



Letter to the Editor

Mental health and disaster related attitudes among Japanese after the 2011 Fukushima nuclear disaster

Dear Sir,

On March 11, 2011 Japan was struck by a magnitude 9.0 Mw earthquake. The results were severe with more than 15,000 people being killed by the earthquake and the following tsunami (Normile, 2011). The aftermath of the disaster was a level 7 nuclear meltdown at Fukushima, matching only the Chernobyl disaster (Weissmann, 2011). The literature of behavioural reactions after nuclear disasters is scarce (Anspaugh et al., 1988; Havenaar et al., 1997; Baum et al., 1983), mainly addressing anxiety. Moreover, in the case of Japan, the nuclear disaster has awakened the memories of the WWII atomic bombs and as such, might have raised historically-based panic among the Japanese (McCartney, 2011). Due to intergenerational transmission of past trauma, the grandchildren of those who survived the dropping of the atom bombs on Hiroshima and Nagasaki may be at high risk of developing mental distress following the current disaster. Parental distress is presumed to be transferred to offspring through maladaptive, postnatal maternal behaviours (Yehuda et al., 2008), child-rearing behaviours (Bar-On et al., 1998; Scharf, 2007), and parental communication of the trauma (Wiseman et al., 2006). Intergenerational transmission of traumatic experiences was found to escalate when second (Baider et al., 2000; Solomon et al., 1998) and third (Scharf, 2007) generation Holocaust survivors were confronted with adverse life events. It is assumed that memories of WWII and the dropping of the A-bombs will be awakened due to the nuclear disaster caused by the Sendai earthquake. These memories will affect the grandchildren of the A-bomb survivors more intensely.

Our aim was to examine the association between people whose grandparents were living in the greater area of Hiroshima and Nagasaki during the dropping of the atom bombs and disaster-related factors and an elevated risk of a clinical level of posttraumatic stress disorder (PTSD). We hypothesized that Japanese whose grandparents lived in the greater area of Hiroshima and Nagasaki would exhibit a higher level of disaster-related vulnerabilities, which present as greater worries regarding the occurrence of future disasters, and a higher proportion of elevated risk of a clinical level of PTSD in comparison to Japanese whose grandparents were not exposed.

1. Methods

A convenience sample of 140 Japanese was collected during the week of 24 April 2011. Each participant was initially screened by a Japanese interviewer for a history of medical or mental disorders and substance abuse. Six participants were excluded from this

survey because of a positive history of the aforementioned conditions and for 12 more participants a significant number of values were missing, leading to a final sample of 122 participants. A battery of self-report questionnaires in Japanese, translated from English and subsequently translated back into English, was administered to each participant. The translations were conducted by different people who were fluent in both English and Japanese.

Each participant had signed an informed consent form. The study was approved by the Institutional Review Board in the School of Social work in Ariel University Center of Samaria.

The survey included demographic questions (age, gender, marital status), a screening question: "Were your grandparents exposed to the atomic bomb in Hiroshima or Nagasaki?" A 'yes' answer led the interviewer to enquire 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: an 'atom' group ($n = 34$) – to represent those who answered 'yes' to the aforementioned question and a comparison group ($n = 88$) – to represent those who answered 'no'.

Disaster related questions included the following: "Since the Fukushima disaster, do you think of Hiroshima and Nagasaki?" This question was rated on a four-point Likert scale ranging from 1 (not at all) to 4 (very much). Another question asked "What is the distance from your residence to Fukushima in kilometres?"

Worries about future disasters were measured by the following: "How worried are you about the occurrences of the following future disasters?" (Nuclear disaster, tsunami, earthquake, any other disaster) rated on a five-point Likert scale ranging from 1 (not at all) to 5 (very much) (Cronbach's $\alpha = 0.89$). A similar method was previously used for risk perception in an earlier study (Sjöberg, 2000).

Meaning in life was measured by the meaning presence subscale of the Meaning in Life Questionnaire (MLQ) (Steger et al., 2006). This 5-item subscale is a very reliable scale (Cronbach's $\alpha = 0.89$).

Posttraumatic stress disorder (PTSD) symptoms were assessed by the 22-item Impact of Event Scale-Revised (IES-R) (Weiss and Marmar, 1997). The IES-R is highly reliable (Cronbach's $\alpha = 0.90$). An IES-R score of 33 and above is an indication of an elevated risk of clinical levels of PTSD (Creamer et al., 2003). This measure was used before and was found to be suitable in relation to other major disasters, such as the 2010 Haiti Earthquake (Ben-Ezra and Soffer, 2010).

We used logistic regression to explore the association between the atom group and an elevated risk of clinical levels of PTSD,

sequentially adjusting for sociodemographic variables (age, gender, marital status), disaster-related factors (thinking about Hiroshima and Nagasaki, fear of radiation exposure, distance from Fukushima in kilometres), worries concerning the occurrence of future disasters (nuclear disaster, tsunami, earthquake, any other disaster) and meaning in life by calculating odds ratios. All analyses were performed using SPSS statistical software (version 19.0, SPSS Inc., Chicago, IL).

2. Results

For demographic information, see Table 1. The atom group reported more rumination of Hiroshima and Nagasaki ($t = 2.015$; $p = 0.046$) and a higher proportion of elevated risk of clinical levels of PTSD (IES-R ≥ 33 , $\chi^2 = 2.117$; $p = 0.0034$).

Before adjustment, in the first step, membership of the atom group was related to an elevated risk of clinical levels of PTSD (OR = 2.40, 95% CI 1.06–5.44; $P = 0.036$). Adding sociodemographic variables (age, gender, marital status) to the model in the second step did not alter the relationship (OR = 2.73, 95% CI 1.09–6.81; $P = 0.032$), neither did rumination on Hiroshima and Nagasaki (OR = 2.77, 95% CI 1.09–7.05; $P = 0.033$), and the factors ‘another nuclear meltdown disaster’ (OR = 2.64, 95% CI 1.04–6.70; $P = 0.042$), ‘another earthquake’ (OR = 2.74, 95% CI 1.08–6.92; $P = 0.034$), ‘any other disaster’ (OR = 2.79, 95% CI 1.08–7.19; $p = 0.034$), and meaning in life (OR = 2.68, 95% CI 1.05–6.87; $p = 0.040$) that were entered in the third step. However, the inclusion of the factor ‘fear of radiation’ (OR = 1.90, 95% CI 1.07–3.37; $p = 0.028$) in the third step appeared to mediate fully the relationship between the atom group and an elevated risk of clinical levels of PTSD, meaning that this relationship became non-significant (OR = 2.36, 95% CI .91–6.08; $P = 0.076$). Similar result was also found for the factor fearing ‘another tsunami’ (OR = 1.71, 95% CI 1.14–2.57; $P = 0.010$) that appeared to mediate fully the relationship

between the atom group and elevated risk of clinical levels of PTSD (OR = 2.47, 95% CI .94–6.44; $P = 0.065$).

3. Discussion

The main finding of this study is that people whose grandparents had lived in the greater Hiroshima or Nagasaki area exhibited a higher proportion of elevated risk of a clinical level of PTSD, more rumination about Hiroshima and Nagasaki, and more worries about the occurrences of future disasters (namely, nuclear meltdown and tsunami). This may indicate the existence of a vulnerable sub-group among the Japanese population who show specific vulnerabilities and should be addressed by mental health professionals. It seems that these specific vulnerabilities are mainly seen in specific cognitions and worries about future disasters without alteration in the participants’ meaning in life, which is known to be affected in times of disaster (Owens et al., 2009). Moreover, it is of interest that, although more than 15,000 people were killed by the earthquake and the following tsunami and none by direct radiation, both fears similarly mediated the relation between being in the atom group and an elevated risk of clinical levels of PTSD. This finding emphasizes the subjective component of fear as a risk factor for PTSD symptomatology.

The main limitations of this study were sample size and specifically the atom group size. In addition, its cross-sectional design was another limitation.

In sum, it is possible that transgenerational processes contributed to the development of a vulnerable sub-group among the Japanese population. In addition, the subjective fear of radiation needs to be addressed by mental health authorities and scientists who will explain the true risk of exposure to low radiation in Japan. However, further studies are needed in order to generalize from this specific vulnerable sub-group of Japanese to other groups who may be at risk due to intergenerational transmission, and additional studies are needed to find appropriate interventions.

Conflict of interest

We declare no conflict of interest or any financial support for this research.

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Table 1
Sample factors profile.

	Atom group (n = 34)	Comparison group (n = 88)	Test statistics	P value
Age, Mean (SD)	26.5 (6.7)	29.3 (9.9)	$t = -1.440$	.153
Gender ^a			$\chi^2 = .143$	.887
Male	11 (32.4)	29 (33.7)		
Female	23 (67.6)	57 (66.3)		
Marital status ^b			$\chi^2 = .950$	.342
Married/cohabitation	13 (38.2)	21 (27.3)		
Not married/cohabitation	21 (61.8)	56 (72.7)		
Distance from Fukushima, Mean (SD)	315.2 (166.8)	256.3 (111.9)	$t = 1.958$	.053
Rumination on Hiroshima and Nagasaki, Mean (SD)	2.24 (.92)	1.90 (.79)	$t = 2.015$	.046
Another nuclear disaster, Mean (SD)	3.59 (.88)	3.34 (.79)	$t = 1.029$	.306
Another tsunami, Mean (SD)	3.53 (1.26)	3.14 (1.18)	$t = 1.622$	.107
Another earthquake, Mean (SD)	3.82 (1.19)	3.73 (1.14)	$t = .412$	.681
Other disaster, Mean (SD)	3.62 (1.23)	3.43 (1.12)	$t = .798$	.426
Meaning in Life, Mean (SD)	20.3 (6.9)	20.7 (7.1)	$t = -.252$	.807
IES-R, Elevated risk for clinical level of PTSD, n (%) ^c			$\chi^2 = 2.117$	.034
No, IES-R < 33	15 (45.5)	58 (66.7)		
Yes, IES-R ≥ 33	18 (54.5)	29 (33.3)		

^a Two missing values in the gender group.

^b One missing value in the marital status group.

^c Two missing values in the elevated risk for psychological trauma group.

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