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Original Article

Life Events and Posttraumatic Stress in Hanshin-Awaji Earthquake Victims

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Abstract

Stress induced by disaster is experienced to varying degrees by all respondents, and is known to evoke psychophysiological reactions. In this study, we investigated the relationships between earthquake-related life events and posttraumatic stress symptoms. A total of 380 adults were surveyed one year after the 1995 Hanshin-Awaji earthquake in Japan. The questionnaire included items concerning earthquake-related life events, emotional support and posttraumatic stress disorder (PTSD) symptoms.

As a result, after controlling for demographic variables, earthquake-related life events were significantly related to the grade of posttraumatic stress and its three components: re-experience, avoidance and arousal, in both male and female subjects. Male subjects who currently had lower emotional support showed higher scores of posttraumatic stress and arousal. In conclusion, a higher experience of earthquake-related life events appears to be an important risk factor for development of poor mental health status following an earthquake disaster.

Key words: posttraumatic stress disorder, stress, life events, emotional support, mental health

Introduction

Natural disasters can have substantial detrimental effects on the physical and mental health of victims. The psychosocial problems of disaster victims have gained increasing recognition over the last few decades[1)] and various studies have indicated the presence of emotional distress and psychiatric disorders among adult disaster victims[2)]. Although there is evidence that disaster stress varies according to the type of disaster experienced[3,4)], it has also been shown that responses to all disasters evolve in a relatively predictable trajectory of early shock and anxiety, followed later by anger, depression, generalized mental distress, and posttraumatic stress[4–6)]. Posttraumatic stress disorder (PTSD) is the mental illness of greatest relevance to the experience of disaster[7)]. Most of the psychological symptoms of disaster victims could stem from PTSD, and follow a long-term course. However, not everyone exposed to traumatic events goes on to develop PTSD, and there are considerable individual differences in the severity and chronicity of symptoms[8)].

Disaster stress is distinct from other major types of stress. It is related to threat to survival, property damage and other substantial life changes[6,7)]. Although natural disasters are single episodic crises, victims are more likely to experience a series of catastrophic events that include multiple negative life events over time[9)]. The association between the stress of day-to-day life events and psychiatric disorders are difficult to establish[10)]. However, since disasters are extreme events occurring within a discrete time period, it is possible to identify linkages between stressors and outcome variables[7)]. Therefore, it was suggested that the impact of a disaster on psychological distress could be investigated by evaluating the effects of multiple life events occurring after an earthquake disaster.

On Jan 17, 1995, the Hanshin-Awaji district in Japan was struck by a major earthquake, with a Magnitude of 7.2. Over 6,500 people were killed and more than 310,000 were made homeless. The present study was conducted to examine the relationship between the disaster stressors measured by earthquake-related life events and mental health status in adults after the Hanshin-Awaji earthquake.

Materials and Method

Subjects

The subjects were 900 earthquake victims who had experienced the Hanshin-Awaji earthquake. They were randomly chosen from employees of five manufacturing companies located in the Hanshin area. These companies were selected because we could obtain cooperation with this research. The survey was performed between February and April, 1996. The questionnaires were distributed to the subjects through their organizations, but the answered questionnaires were collected directly by mail. Participation was voluntary, and 652 subjects (72.4%) returned the questionnaires. Of these, 380 respondents (42.2%) completed questionnaires for all items used for the statistical analysis.

The subjects were comprised of 302 males and 78 females.

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Most (77.6%) of them lived in Kobe city and 20% were other cities or towns of Hyogo Prefecture at the time of the earthquake. Among them, 38.4% were clerical workers, 29.2% were professionals, and 25.0% were blue-collar workers. The age of the respondents ranged from 20 to 59 years, with mean ages (±SD) of 43.9±9.5 for males, and 36.5±11.2 for females.

Measurement of earthquake disaster stressors

The earthquake disaster stressors were measured using a 20-item earthquake-related life event scale. These consisted of new items designed by us in addition to the life event scale developed by Holmes and Rahe[11]. Life event items chosen for use in this study were selected so that the widest possible range of earthquake disaster experience could be included. These items focused on bereavement, ill-health factors, and financial and legal difficulties that might be expected to influence the experience of a disaster. The complete list of items is shown in Table 1.

The subjects were asked to report the presence or absence of experience of earthquake-related life events (ELE) and judge how much effort it took to adjust to each of the events over the past year. The judgements were made using a simple rating of 1 (least life change) to 5 (most life change). The ELE score was constructed using the weighted sum each ELE subject had experienced, with higher scores indicative of more disaster stressors. Cronbach's Alpha coefficient for this scale was 0.96.

Measurement of mental health status

Mental health status was measured using the posttraumatic stress disorder (PTSD) scale based on DSM-IV categories for PTSD[12]. The PTSD scale was a 17-item questionnaire designed to assess the posttraumatic stress of adults after exposure to earthquake disaster. The 17 statements were divided into three subscales of symptoms corresponding to the following three DSM-IV categories for PTSD. I) Persistent re-experience of the traumatic event (five items); II) Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (seven items); III) Persistent symptoms of increased arousal (five items). The complete list of items is displayed in Table 2. Subjects were asked to answer whether they experienced these symptoms. Total PTSD score was between 0 and 17 based on the number of 'yes' responses to each item. The sum of the scores can be interpreted as indicating the severity of psychological distress. Cronbach's Alpha coefficient for this scale was 0.85. Also, the scores of the three subscales (re-experience, avoidance, and arousal) were calculated. Cronbach's Alpha coefficients for these subscales were 0.70, 0.75 and 0.74, respectively.

Other variables

We examined age, marital status, socioeconomic and physical health status, and emotional support network as factors affecting posttraumatic stress by a self-administered questionnaire. Physical health status was assessed by the present perceived somatic condition. The answer consisted of three categories: 'good', 'moderate' and 'bad'. Emotional support items consisted of 3 questions pertaining to the availability of an emotional support system based on human relationship for the individual[13]. These items were recorded on a 4-point scale (range=0–3).

Statistical analysis

Data analyses were conducted separately for males and females. Each respondent was categorized into one of five groups (0–4, 5–9, 10–15, 16–23, and 24 or higher) divided by the total score of experienced ELE. Then, we examined the mean scores of the total PTSD and its three subscales (re-experience, avoidance, and arousal) among the five groups by one-way analysis of variance (ANOVA). Differences in the total score and the three subscales of PTSD among response categories of each other variable (perceived physical health status, emotional support network, socioeconomic status, age, marital status) were also tested by ANOVA or the t test.

Multiple regression analysis was performed in which the dependent variables were each of the three subscales and total score of the PTSD and the independent variables were the ELE score and five other variables. These analyses were conducted using the Statistic Package for Social Sciences (SPSS) computer programs at the Computation Center of Osaka University.

Results

Experience rates for earthquake-related life events (ELE) in the past year by 380 subjects are presented in Table 1. Experience rates of most events were similar between males and females change throughout. Percentage (%) frequencies by each item were as follows: partial to complete destruction of the home, 37.7% (men) and 44.9% (women); injury or illness, 13.9% (men) and 19.2% (women); death of a close family member, 2.3% (men) and 5.1% (women); and death of the spouse, 0.7% men, none women. Decrease of income was reported by about half of subjects (53.3% men, 44.9% women). Scarcely anybody experienced unemployment or a change of occupation. Mean number of total earthquake-related life events for men and women were 4.4 (±2.8) and 4.3 (±2.7), respectively. Mean scores of total earthquake-related life events for men and women were 15.1 (±11.3) and 15.5 (±11.6), respectively.

The list of PTSD scales based on the DSM-IV and PTSD symptoms reported one year after the Hanshin-Awaji earthquake by subjects are presented in Table 2. With regard to symptoms of persistent re-experience, 55.6% of men and 73.1% of women reported 'intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the earthquake'. However, 'recurrent distressing dreams of the earthquake' were reported by only a few subjects (7.6% of men, 10.3% of women). Of the symptoms of persistent avoidance and numbing of responsiveness, 'sense of a foreshortened future' was reported by 19.2% of men and 26.9% of women. 'Efforts to avoid activities, places or people that arouse recollections with the earthquake' were reported by 6.0% of men and 7.7% of women. Increased arousal symptoms were reported at frequencies of 15–30%.

The mean scores of the total PTSD and its three subscales by response categories of each variable in male and female subjects are shown in Table 3. The results for male subjects were as follows. (1) The degree of the experienced ELE score was significantly related to all scores of the total PTSD and its three subscales. (2) The grade of perceived physical health status was significantly associated with the scores of the total PTSD, avoidance, and arousal. (3) The amount of emotional support was significantly related to the score of total PTSD and arousal. (4) Age and marital status were significantly associated with only the

Table 1 Experience rates for earthquake-related life events one year after the Hanshin-Awaji earthquake by 302 male and 78 female victims

Earthquake-related life events	Male N (%)	Female N (%)
Death of spouse	2 (0.7)	0 (0.0)
Death of close family member	7 (2.3)	4 (5.1)
Death of close friend	19 (6.3)	9 (11.5)
Injury and illness of family member	42 (13.9)	15 (19.2)
Income decrease	161 (53.3)	35 (44.9)
Live apart from spouse for reasons other than marital difficulties	25 (8.3)	1 (1.3)
Live apart from family members other than spouse	26 (8.6)	6 (7.7)
Loss of employment	2 (0.7)	0 (0.0)
Change of occupation	1 (0.3)	0 (0.0)
Debt or foreclosure on a mortgage or lone	77 (25.5)	9 (11.5)
Personal injury or illness	33 (10.9)	14 (17.9)
Changed fellowship with neighbors	117 (38.7)	32 (41.0)
Change or repair home damage	190 (62.9)	47 (60.3)
Partial to total destruction of the home	114 (37.7)	35 (44.9)
A fire	5 (1.7)	4 (5.1)
Change in residence	55 (18.2)	16 (20.5)
Temporary absence from or changing of school of children	52 (17.2)	6 (7.7)
Inconvenience to daily life by destruction of life-line	286 (94.7)	73 (93.6)
Life in a shelter	99 (32.8)	24 (30.8)
Embroilment in legal trouble	22 (7.3)	7 (9.0)

Table 2 PTSD symptoms reported one year after the Hanshin-Awaji earthquake by 302 male and 78 female victims

PTSD symptoms and subscales (I–III) based on DSM-IV	Male N (%)	Female N (%)
I. Persistent re-experience of traumatic event		
(1) Recurrent and intrusive distressing recollections of the earthquake	95 (31.5)	28 (35.9)
(2) Recurrent distressing dreams of the earthquake	23 (7.6)	8 (10.3)
(3) Acting or feeling as if the earthquake were recurring	48 (15.9)	18 (23.1)
(4) Intense psychological distress on exposure to internal or external cues that symbolize or resemble an aspect of the earthquake	168 (55.6)	57 (73.1)
(5) Physiological reactivity on exposure to internal or external cue that symbolize or resemble an aspect of the earthquake	80 (26.5)	27 (34.6)
II. Persistent avoidance of stimuli associated with trauma and numbing of responsiveness		
(1) Efforts to avoid thoughts, feeling or conversations associated with the earthquake	31 (10.3)	17 (21.8)
(2) Efforts to avoid activities, places or people that arouse recollections with the earthquake	18 (6.0)	6 (7.7)
(3) Inability to recall an important aspect of the earthquake	25 (8.3)	12 (15.4)
(4) Diminished interest or participation in significant activities	37 (12.3)	14 (17.9)
(5) Feeling of detachment or estrangement from others	32 (10.6)	12 (15.4)
(6) Restricted range of affects	45 (14.9)	7 (9.0)
(7) Sense of a foreshortened future	58 (19.2)	21 (26.9)
III. Increased arousal		
(1) Difficulty falling or staying asleep	70 (23.2)	21 (26.9)
(2) Irritability or outbursts of anger	72 (23.8)	23 (29.5)
(3) Difficulty concentrating	65 (21.5)	20 (25.6)
(4) Hypervigilance	42 (13.9)	18 (23.1)
(5) Exaggerated startle response	37 (12.3)	12 (15.4)

scores of re-experience. The findings for female subjects were as follows. (1) The degree of the experienced ELE score and the grade of perceived physical health status were significantly related to all scores of the total PTSD and its three subscales. (2) The amount of emotional support was significantly associated with the scores of the total PTSD, avoidance, and arousal. (3) The level of socioeconomic status was significantly related to the score of total PTSD and arousal. (4) However, age and marital status were not significantly related to any PTSD scores.

The results of multiple regression analysis are shown in Table 4. Among male subjects, in which the effects of age, marital status, socioeconomic level were also controlled, indicated the following. (1) The scores of subjects who perceived poor physical health status were significantly higher than those of subjects with good or moderate for the total PTSD, avoidance and arousal. (2) Higher scores of experienced ELE were more highly associated

Table 3 Mean scores of the PTSD scale and its subscales (re-experience, avoidance, and arousal symptoms) by earthquake-related life events and other variables in 302 male and 78 female victims

[Male]

Variable		Total PTSD		Re-experience		Avoidance		Arousal	
	N	Mean±SD		Mean±SD		Mean±SD		Mean±SD	
Earthquake-related life events									
0–4	55	1.72±2.65	F=11.24***	0.60±0.91	F=12.79***	0.65±1.30	F=3.95**	0.47±0.99	F=7.56***
5–9	66	2.43±3.07		1.01±1.33		0.57±1.27		0.84±1.33	
10–15	52	3.01±2.57		1.46±1.37		0.73±1.31		0.82±1.11	
16–23	69	3.01±3.10		1.50±1.24		0.68±1.23		0.82±1.29	
24 or higher	60	5.41±4.14		2.23±1.56		1.45±1.80		1.73±1.65	
Perceived physical status									
Good	83	2.65±3.04	F=11.75***	1.43±1.53	F=1.44 ns	0.61±1.29	F=9.08***	0.60±1.05	F=19.73***
Moderate	168	2.75±3.13		1.26±1.31		0.68±1.23		0.80±1.27	
Bad	51	5.15±4.00		1.62±1.45		1.56±1.93		1.96±1.62	
Emotional support									
0	18	5.38±4.93	F=3.37*	1.77±1.73	F=0.58 ns	1.44±1.88	F=1.98 ns	2.16±2.25	F=6.39***
1	35	3.48±3.57		1.25±1.48		1.05±1.64		1.17±1.44	
2	49	3.24±3.46		1.36±1.36		0.87±1.50		1.00±1.44	
3	200	2.84±3.10		1.35±1.37		0.70±1.30		0.78±1.16	
Socioeconomic status									
Upper, middle	263	2.99±3.30	t=–1.87 ns	1.33±1.38	t=–1.16 ns	0.76±1.39	t=–1.47 ns	0.88±1.32	t=–1.90 ns
Lower	39	4.07±3.83		1.61±1.51		1.12±1.64		1.33±1.56	
Age									
20–29	43	2.48±2.89	F=1.59 ns	1.04±1.25	F=3.68*	0.51±1.24	F=1.20 ns	0.93±1.22	F=0.98 ns
30–39	48	2.58±2.75		0.91±1.04		0.77±1.34		0.89±1.15	
40–49	121	3.56±3.62		1.48±1.39		0.97±1.59		1.09±1.47	
50–59	90	3.15±3.54		1.61±1.57		0.81±1.42		0.77±1.37	
Marital status									
Married	242	3.10±3.34	t=–0.30 ns	1.45±1.43	t=2.19*	0.73±1.31	t=–1.83 ns	0.90±1.36	t=–1.07 ns
Single, separated, divorced, widowed	60	3.25±3.60		1.01±1.21		1.11±1.78		1.11±1.37	
Total	302	3.13±3.38		1.37±1.40		0.81±1.42		0.94±1.36	

[Female]

Variable		Total PTSD		Re-experience		Avoidance		Arousal	
	N	Mean±SD		Mean±SD		Mean±SD		Mean±SD	
Earthquake-related life events									
0–4	12	1.83±1.69	F=9.68***	1.08±0.90	F=4.57**	0.16±0.38	F=7.88***	0.58±1.24	F=7.98***
5–9	18	2.72±2.63		1.22±0.94		1.00±1.49		0.50±0.98	
10–15	19	3.21±3.02		1.63±1.38		0.63±1.11		0.94±1.26	
16–23	13	4.30±2.62		2.00±1.29		1.00±1.15		1.30±1.31	
24 or higher	16	8.31±4.81		2.87±1.78		2.75±1.94		2.68±1.20	
Perceived physical status									
Good	23	3.13±1.79	F=18.59***	1.82±1.07	F=9.60***	0.56±0.89	F=16.85***	0.73±1.05	F=12.95***
Moderate	44	3.27±3.04		1.36±1.16		0.90±1.32		1.00±1.27	
Bad	11	9.54±5.41		3.27±2.05		3.27±2.00		3.00±1.67	
Emotional support									
0	2	10.00±5.65	F=3.65*	3.00±2.82	F=1.57 ns	3.50±2.12	F=4.45**	3.50±0.70	F=2.83*
1	3	5.00±4.58		1.33±0.57		2.33±2.51		1.33±1.52	
2	5	7.60±4.09		2.80±1.48		2.60±2.07		2.20±1.30	
3	68	3.64±3.56		1.67±1.39		0.91±1.39		1.05±1.42	
Socioeconomic status									
Upper, middle	70	3.81±3.54	t=–2.08*	1.68±1.34	t=–1.53 ns	1.04±1.49	t=–1.63 ns	1.08±1.39	t=–2.18*
Lower	8	6.75±5.49		2.50±2.00		2.00±2.13		2.25±1.75	
Age									
20–29	29	4.27±3.18	F=0.78 ns	1.86±1.38	F=0.54 ns	1.06±1.33	F=1.48 ns	1.34±1.39	F=0.34 ns
30–39	17	5.11±4.74		1.94±1.74		1.82±2.03		1.35±1.49	
40–49	21	3.23±3.72		1.42±1.07		0.80±1.63		1.00±1.37	
50–59	11	3.81±4.28		1.90±1.70		0.90±1.13		1.00±1.84	
Marital status									
Married	29	3.58±3.97	t=–0.93 ns	1.68±1.36	t=–0.37 ns	0.93±1.55	t=–0.89 ns	0.96±1.49	t=–1.11 ns
Single, separated, divorced, widowed	49	4.42±3.77		1.81±1.48		1.26±1.60		1.34±1.43	
Total	97	4.03±3.69		1.76±1.39		1.09±1.54		1.17±1.41	

F value was computed by one-way analysis of variance. t value was computed by t test.
* P<0.05, ** P<0.01, *** P<0.001.

Table 4 Relationship of earthquake-related life events and other variables to the PTSD and its subscales (re-experience, avoidance, and arousal symptoms) in 302 male and 78 female victims (Multiple regression analysis)

[Male]

Variable	Total PTSD β	Re-experience β	Avoidance β	Arousal β
Age (per 5-year increase)	0.150*	0.158*	0.179**	0.024
Marital status (married=0, others=1)	0.155*	0.023	0.237***	0.114
Socioeconomic status (lower=1, upper and middle=0)	0.014	0.005	0.021	0.009
Perceived physical status (bad=1, good and moderate=0)	0.188***	0.008	0.192**	0.258***
Earthquake-related life events	0.365***	0.389***	0.228***	0.268***
Emotional support (no=1, yes=0)	0.114*	0.058	0.055	0.165**
	R^2=0.23 F=14.93***	R^2=0.19 F=11.53***	R^2=0.14 F=8.49***	R^2=0.21 F=13.22***

[Female]

Variable	Total PTSD β	Re-experience β	Avoidance β	Arousal β
Age (per 5-year increase)	–0.152	–0.100	–0.100	–0.193
Marital status (married=0, others=1)	0.059	0.022	0.079	0.048
Socioeconomic status (lower=1, upper and middle=0)	–0.004	0.015	–0.072	0.053
Perceived physical status (bad=1, good and moderate=0)	0.369***	0.265*	0.359***	0.324**
Earthquake-related life events	0.487***	0.397**	0.462***	0.392***
Emotional support (no=1, yes=0)	0.063	–0.013	0.091	0.081
	R^2=0.55 F=14.86***	R^2=0.31 F=5.47***	R^2=0.49 F=11.65***	R^2=0.43 F=9.16***

β: Standardized partial correlation coefficient.
* P<0.05, ** P<0.01, *** P<0.001.

with scores of total PTSD and its three subscales. (3) The scores of subjects who had no emotional support network were significantly higher for total PTSD and arousal than those of subjects who had one or more emotional support. Among female subjects, the results of multiple regression analysis were as follows. (1) The scores of subjects with poor perceived physical health status were significantly higher for the total PTSD and its three subscales than those of subjects with good or moderate health. (2) Higher scores of the experienced ELE were associated with higher scores of total PTSD and its three subscales. (3) Age, marital status, socioeconomic level and emotional support were not significantly related to any of the PTSD scores.

Discussion

The present study revealed a significant relationship between a higher total score of earthquake-related life events (ELE) and psychological distress measured by the PTSD scale and its three subscales in both male and female subjects. Furthermore, the score of ELE was related positively to all PTSD scores after controlling for the effects of age, marital status, socioeconomic level, somatic condition and emotional support. These findings suggest a significant relationship between the degree of adversity experienced by individuals in a disaster and their level of mental health, which is consistent with the findings of previous studies[14–16].

Events such as bereavement, property loss, personal injury or unemployment are known to increase levels of psychological distress in disaster victims[3, 4,17], and readjustment is needed after natural catastrophes. Stressors such as adjustment to these events lead to a decrease in health status and maladaptive outcomes. Kato et al.[18] reported that the psychological stress of reconstructing their lives and the lives of their families may be greater for younger subjects (under 60 years) than for elderly (60 years or above) earthquake victims. The present study quantified the importance of these stressful life events and showed that experience of a series of adverse earthquake-related events during the recovery period had an impact on the mental health status of earthquake disaster victims. Hanshin-Awaji earthquake may have been a sufficiently strong stressor, producing many life events associated with significant posttraumatic stress. The PTSD scale used in the present study appears to be useful for understanding the relationship between disaster stressors and mental health status of disaster victims.

Many studies[19–21] have indicated that posttraumatic stress disorder is common after disasters. There have been a number of studies of the psychological consequences of large-scale earthquakes, especially posttraumatic stress; e.g. Ecuador[15], Armenia[17, 21] and San Francisco Bay area[22]. A number of studies of posttraumatic stress reactions of victims after the Hanshin-Awaji earthquake in Japan have been reported[18,23]. Sakano et al.[23] described PTSD symptoms among 128 adults, three to four months after the Hanshin-Awaji earthquake. Their findings showed a higher prevalence of PTSD symptoms compared with the present fidings possibly because their survey was conducted only a short-time after the earthquake. Further prospective studies are needed in relation to changes in mental health status of the victims.

An important finding on life events and stress is that social support mitigates the effects of a stressful life event[24]. Individuals with strong social support are generally able to cope more effectively with life stressors than those that lack such resources[25,26]. In the present study, the current level of emotional support in male subjects was a significant predictor of posttraumatic stress, but it

was not in female subjects. Women have been reported to seek out social support as a means of coping more frequently than men[27–29]. Women have also been shown to be more likely to seek information when confronted with stressors than men[30,31]. Among the victims of Hurricane Hugo, social support had a protective effect against distress (anger, depression and global mental distress)[32]. In contrast, tornado victims stated that visitation from primary support groups did not ease their stress[33]. Social support served a protective function in relation to general psychological distress, but it did not appear to do so in relation to posttraumatic stress[34].

The methodological limitations of the current study should be considered in assessing our results. First, our subjects were not randomly selected from the general population exposed to the earthquake. Second, a useable response rate is very low. The return rates in disaster research are much lower than in comparable community surveys[35]. This appears to be the most likely reason since we asked many questions of participants who might had no time to spare or to partake in our study. Finally, we found a significant correlation between life events caused by the earthquake disaster and posttraumatic stress. However, the effects of disaster stressors on mental health status might be modified by various personal factors. Therefore, further evaluations are needed to clarify the roles of these mediating factors.

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References

1) Lystad M. Mental Health Response to Mass Emergencies: Theory and Practice. New York: Brunner/Mazel, 1988.
2) Shore J, Tatum E, Vollner W. Evaluation of mental health effects of disaster, Mount st. Helens eruption. Am. J. Public. Health 1986; 76 (suppl): 76–83.
3) Gleser GC, Green BL, Winget C. Prolonged Psychosocial Effects of a Disaster: A Study of Buffalo Creek. New York: Academic press, 1981.
4) Shore JH, Tatum EL, Vollner WM. Psychiatric reactions to disaster: The Mount st. Helens experience. Am. J. Psychiatry 1986; 143: 590–595.
5) Kinston W, Rosser R. Disaster: Effects on mental and physical state. J. Psychosom. Res. 1975; 18: 437–456.
6) Weinrich S, Hardin SB, Johnson M. Nurses intervene in Hugo disaster stress. Arch. Psychiatr. Nurs. 1990; 4: 195–205.
7) Solomon SD. Research issues in assessing disaster's effects. In: Gist R, Lubin B, editors. Psychosocial Aspects of Disaster. New York: John Wiley & Sons, 1989: 308–340.
8) American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 3rd ed. Washington, DC: APA, 1980.
9) Murphy SA. Mediating effects of intrapersonal and social support on mental health 1 and 3 years after a natural disaster. J. traum. stress 1988; 1: 155–172.
10) McFarlane AC. The aetiology of posttraumatic stress disorders following a natural disaster. Br. J. Psychiatry 1988; 152: 116–121.
11) Holmes TH, Rahe RH. The social readjustment rating scale. J. Psychosom. Res. 1967; 11: 213–218.
12) American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington, DC: APA, 1994.
13) Munakata T, Nakao T, Fujita K, Suwa S. Stressor, coping resources, and mental health in an urban population. Seishin Eisei Kenkyu 1985; 32: 49–68 (in Japanese).
14) McFarlane AC. Life events and psychiatric disorder: The role of a natural disaster. Br. J. Psychiatry 1987; 151: 362–367.
15) Lima BR, Chavez H, Samaniego N, Pompei MS, Pai S, Santacruz H, et al. Disaster severity and emotional disturbance: Implications for primary mental health care in developing countries. Acta Psychiatr. Scand. 1989; 79: 74–82.
16) Pynoos RS, Goenjian AK, Tashjian M, Karakashian M, Manjikian R, Manoukian G, et al. Posttraumatic stress reactions in children after the 1988 Armenian earthquake. Br. J. Psychiatry 1993; 163: 239–247.
17) Goenjian AK, Najarian LM, Pynoos RS, Steinberg AM, Manoukian G, Tavosian A, et al. Posttraumatic stress disorder in elderly and younger adults after the 1988 earthquake in Armenia. Am. J. Psychiatry 1994; 151: 895–901.
18) Kato H, Asukai N, MiyakeY, Minakawa K, Nishiyama A. Posttraumatic symptoms among younger and elderly evacuees in the early stages following the 1995 Hanshin-Awaji earthquake in Japan. Acta Psychiatr. Scand. 1996; 93: 477–481.
19) Weisaeth L. Psychiatric studies in victimology in Norway: Main findings and recent developments. Victimology 1985; 10: 478–487.
20) McFarlane AC. Posttraumatic morbidity of a disaster: A study of cases presenting for psychiatric treatment. J. Nerv. Ment. Dis. 1986; 174: 4–14.
21) Geonjian AK. A mental health relief programme in Armenia after the 1988 earthquake: Implementation and clinical observations. Br. J. Psychiatry 1993; 163: 230–239.
22) Cardena E. Spiegel D. Dissociative reactions to the San Francisco Bay area earthquake of 1989. Am. J. Psychiatry 1993; 150: 474–478.
23) Sakano Y, Shimada H, Tsujiuchi T, Ito K, Akabayashi A, Yoshiuchi K, at al. Psychosomatic problems after the Great Hanshin earthquake in January 1995 (I): Symptoms of posttraumatic stress disorders and psychological stress response. Jpn. J. Psychosom. Med. 1996; 36: 649–656 (in Japanese).
24) Caplan G. The family as a support system. In: Caplan G, Killilea M, editors. Support System and Mutual Help: Multidisciplinary Explorations. New York: Grune & Stratton 1976: 19–36.
25) Cohen S, Wills T. Stress, social support, and the buffering hypothesis. Psychol. Bulletin. 1985; 101: 310–357.
26) Compas BE, Epping J. Stress and coping in children and families: Implications for children coping with disaster. In: Saylor CF, editors. Children and Disasters. New York: Plenum 1993: 11–28.
27) Heppner PP, Reeder BL, Larson LM. Cognitive variables associated with personal problem solving appraisal: Implications for counseling. J. Counsel. Psychol. 1983; 30: 537–545.
28) Stone AA, Neale JM. New measure of daily coping: Develpoment and preliminary results. J. Pers. Soc. Psychol. 1984; 46: 892–906.
29) Fleishman J. Personality characteristics and coping patterns. J. Health Soc. Behav. 1984; 25: 229–244.
30) Billings AG, Moos RH. Life stressors and social resources affect

post-treatment outcomes among depressed patients. J. Abnorm. Psychol. 1985; 94: 140–153.
31) Sidle A, Moos RH, Adams J, Cady P. Development of coping scale. Arch. Gen. Psychiat. 1969; 20: 226–232.
32) Hardin SB, Weinrich M, Weinrich S, Hardin TL, Garrison C. Psychological distress of adolescents exposed to Hurricane Hugo. J. Traum. Stress 1994; 7: 427–440.
33) Bolin RC. Long-term Recovery from Disaster. University of Colorado Institute of Behavioral Science, Boulder 1982.
34) Carr VJ, Lewin TJ, Webster RA, Kenardy JA. A synthesis of the findings from the Quake Impact Study: A two-year investigation of the psychosocial sequelae of the 1989 Newcastle earthquake. Soc. Psychiatry Psychiatr. Epidemiol. 1997; April 32: 123–136.
35) Logue JM, Melick ME, Hansen H. Research issues and directions in the epidemiology of health factors of disasters, Epidemiology Review 1981; 3: 140–162.