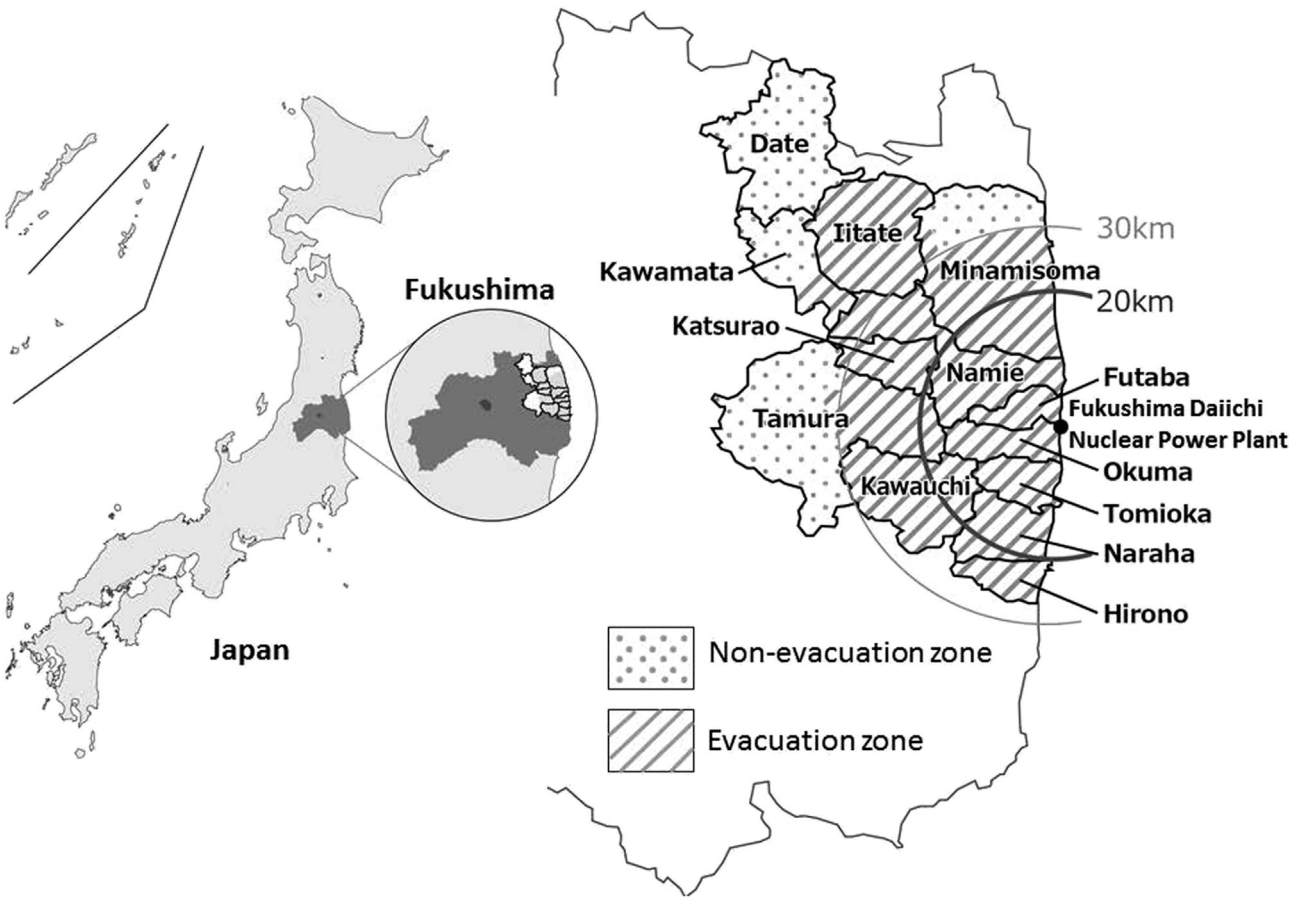

Fig. 1. Map of the evacuee zone, non-evacuee zone, and the Tokyo Daiichi Nuclear Power Plant.

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