

Mental health consequences of the 2011 Fukushima nuclear disaster: are the grandchildren of people living in Hiroshima and Nagasaki during the drop of the atomic bomb more vulnerable?

On March 11, 2011 Japan was struck by a magnitude 9.0Mw earthquake. The results were severe, as more than 15,000 people were killed by the earthquake and the following tsunami (1). The aftermath of the disaster was a level 7 nuclear meltdown in Fukushima, matching only the Chernobyl disaster (1,2). The literature on behavioural reactions after nuclear disasters is scarce (3-5), mainly addressing anxiety. In the case of Japan, the nuclear disaster has awakened the memories of the World War II atomic bombs and as such, might have raised a historically based fear among Japanese (6). Our aim was to examine the differences between people whose grandparents were living in the greater area of Hiroshima and Nagasaki during the dropping of the atomic bombs and those whose grandparents were not.

A convenience sample of 140 Japanese was collected during the week of April 24, 2011. Each participant was initially screened by a Japanese interviewer for history of physical or mental disorders and substance abuse. Six participants were excluded from this survey because of positive history of the aforementioned conditions and 12 more participants had a significant number of missing data, leading to a final sample of 122 participants.

The participants (mean age 28.7±9.0 years, 64.2% women, 29.1% married) filled a short questionnaire collecting demographic data and asking a screening question: "were your grandparents exposed to the atomic bomb in Hiroshima or Nagasaki?" A "yes" answer led the interviewer to inquire if the grandparents were living in 1945 in the greater area of Hiroshima or Nagasaki when the atom bombs were dropped. We divided the sample into two groups: grandchildren of people who where in greater Hiroshima and Nagasaki during World War II (n=34) and a comparison group (n=88). Each participant was administered a battery of self-reported questionnaires, including questions about fear of radiation exposure, rated on a four Likert scale ranging from 1 (not at all) to 4 (very much).

Post-traumatic stress disorder (PTSD) symptoms were assessed by the 22-item Impact of Event Scale – Revised (IES-R) (7). This scale was rated from 0 (not at all) to 4 (extremely) and represents the participants' distress in the following week regarding the Fukushima disaster. This measure was used before and was found to be suitable in other major disasters such as the 2010 Haiti's earthquake (8).

Grandchildren of Japanese living in Hiroshima and Nagasaki showed higher fear of radiation exposure (mean 3.0±0.9 vs. 2.7±0.8; $t=2.131$; $p=0.035$), and higher level of PTSD

symptoms (mean 32.8±21.6 vs. 23.0±15.4; $t=2.755$; $p=0.007$). There were no significant differences between the groups in age, gender, marital status and distance from Fukushima.

These findings may indicate the existence of a sub-group among the Japanese population who shows a specific vulnerability to PTSD and fear of radiation exposure. Although the sample size was small and the design cross-sectional, this study may be of interest, because this is the first time that a nuclear disaster occurs in a country with prior exposure.

This study may encourage future longitudinal investigations focusing on the long-term psychological and psychiatric sequelae of nuclear disaster (1,3-5).

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