JIMA Vol. 72, No. 4 (Oct. 2020) pp. 157-170.

Original

Factors related to long-term outcomes of children's behavior problems after the Great East Japan Earthquake and Tsunami
— Follow-up survey in Iwate Prefecture —

Shuei ONO [1], Junko YAGI [1,2], Kentaro FUKUMOTO [1], Yasuhito YOSHIOKA [1,2] and Kotaro OTSUKA [1]

[1] Department of Neuropsychiatry, School of Medicine, Iwate Medical University, Yahaba, Japan
[2] Department of Pediatric Psychiatry, Iwate Medical University Hospital, Yahaba, Japan

(Received on December 27, 2019 & Accepted on February 7, 2020)

Abstract

Previous studies have suggested that children's behavior problems were related in the short to medium term following a disaster, and no studies suggested that children's behavior problems were related in the long term following a disaster. In this study, we examined the factors related to children's behavior problems in the long term after the Great East Japan Earthquake. A survey was conducted in 2012-2013 (T1) and 2017-2018 (T2), targeting 64 children and their 51 parents living in Iwate at the time of the disaster. The survey consisted of the Child behavior checklist (CBCL) and a questionnaire about disaster experience, family background, health status of the parents, and social capital. Children and parents in the exposure group had many experiences of disaster. The results of CBCL scores in the exposed group were significantly higher than in the control group, and in T1 were significantly higher than in T2. These findings indicate that the children's behavior problems converged over the long term. The experience of stress before the earthquake by parents and children and health status of parents after the earthquake affected children's behavior problems in T2. Thus, it can be said that continuous support is needed for children in the affected areas as well as for their parents.

Key words: *the Great East Japan Earthquake, children's behavior problems, parent's mental health, cohort study*

I. Introduction

It has been indicated that in Japan, most natural disasters are likely to occur due to natural conditions [1], and many natural disasters such as the Tohoku-Pacific Ocean Earthquake (Great East Japan Earthquake) [2], Mt. Ontake eruption [3], and the heavy rain in July, Heisei 30 [4] have occurred. In particular, in the case of Great East Japan Earthquake that occurred off the Sanriku Coast on March 11, 2011, it was announced that there were 15,896 dead, 2,536 missing, and 6,157 injured persons [5], causing tremendous damage to

Corresponding author: Junko Yagi
yagij@flamenco.plala.or.jp

Japan. As of October 2018, there were still 57,917 evacuees due to the Great East Japan Earthquake [6], and although it had been a long time since the earthquake disaster, support for housing and life reconstruction and mental care for victims remained an issue [7].

Disasters cause stress for victims different from that experienced in daily life, but children are especially susceptible stress due to disasters [8]. Several researchers have indicated that traumatic experiences in a large-scale disaster or synchronized terrorist attack have a serious impact on the mental health and problem behaviors of child [9-14]. Thienkrua et al. [9] conducted a survey of children aged 7 to 14 years at 2 and 9 months after the Sumatra earthquake, and indicated that tsunami disaster experiences (e.g., delayed evacuation, tsunami crisis experience) were associated with Post traumatic stress disorder (PTSD) and depressive symptoms. Scheringa et al. [10] conducted a survey of children aged 3 to 6 years at 5 months after Hurricane Katrina, and reported that 50% suffered from PTSD and 88% of those had a comorbidity.

Furthermore, it has been indicated that children's behavior problems increase after natural disasters (e.g., earthquakes, tsunamis, typhoons) [15-19]. Dogan [16] reported that at 13 months following the Izmit earthquake, 89% of adolescents aged 12 to 17 had thinking problems and 79% showed restless behavior. Fujiwara et al. [18] reported that as of 2 years after the Great East Japan Earthquake, 25% of the nursery school students who were affected by the earthquake had behavioral problems. Yagi et al. [19] reported that social capital and maternal mental health issues affect children's emotional and behavioral problems, based on a cross-sectional survey on children's mental health after the Great East Japan Earthquake.

These are consistent in that children's behavior problems increase as a result of exposure to traumatic events such as a natural disaster or terrorist attack. However, all of these studies clarified changes in problem behavior after a short period (less than 1 year) to a medium period (less than 5 years) from the exposure experience, and there have been no studies examining changes in problem behaviors after a long period (over 5 years) following the exposure experience. Therefore, by clarifying factors related to long-term behavior problems, it appeared possible to examine long-term support.

The aims of the present study were to track children living in Iwate Prefecture who experienced the Great East Japan Earthquake and to clarify the factors affecting the children's behavior problems over the long term.

II. Materials and methods

The present study was approved by the Ethics Committee of Iwate Medical University (approval number: H27 - 89).

1. Subjects and investigation procedure

The target facilities for this study were 5 nursery schools in 4 municipalities (Miyako City, Otsuchi Town, Rikuzentakata City, Shizukuishi Town) in Iwate Prefecture that consented to participate in the study. The study was explained to parents of children who were enrolled in a class for 3-5 year-olds at the time of the Great East Japan Earthquake (March 11, 2011), and subjects who consented to participate in the study

were surveyed. The first survey (T1) was conducted from August 2012 to June 2013, and the second survey (T2) was conducted from September 2017 to February 2018. A questionnaire was sent to the households of children and their parents were asked to respond. Moreover, in T1, in addition to the questionnaire, interviews and hearings were conducted. Subjects whose questionnaires could not be collected or who gave incomplete responses were excluded, and 64 children (34 boys, 30 girls, T1 survey age = 5.44 years, T2 survey age = 10.52 years) and 51 parents comprised the subjects for analysis.

2. Measurements

In order to assess behavioral, emotional and social problems, the Child behavior checklist (CBCL) [20, 21] was used in this study. For children between 4-18 years old, the CBCL consisted of 113 questions filled out by parents using a 3-point scale [Not true (0) - Very true or Often true (2)] regarding children aged 4 to 18 years. From the obtained results, T scores of 8 symptom scales ("Withdrawal", "Somatic complaints", "Anxiety / Depression", "Social problems", "Thought problems", "Attention problems", "Delinquency problems", "Aggressive behavior"), 2 upper scales ("Extroversion scale" and "Introversion scale") and "Total score" were calculated. Each scale had a cut-off value, and the "Total score" and upper scale consisted of clinical areas with a score of 64 or higher. T1 included those younger than the CBCL target age. However, because there was no significant difference upon comparison of the total scores and mean scores of the higher scales of those younger than 4 years old (10 persons) and those aged 4 years old or older (54 persons), those under 4 years old were considered to be the same as those aged 4 years and older, and T-score conversion was performed to determine whether or not they were within the clinical range.

As for other survey items, we inquired about disaster experiences and family background of children and parents in T1 and the subjective health status of parents, social capital, and mental health of parents in T1 and T2. Regarding disaster experiences, we inquired about experiences of loss (e.g., deceased relative, missing pet), witnessing /experience the disaster (e.g., tsunami sighting, being swept away by the tsunami, witnessing a person being swept away by the tsunami, fire sighting), and whether or not the person had lived in a shelter. Regarding family background, we inquired about family members living together (e.g. father, mother, siblings, etc.) and whether or not they had moved or changed schools.

For evaluation of parents, we inquired about subjective health using a 5-point scale [Good (1) - Not good (5)]. Moreover, regarding social capital, we asked whether neighbors "trust each other" or whether they "help each other" using a four-point scale [Yes (1) - No (4)]. Regarding the evaluation of the mental health of parents, the Japanese version of the Impact of event scale-revised (IES-R) [22, 23], a scale aimed at measuring traumatic stress symptoms and consisting of a total of 22 items with a 5-point scale [Not at all (0) - Very true (4)], was used to obtain responses, and persons with a total score of 25 or more were assigned to the clinical group. Next, using K6 [24, 25], a screening scale for general mental illness, we asked for responses to a total of 6 items using a 5-point scale [No (0) - Always (4)], and a total

score of 5 or more was defined as the clinical range.

3. Statistical analysis

1) Comparison of disaster experiences and children's behavior problems by area of residence at the time of the disaster

Changes in the children's behavior problems over the long term were examined by classifying the children into the following two groups based on residence at the time of the disaster.

The exposure group consisted of 44 children (22 boys, 22 girls, T1 age = 5.32 years, T2 survey age = 10.43 years) enrolled in a nursery school in the coastal area of Iwate Prefecture (i.e., Miyako City, Otsuchi Town, Rikuzentakata City) and 34 parents.

The control group consisted 20 children (12 boys, 8 girls, T1 survey age = 5.70 years, T2 survey age = 10.70 years) enrolled in a nursery school in the inland area of Iwate Prefecture (Shizukuishi Town) and 17 parents.

(1) Comparison of disaster experiences

In order to compare the characteristics of the exposure group and the control group, the ratio of those who reported "disaster experiences" due to the Great East Japan Earthquake between the two groups was compared using Fisher's exact test. Regarding "disaster experiences", responses of "Don't know" or "Don't want to answer" were regarded as missing values.

(2) Comparison of children's behavior problems

The one-way analyses of variance (ANOVA) for repeated measures was used to compare "CBCL total score" of T1 and T2 in each group (exposure group, control group). In addition, in T1 and T2, the "CBCL total score category" clinical range between the 2 groups was calculated and the ratio compared using Fisher's exact test.

2) Factors affecting children's behavior problems after a long period of time

In order to examine the factors that affect the children's behavior problems a long period of time after the earthquake disaster, we divided them into the following two groups based on the CBCL total score of the CBCL in T2.

The problem group consisted of 11 children (4 boys, 7 girls, T1 age = 5.82 years, T2 age = 10.82 years) whose CBCL total score in T2 fell from clinical to borderline, and 11 parents were targeted.

The non-problem group consisted of 53 children (30 boys, 23 girls, T1 age = 5.35, T2 age = 10.45) whose T2 CBCL total score was in the normal range, and 41 parents were targeted.

(1) Comparison of the problem group and the non-problem group

The Mann-Whitney U test was used to compare the numerical values and Fisher's exact test was used to compare the proportions of the following items of T1 and T2: (1) Comparison of attributes (age at the time of survey, sex, area of residence, traumatic experiences before the earthquake); (2) Comparison of children's behavior problems (CBCL total score, introversion scale, extroversion scale score in T1); and (3) Physical and mental health of parents (comprehensive score of IES-R and K6 in T1 and T2 and the proportions of clinical area, social capital, and subjective health of parents).

(2) Factors affecting children's behavior problems after a long period

In comparison of the problem group and the non-problem group, using CBCL total score in T2 as a dependent variable, multiple regression analysis (forced input method) was performed using the items of the interval scale and ratio scale with statistical significance of $p < 0.10$ and the order scale and nominal scale showing significant differences as independent variables.

SPSS 20.0 for Windows (IBM) was used to perform all statistical analyses, and results were considered significant at $p < 0.05$.

III. Results

1. Comparison of disaster experiences and children's behavior problems by area of residence at the time of the disaster

1) Comparison of disaster experiences

Regarding the disaster experiences of children (Table 1), the exposure group had a significantly higher rate of experience of "Death of friend/acquaintance ($p = 0.009$)", "Tsunami sighting ($p = 0.002$), "Living in shelter ($p = 0.002$)", and "Repeated viewing of the nuclear power plant ($p = 0.040$)". In addition, regarding the disaster expe riences of parents (Table 1), the exposure group members had significantly more persons who experienced the following: "Tsunami sighting ($p = 0.001$)", "Fire sighting ($p < 0.001$)", "Separation experience during the disaster ($p = 0.044$)", "Living at a shelter ($p = 0.003$)", "Living at a relative's home ($p = 0.003$)", "Living in temporary housing ($p = 0.006$)", "Trauma experience before the earthquake ($p = 0.040$)".

2) Comparison of children's behavior problems

"CBCL total score" of T2 was significantly lower than "CBCL total score" of T1 in each group [exposure group ($F = 8.336$, $p = 0.006$), control group ($F = 5.090$, $p = 0.036$)]. (Fig. 1). In addition, the results of comparison of the proportion of those in the clinical range in T1 and T2 (Table 2) revealed that there were no significant differences between T1 ($p = 0.165$) and T2 ($p = 0.300$).

2. Factors affecting children's behavior problems after a long period

1) Comparison between the problem group and the non-problem group

In T1, the number of persons in the problem group was significantly higher than in the non-problem group with regard to "Subjective health of parents ($p = 0.040$)", "CBCL total score ($p = 0.036$)" and in T2, with regard to "IES-R total score ($p = 0.047$)" (Table 3). In addition, regarding the place of residence, it was shown that the problem group had a higher proportion of persons living in coastal areas ($p = 0.013$; Table 4).

There was a significant difference between children ($p = 0.027$) and parents ($p = 0.037$) regarding "There was another stressful event", which shows trauma experiences before the earthquake ($p = 0.027$), and in both cases the number was significantly higher in the problem group (Table 5).

2) Factors affecting children's behavior problems after a long period

"T2 CBCL total score" was set as a dependent variable, and "Area of residence", "T1 Subjective health of parents", "T1 CBCL total score", "T1 CBCL introversion Scale", "T1 CBCL extroversion Scale", "T2 subjective health of parents", "T2 IES-R total score" and "Having an event other than the above that caused severe stress to be felt" by the children or parents were set as independent variables.

Table 1. Comparison of disaster experiences between the exposure group and the control group

	Exposure group (n = 44)			Control group (n = 20)			p-value
	Valid number of responses	n	%	Valid number of responses	n	%	
1. Disaster experiences of children							
Death of a friend / acquaintance	32	9	28.13	20	0	0.00	0.009 **
Missing pet	29	0	0.00	20	0	0.00	–
Witnessing of the tsunami	36	13	36.11	18	0	0.00	0.002 **
Hit by the tsunami	37	0	0.00	19	0	0.00	–
Experience being swept away by the tsunami	37	2	5.41	19	0	0.00	0.544
Experience witnessing a person being swept away by the tsunami	31	2	6.45	19	0	0.00	0.519
Witnessing of a fire	29	6	20.69	19	0	0.00	0.068
Heard an explosion	32	1	3.13	19	0	0.00	1.000
Saw a corpse	34	4	11.76	19	0	0.00	0.284
Heard an explosion from the nuclear power plant	34	0	0.00	19	1	5.26	0.358
Living in a shelter	40	14	35.00	19	0	0.00	0.002 **
Experience being taken care by someone else	39	5	12.82	19	1	5.26	0.653
Repeated viewing of images of the tsunami	36	20	55.56	19	12	63.16	0.775
Repeated viewing of images of the nuclear power plant	32	11	34.38	16	1	6.25	0.040 *
Limitation of activities due to the nuclear power plant	33	0	0.00	17	0	0.00	–
Traumatic experiences before the disaster	34	4	11.76	19	1	5.26	0.643
2. Disaster experiences of parents							
Death of a relative	41	4	9.76	20	3	15.00	0.674
Missing relative	41	0	0.00	20	2	10.00	0.104
Experience of loss	39	9	23.08	20	3	15.00	0.734
Injury/disease	42	5	11.90	20	0	0.00	0.165
Witnessing of the tsunami	41	15	36.59	20	0	0.00	0.001 **
Experience being hit by the tsunami	42	0	0.00	20	0	0.00	–
Experience being swept away by the tsunami	42	0	0.00	20	0	0.00	–
Experience witnessing a person being swept away by the tsunami	39	1	2.56	20	0	0.00	1.000
Witnessing of a fire	37	15	40.54	20	0	0.00	< 0.001**
Heard an explosion	37	1	2.70	20	0	0.00	1.000
Saw a corpse (other than at a morgue)	35	6	17.14	20	0	0.00	0.076
Saw a corpse at a morgue	34	1	2.94	20	2	10.00	0.548
Experience of separation at the time of the disaster	40	17	42.50	20	3	15.00	0.044 *
Heard an explosion from the nuclear power plant	32	0	0.00	18	0	0.00	–
Seeking shelter from the nuclear power plant	33	1	3.03	18	0	0.00	1.000
Living in a shelter	43	14	32.56	20	0	0.00	0.003 **
Living at the home of a relative	43	18	41.86	20	1	5.00	0.003 **
Living in one's destroyed home	42	2	4.76	20	2	10.00	0.588
Living in temporary housing	42	13	30.95	20	0	0.00	0.006 **
Limitation of activities due to the nuclear power plant	33	0	0.00	18	0	0.00	–
Traumatic experiences before the disaster	32	7	21.88	18	0	0.00	0.040 *

* $p < 0.05$; ** $p < 0.01$

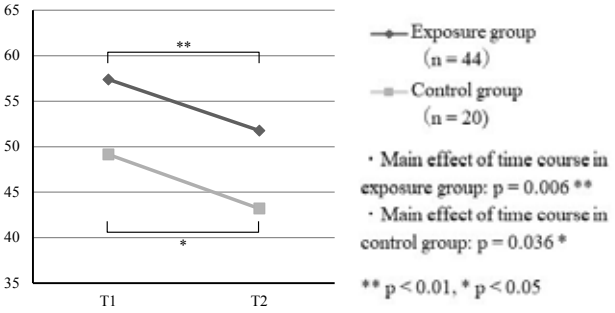

Fig. 1. Comparison of "CBCL total score" in T1 and T2

Table 2. Comparison of the proportion of the CBCL total score in the clinical range in T1 and T2

	Exposure group (n = 44)		Control group (n = 20)	
	n	%	n	%
T1	6	13.64	0	0
T2	4	9.09	0	0
p value	0.165		0.300	

Table 3. Comparison of the problem group and the non-problem group (1)

		Problem group (n = 11)		Non-problem group (n = 53)		p-value
		M	SD	M	SD	
T1	T1 Age at time of survey	5.82	1.89	5.36	1.61	0.427
	Social capital - mutual trust	2.09	0.70	1.81	0.62	0.201
	Social capital - mutual assistance	2.09	0.70	1.83	0.67	0.212
	Subjective health of parents	2.55	0.93	1.91	0.99	0.040 *
	CBCL total score	60.45	9.23	53.64	9.86	0.036 *
	CBCL introversion scale	59.09	10.56	53.53	8.33	0.089
	CBCL extroversion scale	60.09	7.19	54.91	10.71	0.065
	IES-R total score	19.09	16.26	12.42	13.01	0.202
	K6 total score	4.82	6.65	2.43	3.24	0.223
T2	T2 Age at time of survey	10.82	1.72	10.45	1.61	0.556
	Social capital - mutual trust	2.18	0.87	2.11	0.72	0.837
	Social capital - mutual assistance	2.00	0.77	2.11	0.70	0.701
	Subjective health of parents	2.82	1.17	2.11	1.09	0.071
	IES-R total score	10.82	9.42	5.75	6.69	0.047 *
	K6 total score	5.18	6.29	2.57	4.05	0.129

* $p < 0.05$

The results of the analysis indicated that the variance inflation factor (VIF) of the "T1 CBCL total score" exceeded 10, and was therefore excluded from the independent variables and reanalyzed. The results revealed that a significant difference was noted (adjusted $R^2 = 0.135$, $F = 2.089$; Table 6) for "Area of residence" ($p = 0.005$).

IV. Discussion

1. Comparison of disaster experiences and children's behavior problems by area of residence at the time of the disaster

The results of comparison of the disaster experience showed that children who were enrolled in nursery schools in the coastal area of Iwate Prefecture and their parents had many disaster experiences at the

Table 4. Comparison of the problem group and the non-problem group (2)

		Problem group (n = 11)		Non-problem group (n = 53)		p-value
		n	%	n	%	
1. Attributes						
Sex	Male	4	36.36	30	56.60	0.322
	Female	7	63.64	23	43.40	
Area of residence	Coastal area	11	100.00	33	62.26	0.013*
	Inland area	0	0.00	20	37.74	
2. T1 CBCL category						
Total score	Normal range-borderline range	8	72.73	50	94.34	0.058
	Clinical range	3	27.27	3	5.66	
Introversion scale	Normal range-borderline range	7	63.64	47	88.68	0.060
	Clinical range	4	36.36	6	11.32	
Extroversion scale	Normal range-borderline range	7	63.64	44	83.02	0.213
	Clinical range	4	36.36	9	16.98	
3. Mental health of parents						
T1 IES-R	Normal range	7	63.64	46	86.79	0.085
	Clinical range	4	36.36	7	13.21	
T1 K6	Normal range	7	63.64	44	83.02	0.213
	Clinical range	4	36.36	9	16.98	
T2 IES-R	Normal range	9	81.82	51	96.23	0.134
	Clinical range	2	18.18	2	3.77	
T2 K6	Normal range	6	54.55	41	77.36	0.144
	Clinical range	5	45.45	12	22.64	

* $p < 0.05$

time of the Great East Japan Earthquake. Because in Iwate Prefecture, the number of deaths, missing persons, and number of houses collapsed due to the Great East Japan Earthquake was concentrated in coastal areas [26], it appeared that those who lived in the coastal areas had more disaster experiences because they were more affected by the earthquake than those in the inland areas.

The comparison of results of the children's behavior problems showed that T2 had fewer children's behavior problems than T1 regardless of the region. That is, the children's behavior problems decreased during the long term after the Great East Japan Earthquake. Previous studies [16, 18, 19] have shown that children's behavior problems increased in the short and mid-term after the earthquake, in the second to fifth years after the earthquake in Iwate Prefecture, the children's behavior problems tended to converge. It was also shown that children in coastal areas of Iwate Prefecture had more children's behavior problems regardless of the time. Based on these findings, it appeared that children in coastal areas where the damage from the earthquake was concentrated are more likely to have children's behavior problems, and therefore require more support in comparison with children in other areas. Furthermore, the

Table 5. Comparison of traumatic experiences before the earthquake between the problem group and the non-problem group

	Problem group (n = 11)		Non-problem group (n = 53)		p-value
	n	%	n	%	
1. Traumatic experiences of child before the disaster					
Experienced a terrible accident (accident that made the person feel to be in danger)	0	0.00	1	1.89	1.000
Witnessed a terrible accident	0	0.00	0	0.00	–
Was attacked by a dog or other animal	0	0.00	1	1.89	1.000
A familiar person got a serious disease	0	0.00	6	11.32	0.579
A familiar person died	2	18.18	8	15.09	1.000
Went to the hospital due to a serious disease or injury, underwent surgery or was admitted to the hospital	0	0.00	4	7.55	1.000
Lived away from the caregivers (or either the mother or the father)	4	36.36	7	13.21	0.085
Was a victim of a sexual crime (including groping)	0	0.00	0	0.00	–
Was a victim of another type of crime	0	0.00	0	0.00	–
Was bullied at nursery school or by neighborhood friends	0	0.00	0	0.00	–
Was a victim of violence by a familiar person	0	0.00	0	0.00	–
Witnessed violence by a familiar person	0	0.00	1	1.89	1.000
A familiar person attempted suicide (committed suicide)	1	9.09	0	0.00	0.172
Experienced a natural disaster other than the Great East Japan Earthquake	1	9.09	0	0.00	0.172
Experienced an event other than the above that caused the person to feel severe stress	2	18.18	0	0.00	0.027 *
History of traumatic experience before the disaster	6	54.55	17	32.08	0.182 .
2. Traumatic experience of parent before the disaster					
Experienced a terrible accident (accident that made the person feel to be in danger)	0	0.00	9	16.98	0.338
Witnessed a terrible accident	1	9.09	1	1.89	0.331
Was attacked by a dog or other animal	0	0.00	0	0.00	–
A familiar person got a serious disease	0	0.00	16	30.19	0.052
A familiar person died	3	27.27	13	24.53	1.000
Went to the hospital due to a serious disease or injury, underwent surgery or was admitted to the hospital	0	0.00	7	13.21	0.339
Lived away from the caregivers (or either the mother or the father) as a child	1	9.09	1	1.89	0.316
Received violence from a caregivers as a child	1	9.09	1	1.89	0.316
Was a victim of a sexual crime (including groping) as a child	0	0.00	5	9.43	0.575
Was a victim of another type of crime	0	0.00	0	0.00	–
Was bullied at nursery school or by neighborhood friends	2	18.18	12	22.64	1.000
Was a victim of violence by a familiar person	1	9.09	3	5.66	0.539
Witnessed violence by a familiar person	0	0.00	0	0.00	–
A familiar person attempted suicide (committed suicide)	3	27.27	5	9.43	0.131
Experienced a natural disaster other than the Great East Japan Earthquake	2	18.18	2	3.77	0.134
Experienced an event other than the above that caused the person to feel severe stress	5	45.45	8	15.09	0.037 *
History of traumatic experience before the disaster	7	63.64	31	58.49	1.000

* $p < 0.05$

Table 6. Factors affecting children's behavior problems after a long period of time

	β	p-value	R^2
Area of residence (1 = coastal area, 0 = inland area)	0.415	0.005 *	
T1 Subjective health of parents	0.048	0.744	
T1 CBCL introversion scale	0.213	0.209	
T1 CBCL extroversion scale	−0.151	0.367	
T2 Subjective health of parents	−0.031	0.831	0.135
T2 IES-R total score	−0.209	0.210	
C) Experienced an event other than the above that caused the person to feel severe stress	0.142	0.167	
P) Experienced an event other than the above that caused the person to feel severe stress	0.177	0.348	

* $p < 0.05$
Dependent variable: T2 CBCL total score
C) , child; P) , parent

percentage of the "Total score by clinical area" in the exposure group in T2 (approximately 9%) was close to the standard result as it was close to the ratio shown by Itani et al. [27]. That is, even in the coastal areas where there was a lot of damage, it appeared that general emotional and children's behavioral problems had converged to a mean level over the period of 6-7 years.

2. Factors affecting children's behavior problems after a long period of time

The characteristic features of persons with children's behavior problems that emerged after a long period of time following the earthquake were living in a coastal area, poor subjective health of parents 1 to 2 years after the earthquake or many children's behavior problems at that time, and serious traumatic stress symptoms of parents at 6 to 7 years after the earthquake. Moreover, it was also shown that both children and their parents had experienced an event that caused them to feel some kind of stress before the earthquake. In addition, area of residence (stricken coastal area) was extracted as a factor affecting child behavior problems after a long period of time. The above findings clarified that, to begin with, living in an area where the damage was great at the time of the earthquake and having various disaster experiences due to the earthquake is related to the children's behavior problems after a long period of time. Therefore, it appears that children who live in areas that are severely damaged by a natural disaster have many disaster experiences and are likely to exhibit children's behavior problems immediately after the disaster, and the children's behavior problems tend to be sustained even after a long period of time.

Secondly, it was assumed that the subjective health status of the parents immediately after the earthquake and the severity of the traumatic stress symptoms may affect the children's behavior problems. Lowe et al. [17] showed that the mother's psychological distress 1 year after a natural disaster (Hurricane Katrina) was associated with children's behavior problems 3 years after the disaster. In addition, Yagi et al. [19] reported that regarding the mental health of children

after the Great East Japan Earthquake, the mental health problems of mothers affected the children's behavior problems. These results indicate that the traumatic stress symptoms of the parents of children with behavior problems are severe, which can be said to partially support the results of previous studies [13, 19]. These findings suggest that the mental and physical health of children and their parents are related in the long term, and that support for both is necessary for a long period of time from immediately after the earthquake.

Third, there was significantly more experience of severe stress before the earthquake in the group in which both children and parents had problems. It has been indicated that an accumulation of adverse childhood experiences (ACEs) such as abuse and childcare dysfunction can cause various health problems even in adulthood [28, 29]. The results of the present study also revealed that the accumulation of severe stress experiences before the earthquake and experiences of the disaster caused by the earthquake may have affected children's behavior problems. Therefore, when looking at the progress over a long period of time, it appeared effective to confirm the living conditions before the earthquake and evaluate the accumulation of ACEs.

However, regarding children's behavior problems, it is possible that various problems such as living conditions after the earthquake are related in a complex manner, in addition to disease characteristics other than environmental factors and problems related to learning.

3. Limitations of the present study

The limitations of the present study are as follows: 1) the data was limited to data samples in Iwate Prefecture, and 2) the research of this longitudinal survey is ongoing. Regarding 1), because the data of present study is limited to a specific region, there is a possibility that the data may be biased due to regional characteristics. Therefore, it can be said that reinvestigation after integration with data of other prefectures is an issue for future study. Regarding 2), it is necessary to pay attention to the fact that this study covers the second to seventh years following the Great East Japan Earthquake, and is a result of a part of the results of an ongoing longitudinal investigation.

4. Conclusion

The results of the present study revealed that children's behavior problems tended to decrease to the mean level over a long period after the earthquake disaster. In addition, the physical and mental health of parents, the stress experiences of children and parents before the disaster, and the area of residence at the time of the earthquake were cited as factors affecting children's behavior problems over the long term. Based on the above findings, it can be said that continuous support is necessary for children and their parents in the areas where the damage was severe even following a long period after the earthquake.

Acknowledgements

We are deeply indebted to the survey subjects and all persons who were involved in the investigation.

Conflict of interest: This present study was conducted as a part of a follow-up survey using the following studies as a baseline: 2012 - 2015 health and

labor sciences research grant for next-generation development basic research project for overcoming child's diseases, etc. "Study on child health in the areas affected by the Great East Japan Earthquake (principal researcher: Shigeo Kure)", "Study on the long-term impact of the Great East Japan Earthquake on child's mental health (co-researcher: Junko Yagi)", and 2012 - 2015 survey conducted by Iwate child care center project (research).

References

1) Cabinet Office: White Paper on Disaster Management in Japan 2006. Cabinet Office, Tokyo, 2006.
2) Japan Meteorological Agency: Report of natural phenomena at the time of disaster 2011 No.1. Japan Meteorological Agency, Tokyo, 2011. https://www.jma.go.jp/jma/kishou/books/saigaiji/saigaiji_201101/saigaiji_201101.pdf
3) Tokyo District Meteorological Observatory: Report of natural phenomena at the time of disaster 2014 No.2. Tokyo District Meteorological Observatory, Tokyo, 2014. https://www.jma.go.jp/jma/kishou/books/saigaiji/saigaiji_201405.pdf
4) Japan Meteorological Agency: About the heavy rain in July, Heisei 30. Japan Meteorological Agency, Tokyo, 2018. https://www.jma.go.jp/jma/press/1807/09b/20180709_sankou.pdf
5) National Police Agency: Police Countermeasures and Damage Situation associated with 2011 Tohoku district - off the Pacific Ocean Earthquake. National Police Agency, Tokyo, 2018. https://www.npa.go.jp/news/other/earthquake2011/pdf/higaijokyo_e.pdf
6) Reconstruction Agency: The number of Refugees Nationwide. Reconstruction Agency, Tokyo, 2018. http://www.reconstruction.go.jp/topics/main-cat2/sub-cat2-1/20181130_hinansha.pdf
7) Reconstruction Agency: Recovery situation and efforts from the Great East Japan Earthquake. Reconstruction Agency, Tokyo, 2018. http://www.reconstruction.go.jp/topics/main-cat7/sub-cat7-2/201801_Pamphlet_fukko-jokyo-torikumi.pdf
8) **Imamura Y**: Disasters and child. In "Introduction to the disaster psychiatry", ed by Takahashi S, et al., pp. 89-101, Kongo Shuppan, Tokyo, 2015.
9) **Thienkrua W, Cardozo BL, Chakkraband MS, et al.**: Symptoms of posttraumatic stress disorder and depression among child in tsunami-affected areas in southern Thailand. JAMA **296**, 549-559, 2006.
10) **Scheeringa MS** and **Zeanah CH**: Reconsideration of harm's way: Onsets and comorbidity patterns of disorders in preschool child and their caregivers following Hurricane Katrina. J Clin Child Adolesc Psychol **37**, 508-518, 2008.
11) **Chemtob CM, Nomura Y** and **Abramovitz RA**: Impact of conjoined exposure to the World Trade Center attacks and to other traumatic events on the behavioral problems of preschool child. Arch Pediatr Adolesc Med **162**, 126-133, 2008.
12) **Kar N**: Psychological impact of disasters on child, review of assessment and intervention. World J Pediater **5**, 5-11, 2009.
13) **Ayub M, Poongan I, Masood K, et al.**: Psychological morbidity in child 18 months after Kashmir Earthquake of 2005. Child Psychiatry Hum Dev **43**, 323-336, 2012.
14) **Zhang Z, Ran MS, Li YH, et al.**: Prevalence of post-traumatic stress disorder among adolescents after the Wenchuan earthquake in China. Psychol Med **42**, 1687-1693, 2012.
15) **McLaughlin KA, Fairbank JA, Gruber MJ, et al.**: Serious emotional disturbance among youths exposed to Hurricane Katrina 2 years postdisaster. J Am Acad Child Adolesc Psychiatry **48**, 1069-1078, 2009.
16) **Dogan A**: Adolescents' posttraumatic stress reactions and behavior problems following Marmara earthquake. Eur J Psychotraumato **2**, 5825-5833, 2011.
17) **Lowe SR, Godoy L, Rhodes JE, et al.**: Predicting mothers' reports of child's mental health three years after Hurricane Katrina. J Appl Dev Psychol **34**, 17-27, 2013.
18) **Fujiwara T, Yagi J, Homma H, et al.**: Clinically significant behavior problems among young child 2 years after the Great East Japan Earthquake. PLoS One **9**, e109342, 2014.
19) **Yagi J, Fujiwara T, Yambe T, et al.**: Does social capital reduce child behavior problems? Results from the Great East Japan Earthquake

follow-up for Child Study. Soc Psychiatry Psychiatr Epidemio **51**, 1117-1123, 2016.
20) **Achenback TM**: Manual for child behavior checklist/4-18 and 1991 profile. University of Vermont, Department of Psychiatry, Burlington, 1991.
21) **Togasaki Y** and **Sakano Y**: The assessment of behavioral problems in childhood and adolescence: the assessment and diagnosis by child behavior checklist japanese version. Jpn Arch of Psychiatr Diagn Clin Eval **9**, 235-245, 1998.
22) **Weiss DS**: The Impact of Event Scale-Revised. In "Assessing psychological trauma and PTSD (Second Edition)" ed by Wilson JP, et al., pp. 168-189, The Guilford Press, New York, 2004.
23) **Asukai N, Kato H, Kawamura N, et al.**: Reliabiligy and validity of the japanese-language version of the impact of event scale-revised (Ies-RJ): four studies of different traumatic events. J Nerv Ment Dis **190**, 175-182, 2002.
24) **Kessler RC, Andrews G, Colpe LJ, et al.**: Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med **32**, 959-976, 2002.
25) **Furukawa TA, Kessler RC, Slade T, et al.**: The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. Psychol Med **33**, 357-362, 2003.
26) Iwate Prefecture: Iwate Moving toward Reconstruction: A record of the reconstruction from March 2011 to March 2019 after the Great East Japan Earthquake and Tsunami. Iwate Prefecture, Iwate. 2019. https://www.pref.iwate.jp/_res/projects/default_project/_page_/001/022/737/eng-ayumi2019a4.pdf
27) **Itani T, Kanbayashi Y, Nakata Y, et al.**: Standardization of the japanese version of the child behavior checklist/4-18. Psych Neurol Paediatr Jpn **41**, 243-252, 2001.
28) **Felitti VJ, Anda RF, Nordenberg D, et al.**: Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the adverse childhood experiences (ACE) Study. Am J Prev Med **56**, 774-786, 2019.
29) **Dong M, Anda RF, Felitti, VJ, et al.**: The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. Child abuse neglect **28**, 771-784, 2004.

岩手医誌 72 巻，4 号（令和 2 年 10 月）157-170 頁.

東日本大震災津波後の子どもの問題行動への長期転帰における関連因子について
― 岩手県内における追跡調査 ―

小野舟瑛[1)]，八木淳子[1), 2)]，福本健太郎[1)]，
吉岡靖史[1), 2)]，大塚耕太郎[1)]

[1)] 岩手医科大学医学部，神経精神科学講座
[2)] 岩手医科大学附属病院，児童精神科

(Received on December 27, 2019 & Accepted on February 7, 2020)

要旨

災害と子どもの問題行動が短期・中期において関連することが認められているが，長期においての指摘はなされていない．そこで東日本大震災後，長期経過における子どもの問題行動に関連する要因について検討した．震災時岩手県内に在住していた子ども 64 名とその親 51 名を対象に 2012 ～ 2013 年（T1）と 2017 ～ 2018 年（T2）に調査を実施し，子ども行動チェックリスト（CBCL）と被災体験，家族背景，保護者の心身の健康状態，ソーシャル・キャピタルについて調べた．被災体験は曝露群（沿岸在住）の方が多く，CBCL 得点は T1 と曝露群の方が有意に高かった．保護者の心身の健康状態，震災前の親子のストレス体験，震災時の居住地が T2 の問題行動に影響することが明らかになった．以上より，長期経過により子どもの問題行動は収束し，問題行動には親子の震災前のストレス体験や震災後の保護者の健康状態が影響することが示唆され，被災地の親子に対しては継続的な支援が必要と言えた．