Post-traumatic stress disorder status in a rescue group after the Wenchuan earthquake relief

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Abstract

Previous studies have suggested that the incidence of post-traumatic stress disorder in earthquake rescue workers is relatively high. Risk factors for this disorder include demographic characteristics, earthquake-related high-risk factors, risk factors in the rescue process, personality, social support and coping style. This study examined the current status of a unit of 1 040 rescue workers who participated in earthquake relief for the Wenchuan earthquake that occurred on May 12th, 2008. Post-traumatic stress disorder was diagnosed primarily using the Clinician-Administered Post-traumatic Stress Disorder Scale during structured interviews. Univariate and multivariate statistical analyses were used to examine major risk factors that contributed to the incidence of post-traumatic stress disorder. Results revealed that the incidence of this disorder in the rescue group was 5.96%. The impact factors in univariate analysis included death of family members, contact with corpses or witnessing of the deceased or seriously injured, near-death experience, severe injury or mental trauma in the rescue process and working at the epicenter of the earthquake. Correlation analysis suggested that post-traumatic stress disorder was positively correlated with psychotic and neurotic personalities, negative coping and low social support. Impact factors in multivariate logistic regression analysis included near-death experience, severe injury or mental trauma, working in the epicenter of the rescue, neurotic personality, negative coping and low social support, among which low social support had the largest odds ratio of 20.42. Findings showed that the occurrence of post-traumatic stress disorder was the result of the interaction of multiple factors.

Key Words

neural regeneration; post-traumatic stress disorder; incidence; Wenchuan earthquake; rescue groups; influencing factor; coping style; personality; social support; cross-sectional investigation; risk factors; neuroregeneration

Research Highlights

(1) Occurrence of post-traumatic stress disorder in a rescue group after the Wenchuan earthquake relief resulted from the interaction of various factors.
(2) Impact factors in univariate analysis included death of family members, contact with corpses or witnessing of the deceased or seriously injured, near-death experience, severe injury or mental trauma in the rescue process and working at the epicenter of the earthquake.

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(3) Impact factors in multivariate logistic regression analysis included near-death experience, severe injury or mental trauma, working in the epicenter of the rescue, neurotic personality, negative coping and low social support.

(4) An earthquake rescue group is a special population with strong physical ability and coping capacity as well as strong ability to endure mental pressure.

INTRODUCTION

Post-traumatic stress disorder is one of the most severe mental illnesses afflicting these workers. To provide better care and treatment for rescue workers after an earthquake, scholars in various countries have carried out studies focusing on the incidence of post-traumatic stress disorder and related risk factors in this population. Many studies conducted both in China and abroad have found that rescue workers who participate in earthquake relief have a higher prevalence of post-traumatic stress disorder[1-3]. To effectively reduce the incidence of this disorder, researchers have carried out in-depth analysis of risk factors. Findings show that the main factors influencing post-traumatic stress disorder are earthquake-related risk factors[4-5], initial level of exposure (earthquake-related risk factors[4-5] and rescue mission-related risk factors[6-7]), personality[8-10], degree of social support[11-12] and coping style[10, 13].

At 2:28 p.m. on May 12th, 2008, an earthquake 8.0 on the Richter scale struck the Wenchuan area of Sichuan Province in southwest China. It was one of the most catastrophic earthquakes in the history of mankind[14]. This study investigated post- traumatic stress disorder incidence in rescue workers participating in the earthquake relief as well as risk factors for post-traumatic stress disorder in this population. We diagnosed post-traumatic stress disorder primarily using the Clinician-Administered Post-Traumatic Stress Disorder Scale[15], which is the gold standard of post- traumatic stress disorder assessment and thus facilitates diagnostic accuracy. Previous studies[5-14] used this instrument to conduct univariate or multivariate analysis on risk factors for post-traumatic stress disorder. This study not only analyzed single factors, but also inte-

grated them using multivariate logistic regression analysis. We investigated post-traumatic stress disorder incidence using a current status survey in a group of rescue workers after the "5·12" Wenchuan earthquake relief and analyzed major risk factors for post-traumatic stress disorder using univariate and multivariate analyses. Results suggested several preventive and therapeutic strategies to help reduce post-traumatic stress disorder incidence in rescue workers, providing a scientific and reliable basis for the handling of similar events in the future.

RESULTS

Quantitative analysis of subjects
Ninety-nine percent of the rescue personnel (1 028) participated in this survey. The 1% (14) who had functional or organic mental illness in the past were excluded. Ninety-five percent (988) completed the questionnaire and participated in the post-traumatic stress disorder diagnostic interview. From the self-report questionnaire and Clinician-Administered Post-Traumatic Stress Disorder Scale survey, information provided by 89% of subjects (923) was analyzed. Only 923 subjects were involved in the final analyses after exclusion criteria were applied and those with insufficient data eliminated. Fifty-five subjects with post-traumatic stress disorder as diagnosed by the Clinician-Administered Post-Traumatic Stress Disorder Scale constituted the post- traumatic stress disorder group. The control group comprised the remaining 868 subjects without post-traumatic stress disorder (19.6 ± 2.3). The vast majority were Han Chinese (97.2%)

Baseline analysis of subjects
There were 923 male subjects, aged 18–28 years old with education less than or equal to a high school diploma (855, 92.6%). The

vast majority were single (896, 97.1%), and the remaining were married (27, 2.9%). The post-traumatic stress disorder and control groups showed no difference in age, ethnicity, education level or marital status (Table 1).

Univariate analysis of earthquake-related risk factors
The post-traumatic stress disorder prevalence rate was 5.96% ($n = 55$). Clinician-Administered Post-Traumatic Stress Disorder Scale scores in patients with post-traumatic stress disorder ranged from 37 to 59 (40.83 ± 15.42). Univariate analysis showed that individuals who experienced death of family members in the earthquake suffered from post-traumatic stress disorder symptoms at a rate 4.7 times greater than those who did not (*OR*: 4.71, 95%*CI*: 1.83–12.15; Table 1).

Table 1   Distribution and comparison of demographic characteristics of post-traumatic stress disorder (PTSD) and control groups, PTSD *OR* and 95%*CI*

Demographic variable	Overall (people)		PTSD [*OR* (95%*CI*)]	*P*
	PTSD ($n = 55$)	Control ($n = 868$)		
Age (year)				1.00(FET)
> 20	3	60	1.00	
≤ 20	52	808	1.29(0.39–4.24)	
Ethnic			ND	0.40(FET)
Non-Han Chinese	0	26		
Han Chinese	55	842		
Education level				0.60(FET)
> high school	5	63	1.00	
≤ high school	50	805	0.78(0.30–2.03)	
Marital status				0.67(FET)
Married	2	25	1.00	
Single	53	843	0.79(0.18–3.41)	
Family death				0.00(FET)
No	49	846	1.00	
Yes	6	22	4.71(1.83–12.15)	

OR: Odds ratio; 95% *CI*: 95% confidence interval; ND: not determined; FET: Fisher's exact test.

Univariate analysis of risk factors related to the rescue mission
Univariate analysis revealed that individuals who had contact with corpses, or witnessed the deceased or seriously injured suffered from post-traumatic stress disorder symptoms at a rate 10.3 times higher than those without those experiences (*OR* = 10.35; 95%*CI*: 5.79–18.48). Subjects who themselves survived death, were seriously injured or had severe mental trauma had a rate of post-traumatic stress disorder 25.6 times higher than those who did not (*OR* = 25.6, 95%*CI*: 13.9–47.3). Rescuers at the epicenter suffered from post-traumatic stress disorder symptoms 11.79 times that of rescuers who were not at the epicenter (*OR* = 11.79, 95%*CI*: 6.61 –21.0; Table 2).

Comparison and correlation analysis of the Eysenck Personality Questionnaire, Trait Coping Style Questionnaire and Social Support Rating Scale in post-traumatic stress disorder and control groups
Statistical comparisons of results from scales of the Eysenck Personality Questionnaire including Neuroticism, Psychoticism, Extraversion/Introversion and Lie as well as coping style and social support were conducted between the post-traumatic stress disorder and control groups. All differences were statistically significant (*P* < 0.01; Table 3). For the Eysenck Personality Questionnaire, post-traumatic stress disorder was positively correlated with Eysenck Personality Questionnaire-Neuroticism and Eysenck Personality Questionnaire-Psychoticism ($r = 0.44, 0.25$), but negatively correlated with Eysenck Personality Questionnaire- Extraversion/Introversion and Eysenck Personality Questionnaire-Lie ($r = -0.20, -0.18$). Results of the Trait Coping Style Questionnaire showed that post-traumatic stress disorder and negative coping were positively correlated ($r = 0.29$). For the Social Support Rating Scale, post-traumatic stress disorder and low social support were positively correlated ($r = 0.58$). All the correlations were statistically significant (*P* < 0.01; Table 3)

Multivariate logistic regression analysis influencing post-traumatic stress disorder incidence
We integrated all the factors in this study (demographic and earthquake-related risk factors, rescue mission-related risk factors, personality, coping style and social support) in multivariate logistic regression analysis. We selected only a single factor that was statistically significant (*P* ≤ 0.05) between the post-traumatic stress disorder and control groups in univariate analysis to enter in the multivariate logistic regression analysis. In the univariate analysis of demographic factors, the two groups were significantly different regarding whether there were any family member deaths in the earthquake. In the study of risk factors related to the rescue mission, three factors were statistically significant in the comparison of the post-traumatic stress disorder and control groups: (1) contact with corpses or witnessing of the deceased or seriously injured; (2) near-death experience, severe injury or severe mental trauma of the rescuers themselves during the rescue and (3) working in the epicenter of the rescue. Regarding personality, Eysenck Personality Questionnaire-Neuroticism, Eysenck Personality Questionnaire-Psychoticism, Eysenck Personality Questionnaire-Extr- aversion/Introversion and Eysenck Personality Questionnaire-Lie scores were statistically significant in the comparison of the two groups, with Eysenck Personality Questionnaire-Neuroticism score being the most significantly different.

Table 2 Distribution and comparison of rescue mission-related risk factors for post-traumatic stress disorder (PTSD) and control groups

Rescue mission-related traumatic factors	Overall(people)		PTSD [OR (95%CI)]	χ^2 (df)	P
	PTSD (n = 55)	Control (n = 868)			
Contact with corpses or witness of the deceased or seriously injured				87.33(1)	0.00[a]
Yes	28	794			
No	27	74	10.35(5.79–18.48)		
Survival experience, severe injury or severe mental trauma of the rescuers themselves during the rescue					0.00 (FET)
No	22	820			
Yes	33	48	25.60(13.9–47.3)		
The amount of time the rescuers participated in the rescue				0.54(1)	0.46[a]
> 1 month	18	327			
≤ 1 month	37	541	1.24(0.70–2.22)		
Whether the rescuers worked in the epicenter of the rescue				100.77(1)	0.00[a]
No	22	770			
Yes	33	98	11.79(6.61–21.0)		
Whether the rescuers were extremely frightened by the earthquake or aftershock				0.31(1)	0.58[a]
No	17	300			
Yes	38	568	1.19(0.66–2.13)		

OR: Odds ratio; 95%CI: 95% confidence interval; FET: Fisher's exact test. n: Number of samples; [a]Pearson χ^2 test.

Table 3 Comparison of the Eysenck Personality Questionnaire (EPQ), Trait Coping Style Questionnaire (TCSQ) and Social Support Rating Scale (SSRS) for post-traumatic stress disorder (PTSD) and control groups with correlation analysis

Item	PTSD (n = 55)	Control (n = 868)	χ^2(df)	P	r
EPQ [n(%)]					
EPQ-Neuroticism	31(56.3)	45(5.2)	179.30(1)	0.00[a]	0.44[b]
EPQ-Psychoticism	17(30.9)	42(4.8)	58.75(1)	0.00[a]	0.25[b]
EPQ-Extraversion/ Introversion	5(9.1)	428(49.3)	33.59(1)	0.00[a]	–0.20[b]
EPQ-Lie	2(3.6)	353(40.7)	29.97(1)	0.00[a]	–0.18[b]
TCSQ [n(%)]			76.27(1)	0.00[a]	0.29[b]
PC	9(16.4)	629(72.5)			
NC	46(83.6)	239(27.5)			
Total score of SSRS [n(%)]			307.92(1)	0.00[a]	0.58[b]
< 25 (low social support)	47(85.5)	61(7.0)			
≥ 25 (low social support)	8(14.5)	807(93.0)			

n: Number of samples; [a]Pearson χ^2 test; [b]Pearson correlation test. PC: Positive coping; NC: negative copying.

Thus, we incorporated Eysenck Personality Questionnaire-Neuroticism score into the logistic regression analysis. With regard to coping styles and social support, negative coping and low social support were statistically significant between the two groups. Therefore, we selected the seven factors including family deaths in the earthquake, the three factors related to the rescue mission, Eysenck Personality Questionnaire-Neuroticism,

negative coping, and low social support as the independent variables, and the two categories of post-traumatic stress disorder diagnosis (post-traumatic stress disorder and non-post-traumatic stress disorder) as the dependent variables to perform a backward step-by-step multivariate logistic regression analysis. The analysis showed that the post-traumatic stress disorder odds ratio increased in the five conditions in which the rescuers (1) had a near-death experience, serious injury or severe mental trauma during the rescue process; (2) worked in the epicenter of the rescue; (3) had an elevated Eysenck Personality Questionnaire-Neuroticism score; (4) showed negative coping and (5) had low social support. Results from the analysis were statistically significant ($P \leq 0.001$). Among all the factors, low social support had the largest odds ratio (OR), being 20.42 (Table 4).

DISCUSSION

Post-traumatic stress disorder prevalence
Rescue personnel are at a high risk of post-traumatic stress disorder after participating in rescue missions, as demonstrated by previous reports.

However, in this study, the prevalence of post-traumatic stress disorder in rescue workers was lower than that reported by the studies mentioned above[2-4]. There are several possible reasons for the lower prevalence in our study. Rescue workers in this study were provided with professional psychological services after the earthquake.

Table 4   Multivariate logistic regression analysis of post-traumatic stress disorder (PTSD) risk factors in rescue workers

Variable X	PTSD [n(%)]	Control [n(%)]	OR	95%CI	P
Whether the rescuers have survival experience, severe injury or severe mental trauma during the rescue					
No	22(40.0)	820(94.5)	1.00		
Yes	33(60.0)	48(5.5)	0.42	0.18–0.67	< 0.001
Whether the rescuers work at the epicenter of the earthquake					
No	22(40.0)	770(88.7)	1.00		
Yes	33(60.0)	98(11.3)	0.23	0.09–0.54	0.001
EPQ-Neuroticism					
No	24(43.6)	823(94.8)	1.00		
Yes	31(56.4)	45(5.2)	0.05	0.02–0.10	< 0.001
Coping style					
Positive coping	9(16.4)	629(72.5)	1.00		
Negative coping	46(83.6)	239(27.5)	0.14	0.06–0.30	< 0.001
Social support					
High	8	807	1.00		
Low	47	61	20.42	9.36–44.54	< 0.001

OR: Odds ratio; 95%*CI*: 95% confidence interval; *n*: number of samples. In univariate analysis, only factors with *P* ≤ 0.05 were selected to enter the multivariate logistic regression analysis. EPQ: Eysenok Personability Questionaire.

A prior study indicated that such services helped reduce the incidence of mental illness in firefighters who participated in the Chi-Chi earthquake relief in Taiwan[16]. The rescuers in our study were given psychological and other support services 2 weeks, 4 months, 8 months and 12 months after the earthquake. Psychological services included critical incident stress debriefing[17], relaxation techniques[18], methods of physical and psychological adjustment[19] and psychological consultation. The relatively young average age of our subjects may also partially explain the low post-traumatic stress disorder prevalence. Our data suggest that provision of professional psychological services should be considered for the prevention or treatment of post-traumatic stress disorder in rescuers after an earthquake and can be effective for other types of rescue personnel.

Post-traumatic stress disorder and rescue mission-related risk factors

Many studies have shown that post-traumatic stress disorder incidence in earthquake rescuers is related to whether they saw corpses during the relief effort[3, 20-21]. Our findings are consistent with these studies. The re-

view by Aker[7] in 2006 suggested that many risk factors (witnessing of the deceased, seeing a large number of injured, contact with corpses and near-death experience) contribute to the occurrence of mental illness in rescue workers. Similarly, we found that rescue workers who had contact with corpses, witnessed the deceased or seriously injured, had a near-death experience themselves during the rescue, or were severely injured or had severe mental trauma were more prone to post-traumatic stress disorder. We also found that being at the epicenter of the earthquake was a risk factor. The Wenchuan earthquake measuring 8.0 on the Richter scale, making it one of the most catastrophic earthquakes in recorded history. The epicenter was the most severely damaged area in the earthquake and had the largest number of casualties. Therefore, rescuers working there were more susceptible to post-traumatic stress disorder. In general, because of the large number of risk factors that may affect workers participating in the rescue mission of an earthquake, such personnel should be provided a high degree of concern and care. Correspondingly, we should give more mental, spiritual and social support to rescuers during such a significant time of aid.

Relationship between post-traumatic stress disorder and personality

In our analysis of post-traumatic stress disorder factors, we found that individual personality characteristics and the occurrence of post-traumatic stress disorder were highly correlated. From a physiological point of view, personality traits such as psychoticism, neuroticism and extroversion-introversion as measured by the Eysenck Personality Questionnaire-Psychoticism, Eysenck Personality Questionnaire-Neuroticism and Eysenck Personality Questionnaire-Extraversion/Introversion, respectively, have a close relationship with the strength of inhibitive processes in the cerebral cortex. These personality traits also influence the upstream reticular activating threshold in the central nervous system as well as autonomic nervous system functioning[22]. Score on the Eysenck Personality Questionnaire-Neuroticism was identified as a factor related to the psychological effect of the relief effort. Neuroticism is a personality trait characterized by emotional instability and anxiousness[23] and increases susceptibility to psychological trauma[24]. It seems valid to conclude that some personality tendencies are a major factor in increasing psychological distress. Previous reports have demonstrated that post-traumatic stress disorder occurrence is highly correlated with personality factors, among which neuroticism plays an important role[9-11]. Our findings in this study support those results.

Relationship between post-traumatic stress disorder and coping style

Negative coping style is mainly expressed as evasion, yield, fantasy and repression. A negative state of mind and emotion often results in a series of changes in physiological functions, such as insomnia, fatigue, loss of appetite, distractibility and slow response, which further result in mental fatigue, reduced efficiency and error proneness. These behaviors in turn weaken self-confidence and worsen negative emotional experiences[25]. Jiang *et al* [26] demonstrated that a negative coping style is associated with the incidence of cancer, and negative coping is stably correlated with psychosomatic symptoms as well as a variety of diseases. In contrast, positive coping is a positive approach used when people actively search for the solution to a problem. Individuals who demonstrate positive coping tend to adapt well to a stressful environment and actively seek help and relief, which can change their subjective perception, boost resilience and improve mood. From the univariate analysis of post-traumatic stress disorder risk factors in our study, we observed a positive correlation between post-traumatic stress disorder and negative coping, which is consistent with previous reports[11, 14].

Relationship between post-traumatic stress disorder and social support

Social support has a buffering effect on stressors and plays an important role in maintaining good emotional experiences[27]. In the post-traumatic stress disorder survey of Yantai salvage soldiers, post-traumatic stress disorder occurrence was associated with social support, self-characteristics, the level of content and experiences[28]. In general, increasing social support, such as improving the methods of superiors and actively seeking social support can reduce the occurrence of post-traumatic stress disorder. The survey in Shangyi, Zhangbei 3 months after the local earthquake found that post-traumatic stress disorder incidence was closely related to social support[29]. Many researchers believe that good social support is beneficial for health, while the presence of inferior social relations does harm to physical and mental health. Social support on one hand protects the individuals under stress (*i.e.* buffering effect), and on the other hand is of great significance in maintaining good emotional experiences[30-31]. The present study found that post-traumatic stress disorder and low social support were positively correlated, which is consistent with previous results[12-13]. Among all the factors in our study, low social support had the largest post-traumatic stress disorder odds ratio with $OR = 20.42$.

Considering that social support is subjective and can be changed, we should emphasize the role of social support in the prevention of post-traumatic stress disorder and give more social support to rescuers to reduce the post-traumatic stress disorder incidence rate in these workers.

Multivariate logistic regression analysis of post-traumatic stress disorder-influencing factors

We integrated all the factors in this study (demographic and earthquake-related risk factors, rescue mission-related risk factors, personality, coping style and social support) into a multivariate logistic regression analysis, which gave an integrated overview of all the post-traumatic stress disorder risk factors for rescue workers. Only a single factor that was statistically significant between the post-traumatic stress disorder and control groups in univariate analysis was selected to enter the multivariate logistic regression analysis. This analysis showed that the post-traumatic stress disorder odds ratio was increased in conditions in which the rescuers (1) had a near-death experience, serious injury or severe mental trauma in the rescue process; (2) worked in the epicenter of the rescue; (3) had an elevated neuroticism score (Eysenck Personality Questionnaire-Neuroticism); (4) had a negative coping style and (5) had low social support. Analysis of the results indicated statistically significant differences. Among all the factors, low social support had the largest odds ratio. Taken together, risk factors related to the rescue mission, elevated Eysenck Personality Questionnaire-Neuroticism score, negative coping and low social support represented the major risk factors influencing post-traumatic stress disorder. Targeted measures should be taken to reduce the incidence of post-traumatic stress disorder related to these risk factors. The occurrence of post-traumatic stress disorder can be associated with many risk factors. The relatively low incidence of post-traumatic stress disorder in the rescue group we studied may be related to the following factors: (1) single gender: all of the subjects in our study were male. It has been reported in the literature that men have lower rates of post-traumatic stress disorder than women under the same stressor[32-33]. (2) A relatively young average age: some studies have suggested that the prevalence of post-traumatic stress disorder in young people is lower compared with the elderly[34-35]. (3) Non-professional rescuers: all personnel were participating for the first time in a rescue. There is some evidence indicating that professional rescuers who participate in rescues long-term are more prone to post-traumatic stress disorder[36].

The group in this study was a special population. They

were neither professional rescuers nor common volunteers. They received strict military basic training, and therefore had stronger physical skills, better response capacity and were more able to endure psychological stress. This group was optimally pre-selected. The sample size of our study was limited, with a relative low incidence of post-traumatic stress disorder. The small number of cases could have affected the accuracy of the results to a certain extent. However, because the composition of the surveyed sample was simple (single gender, concentrated age distribution, as well as relatively uniform race, education level and marital status) and there were few confounding factors, the relatively small sample size is acceptable. In summary, this study analyzed the incidence of and risk factors for post-traumatic stress disorder in a rescue group after relief following the 5.12 Wenchuan earthquake. Results showed the major risk factors for post-traumatic stress disorder and their respective significances. We also pointed out several possible strategies to prevent and reduce post-traumatic stress disorder incidence in rescue workers, which can provide a scientific and reliable basis for handling of similar incidents in the future.

SUBJECTS AND METHODS

Design
A cluster sampling, cross-sectional study.

Time and setting
This study comprised two parts: a self-report questionnaire and clinical interview. All subjects completed a self-questionnaire 18 months after the earthquake. Then psychiatrists performed a post-traumatic stress disorder assessment of the rescue workers 18 months after the earthquake using the Clinician-Administered Post-Traumatic Stress Disorder Scale.

Subjects
Inclusion criteria: (1) staff: rescue workers from a unit that had participated in the rescue mission of the 5·12 Wenchuan earthquake; (2) rescue sites: epicenter or close to the epicenter (Beichuan County, the Dujiangyan region and Wenchuan County); (3) time arrived at the rescue sites: within 3 days after the earthquake and (4) length of time participating in the rescue: 30–60 days.

Exclusion criteria: (1) staff who had functional or organic mental illness in the past (according to the mental illness diagnosis provided by the psychological department of

the unit 3 months before the earthquake) and (2) staff who did not provide informed consent.

Subjects were from a unit of 1 040 rescue workers who had participated in the rescue mission of the 5·12 Wenchuan earthquake. These workers participated in the relief work in Beichuan County, the Dujiangyan region and Wenchuan County. They arrived at the rescue sites 1–3 days after the earthquake and continued working on site for 39 ± 9 days (range: 34–55 days). Beichuan County, the Dujiangyan region and Wenchuan County were at or close to the epicenter and incurred very serious damage from the earthquake.

Methods
Survey of the subjects included a questionnaire and the Clinician-Administered Post-Traumatic Stress Disorder Scale
This questionnaire included demographic and earthquake-related factors (whether there were deaths of family members), traumatic factors related to the rescue mission, the Eysenck Personality Questionnaire (Eysenck Personality Questionnaire-adult version)[37], Trait Coping Style Questionnaire[38] and Social Support Rating Scale[39]. In our self-questionnaire, demographic variables were age, race, education level and marital status. Earthquake-related risk factors included death of family members in the earthquake[5-6]. Traumatic factors related to the rescue mission included the following five conditions[7-8]: (1) contact with corpses or witnessing of a deceased or seriously injured person; (2) a near-death experience, severe injury or severe mental trauma of the rescuers themselves during the rescue; (3) amount of time spent in the rescue; (4) working in the epicenter of the rescue and (5) whether the subjects were extremely frightened by the earthquake or aftershock.

The Eysenck Personality Questionnaire-adult version used in our self-questionnaire was amended by Gong[37]. It consisted of 88 entries and included four dimensions: Eysenck Personality Questionnaire- Extraversion/Introversion, Eysenck Personality Questionnaire-Psychoticism, Eysenck Personality Questionnaire-Neuroticism and Eysenck Personality Questionnaire-Lie. Its reliability and validity have been verified in a previous study[38]. The Trait Coping Style Questionnaire used in our self- questionnaire was amended by Jiang[39] and consisted of 20 entries with five scales to assess the relatively stable coping strategies related to personality traits, which can be divided into two dimensions: positive coping and negative coping. The reliability and validity of the Trait Coping Style Questionnaire have also been verified. The Social Support Rating

Scale designed by researchers comprised 10 entries with three dimensions including subjective social support[40], objective social support and use of social support. The summed score of the 10 entries represented total social support. A higher total score indicated better social support. It has been shown that the Social Support Rating Scale has good reliability and validity and is appropriate for use in the Chinese population.

The Clinician-Administered Post-Traumatic Stress Disorder Scale is widely considered the gold standard of post-traumatic stress disorder assessment. It is a structured interview that provides scaled diagnosis and is capable of measuring the severity of post-traumatic stress disorder symptoms. These symptoms are in line with the diagnostic criteria of Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. The Clinician- Administered Post-Traumatic Stress Disorder Scale assessment is performed by a trained psychiatrist, and the process usually takes 40–50 minutes[15]. In addition, the Clinician-Administered Post-Traumatic Stress Disorder Scale is able to measure post-traumatic stress disorder prevalence in the month prior to the assessment as well as the severity of up to 17 symptoms.

Evaluation of the subjects through a self-report questionnaire and clinical interview

To assess the psychological impact of the earthquake on rescue workers, this study was carried out in two parts: a self-report questionnaire and clinical interview. We assessed demographic variables and earthquake-related risk factors, traumatic factors related to the rescue mission, the Eysenck Personality Questionnaire-adult version, Trait Coping Style Questionnaire and Social Support Rating Scale from the self-reports of the rescuers. Post-traumatic stress disorder diagnosis was performed by psychiatrists who had more than 5 years of qualified experience administering the Clinician-Administered Post-Traumatic Stress Disorder Scale.

Statistical analysis of survey data and quality control

In univariate analysis, demographic and earthquake-related risk factors were considered categorical variables, and the Pearson's chi-squared test or exact test was used for analysis. The correlation between post-traumatic stress disorder and personality, coping style or social support was analyzed using the Pearson correlation test. A multivariate logistic regression model was used to assess the relationship between post-traumatic stress disorder and multiple variables including earthquake-related risk factors, rescue-related traumatic factors, personality, coping style and social support.

Post-traumatic stress disorder diagnostic results were classified as either post-traumatic stress disorder or non-post-traumatic stress disorder and analyzed with logistic regression (backward stepwise regression) with $P < 0.05$ considered significantly different. SPSS 17.0 (SPSS, Chicago, IL, USA) was used in the above analysis. All questionnaires were pretested prior to the survey, and parts that were not designed well were modified accordingly. The survey information was encoded and uploaded to the Epidata database. Data were entered separately by two individuals. Inconsistent information was double-checked, errors were corrected and illegible writing was evaluated. Investigators worked independently in an undisturbed environment. To ensure the quality of the investigation, this study hired trained medical personnel to check the quality of the survey.

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