

# Posttraumatic Symptoms in Elementary and Junior High School Children after the 2011 Japan Earthquake and Tsunami: Symptom Severity and Recovery Vary by Age and Sex

Yoshitaka Iwadare, MD, PhD<sup>1</sup>, Masahide Usami, MD, PhD<sup>1</sup>, Yuriko Suzuki, MD, PhD<sup>2</sup>, Hirokage Ushijima, MD, PhD<sup>1</sup>, Tetsuya Tanaka, MD<sup>1</sup>, Kyota Watanabe, MD, PhD<sup>1</sup>, Masaki Kodaira, MD, PhD<sup>3</sup>, and Kazuhiko Saito, MD, PhD<sup>3</sup>

**Objectives** To measure psychiatric symptoms exhibited by children in Ishinomaki City, Japan, an area severely damaged by the 2011 earthquake and tsunami, at 8 and 20 months post-tsunami to investigate differences in symptom severity and recovery rate by age, sex, and degree of trauma experienced.

**Study design** Prospective data were collected from children in elementary school (5th and 6th grades) and junior high school (8th and 9th grades). Students completed the Post-Traumatic Stress Symptoms for Children-15 (PTSSC-15) survey. Trauma severity was scored according to experiences of bereavement, home damage, and evacuation. In total, 3795 PTSSC-15 surveys were analyzed, yielding total scores, post-traumatic stress disorder (PTSD) factor subscores, and depression factor subscores, which were analyzed according to grade group, sex, and degree of trauma (trauma dose).

**Results** In the elementary school children, mean total PTSSC-15 score, PTSD factor score, and depression factor score were significantly improved at 20 months post-tsunami compared with 8 months ( $P < .0001$  for all), whereas there were no significant improvements in the junior high school children. In females of the older group, the depression factor score at 20 months post-tsunami was significantly higher than at 8 months ( $P < .01$ ).

**Conclusions** Elementary school and junior high school children living near the epicenter of the 2011 Japan earthquake and tsunami exhibited marked differences in PTSD and depressive symptoms. The mental health status of elementary school children improved, whereas that of junior high school children did not. (*J Pediatr* 2014;164:917-21).

On March 11, 2011, the northeastern coast of Japan was struck by a huge earthquake and tsunami. The tsunami caused tremendous damage, killed thousands, and left many thousands more homeless and traumatized.<sup>1-4</sup> There have been a number of studies on the mental health status of children who survived disasters.<sup>5-7</sup> Studies of psychiatric problems in children who experienced the South East Asian tsunami of 2004 have been reviewed.<sup>8-11</sup> After any disaster, the prevalence of posttraumatic stress disorder (PTSD)<sup>6,12</sup> and depression increase.<sup>13</sup> We previously reported the results of an investigation of traumatic symptoms in children conducted about 8 months after the 2011 disaster.<sup>14</sup> That study revealed severe traumatic symptoms in children who had experienced home damage, evacuation, and (or) bereavement, with particularly high symptom rates in girls.

The incidence of mood disorders has been shown to increase in children after puberty.<sup>15,16</sup> Indeed, depression scores measured by a self-report questionnaire targeting the general pediatric population begin to rise in junior high school.<sup>17</sup> Thus, young adolescents may be more prone to stressors associated with depression.

The 2011 earthquake and tsunami was a disaster of unprecedented scale in modern Japan. Although many studies have examined mental health status in different populations at a given time, few have measured changes in child and adolescent mental health over time following a disaster. This study had 2 goals: (1) to document changes in psychiatric symptoms exhibited by children in the affected areas over time; and (2) to investigate the differences in symptoms exhibited by age, sex, and severity of trauma experienced.

## Methods

This is a prospective cohort study. The study was school-based and conducted in collaboration with the Ishinomaki City Educational Board. Ishinomaki City is the second largest city (population, 162 822) in Miyagi Prefecture. As of June 30, 2012, the death toll in Ishinomaki City was 3103, and 488 people were still

PTSD	Posttraumatic stress disorder
PTSS-10	Post-Traumatic Stress Symptom-10
PTSSC-15	Post-Traumatic Stress Symptoms for Children-15

From the <sup>1</sup>Department of Child and Adolescent Psychiatry, National Center for Global Health and Medicine, Kohnodai Hospital, Ichikawa, Japan; <sup>2</sup>Department of Adult Mental Health, National Institute of Mental Health, National Center of Psychiatry and Neurology, Kodaira, Japan; and <sup>3</sup>Department of Child and Adolescent Psychiatry, Aikku Hospital, Minato, Japan. Supported the National Center for Global Health and Medicine (24-108), Soroptimist International of the Americas Japan Shimomatsu Region, Ishinomaki Rotary Club, Yaohigashi Rotary Club, and Tokuyama Rotary Club. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The authors declare no conflicts of interest.

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missing. The total number of collapsed houses and buildings, including half-collapsed houses, was 33 378, and 20 364 temporary houses had been constructed.<sup>18</sup>

Self-administered questionnaires were distributed to all children who attended 43 elementary schools and 21 junior high schools in Ishinomaki City. The surveys were conducted in November 2011 (8 months after the disaster) and again in November 2012 (20 months after the disaster).

The survey method was explained to the principals of all participating schools by the Education Committee of Ishinomaki City. The teachers then distributed a letter (drafted by the Education Committee) explaining the survey to all children and their parents. The letter clearly stated that completing the questionnaire constituted consent from both the parents and students. The letter also specified that the survey results would be used to provide children with psychological care to facilitate their education at school, and that the results would be published as a medical paper. This consent procedure was approved by the ethics committee of the National Center for Global Health and Medicine.

The Post-Traumatic Stress Symptoms for Children-15 (PTSSC-15) survey, a 15-item self-report questionnaire of traumatic symptoms, was distributed to 5582 children registered at the municipal schools in Ishinomaki City. A questionnaire on the trauma experienced by each child was completed by the child's teachers.

### PTSSC-15

The PTSSC-15 is a self-report questionnaire on stress reactions in children after disasters. The Post-Traumatic Stress Symptom-10 (PTSS-10),<sup>19</sup> which has fewer questions, was used as a screening test after the Great Hanshin Earthquake. PTSS-10 is used commonly to evaluate the mental health reactions of children after major disasters and accidents in Japan.<sup>12</sup> The PTSS-10 was administered to 105 Norwegian children (6-17 years of age), 10 and 30 months after the 2004 South East Asia Tsunami disaster.<sup>20</sup> Five questions considered to be important for examining psychosomatic characteristics after disasters (flashback, appetite loss, somatic reactions, such as headache and abdominal pain, attention deficit, and anxiety) were added to PTSS-10 to construct the PTSSC-15.<sup>21</sup>

Each item was scored as 1 point: the depression factor consists of insomnia (Question 1), withdrawal (Question 5), appetite loss (Question 12), inattention (Question 13), and physical symptoms (Question 14). The PTSD factor consists of irritability (Question 4), displeasure (Question 6), emotional upset (Question 7), avoidance (Question 8), nervousness (Question 9), guilt (Question 10), re-experience (Question 11), and anxiety (Question 15). Tominaga et al<sup>21</sup> demonstrated the reliability and validity of PTSSC-15 in Japanese children and adolescents.

### Severity of Trauma

The authors and the educational committee in Ishinomaki City developed a questionnaire measuring the degree of trauma experienced by the children. We designed the form

to be completed by teachers. It queried the extent of disaster damage to the child's home, bereavement experience, and life in evacuation centers. To rate damage to the child's home, one of the following 3 answers could be selected: "no damage," "total collapse by the earthquake or tsunami (incapable of living in the house)," or "half collapse by the earthquake or tsunami (necessary to repair the house in order to live in it)". The latter 2 choices were both considered "yes" responses. Regarding the living conditions in evacuation centers, answers were selected from the following options: "no experience," "currently living in the evacuation center," "used to live in the evacuation center," "living in a temporary house," and "used to live in a temporary house." The last 4 choices were all considered "yes." For bereavement (death or disappearance), allowed responses were "no experience," "father," "mother," "brothers and sisters," "grandfather and grandmother," "kindergarten and school classmates at the time of the earthquake," "teacher in charge of the class at the time of the earthquake," and "others" (all considered yes).

### Statistical Analyses

Children were divided into the following 2 grade groups: higher-grade elementary school students (5th and 6th grade) and junior high school students (8th and 9th grade). We chose these school years because the effects of changing schools are relatively small and the follow-up rate is good. Additionally, children were divided according to the trauma dose score, with 1 point for each of "house damage," "evacuation experience," and "bereavement experience" (range, 0-3).

The median PTSSC-15 score and IQR were determined for each grade group, sex, and traumatic dose group (children with the same dose score). The PTSSC-15 total scores and factor scores at 8 months and 20 months post-tsunami were compared within each grade group, sex, and trauma dose group by Wilcoxon matched-pairs signed-ranks test. Effect sizes were calculated based on a Wilcoxon matched-pairs signed-ranks analysis. In all tests,  $P < .05$  (2-sided) was considered significant. All analyses were performed using PASW 18.0 (SPSS Inc., Chicago, IL).

## Results

For the 20-month post-tsunami survey, answers were returned by 5041 of the 5582 children (90.3%) to whom questionnaires were distributed. Of these 5041 subjects, 3795 (68.0%) also had completed the PTSSC-15 at 8 months and could also be graded for trauma severity by the matching teachers' report. **Table I** (available at [www.jpeds.com](http://www.jpeds.com)) shows the trauma dose scores (home damage, evacuation conditions, and bereavement experience) by sex for all 3795 children.

### Elementary School Students

The mean PTSSC-15 total scores, PTSD factor scores, and depression factor scores at 20 months and 8 months after the disaster for the elementary school children are presented in **Table II**. Total scores at 20 months were significantly

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