

# ORIGINAL RESEARCH

## Prevalence and Determinants of Chronic Post-Traumatic Stress Disorder After Floods

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### ABSTRACT

**Objective:** To explore the prevalence and determinants of chronic post-traumatic stress disorder (PTSD) among flood victims.

**Methods:** A cross-sectional survey was carried out in 2014 among individuals who had experienced the 1998 floods and had been diagnosed with PTSD in 1999 in Hunan, China. Cluster sampling was used to select subjects from the areas that had been surveyed in 1999. PTSD was diagnosed according to DSM-IV criteria, social support was measured according to a Social Support Rating Scale, coping style was measured according to a Simplified Coping Style Questionnaire, and personality was measured by use of the revised Eysenck Personality Questionnaire Short Scale for Chinese. Data were collected through face-to-face interviews by use of a structured questionnaire. Multivariate logistic regression analysis was used to reveal the determinants of chronic PTSD.

**Results:** A total of 123 subjects were interviewed, 17 of whom (14.4%) were diagnosed with chronic PTSD. Chronic PTSD was significantly associated with disaster stressors (odds ratio [OR]: 1.74; 95% confidence interval [CI]: 1.22-2.47), nervousness (OR: 1.09; 95% CI: 1.01-1.17), and social support (OR: 0.85; 95% CI: 0.74-0.98).

**Conclusions:** Chronic PTSD in flood victims is significantly associated with disaster stressors, nervousness, and social support. These factors may play important roles in identifying persons at high risk of chronic PTSD. (*Disaster Med Public Health Preparedness*. 2015;9:504-508)

**Key Words:** stress disorders, post-traumatic, floods, mental disorders

Floods are the most common natural disaster in both developed and developing countries and their impact is occasionally devastating.<sup>1</sup> As traumatic events, floods are experienced by many people and may result in a wide range of mental and physical health consequences.<sup>2</sup> Accounts of the psychosocial impacts of flood events suggest that they can have significant effects on people's well-being, relationships, and mental health.<sup>3</sup> Post-traumatic stress disorder (PTSD) is the most commonly studied and probably the most frequent and debilitating psychological disorder that occurs after floods.<sup>4</sup>

PTSD is a severe and complex disorder precipitated by exposure to a psychologically distressing event and is characterized by persistent intrusive memories about the traumatic event, persistent avoidance of stimuli associated with the trauma, and persistent symptoms of increased arousal.<sup>5</sup> People with PTSD may experience a long recovery process after a traumatic event.<sup>6</sup> According to a published study, 10% of PTSD

patients will live with a psychological impact and be diagnosed with chronic PTSD.<sup>7</sup> Compared to young adults with nonchronic PTSD, those with chronic PTSD have a higher number of PTSD symptoms (as diagnosed by the *Diagnostic and Statistical Manual of Mental Disorders*, third edition, revised) and higher rates of interpersonal numbing and overreactivity to stimuli that symbolize the stressor, as well as higher rates of psychiatric comorbidity and other medical conditions.<sup>6</sup> Currently, research on PTSD is mainly focused on the morbidity or risk factors among victims after disasters like earthquakes or snowstorms.<sup>8</sup> A limited number of studies have revealed the prevalence and determinants of chronic PTSD. Mollica found that 45% of the Bosnian refugees in a camp who had depression or PTSD in 1996 continued to have these disorders in 1999.<sup>9</sup> In a 14-year follow-up study about American legionnaires, it was revealed that combat exposure, perceived negative community attitudes to homecoming, minority race, depression symptoms, and more anger predicted a more chronic course.<sup>10</sup>

In the present study, a cross-sectional survey was carried out among individuals who had suffered the 1998 floods and had been diagnosed with PTSD 16 years ago (1999) in Hunan, China. We explored the prevalence and determinants of chronic PTSD among the flood victims.

## METHODS

### Study Population and Data Sources

Victims of the 1998 summer floods, which lasted for 45 days in Hunan, China, who were diagnosed with PTSD formed the target population. The study area was the catchment area of Dongting Lake, located south of the middle reach of the Yangzi River in Southern China (a flood-prone area).

A cross-sectional survey was used to investigate the prognosis of PTSD and the determinants of chronic PTSD. The result of a pre-survey we conducted 1 month before this survey showed a 23.3% (7/30) prevalence rate of chronic PTSD. It could be hypothesized that the margin of error in this study was 0.35\*p. The sample size of 107 was determined from the sample size formula for enumeration data in a descriptive study:  $N = 4p(1-p)/d^2$ , ( $\alpha = 0.05$ ,  $q = 1-p$ ). We then determined a sample size of 150 considering the fact that the response rate of patients would not be high after 16 years. We used a cluster sampling method to select study subjects. We selected 2 counties (Ziyang and Anxiang) from all 8 flood-affected counties for which the PTSD prevalence was 8.6% in the 1999 survey. All 123 patients who had been diagnosed with PTSD were selected and investigated again this time.

### Survey Method

The survey was conducted in June 2014. Three days before the survey, we contacted the patients with the help of the local health center to make an appointment and to ensure their participation. Trained investigators, who studied in the medical school or worked at the local centers for disease control and prevention, carried out face-to-face interviews in the patients' houses by use of a structured questionnaire to obtain demographic data, assess disasters stressors and persistent stressors, ascertain PTSD, and measure social support, coping style, and personality. These investigators received on-site supervision from psychologists. Nearly half an hour was needed to administer the questionnaire for each respondent. All the data collected were keyed into the database in the computer. This project was approved by the ethics committee of Central South University and all subjects agreed to participate in the investigation.

### Measures

The PTSD patients who were diagnosed in 1999 completed the following scales in this investigation. The Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C)<sup>11</sup> was

used to measure PTSD symptomatology. The PCL-C, which consists of 17 items that correspond to the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV),<sup>12</sup> is a commonly used self-report questionnaire for determining PTSD following a trauma. It was designed in November 1994 and translated into Chinese to assess PTSD symptoms in civilian populations. According to the research,<sup>13</sup> the PCL-C in this study demonstrated a good validity, reliability, and capacity to identify PTSD patients. For the sample, the sensitivity was 0.86, Cronbach's  $\alpha$  for the checklist was 0.82, and the split-half reliability was 0.65.<sup>13</sup>

Measures for disasters stressors and persistent stressors were contained in the questionnaire to evaluate the effects of the 1998 flood and adverse events over the 16 years, respectively. Death of family members, loss of incomes, aggravation of health, and 5 other items were investigated to ascertain the level of stressors (disaster stressors) in the 1998 flood. Persistent stressors consisting of horrible experiences and fear or hopelessness about the experience were assessed to determine the stress situation from 1999 to the present. Patients who suffered very bad situations with terrified feelings were classified as the positive group; others were classified as negative.

The Chinese version of the Social Support Rating Scale (SSRS),<sup>14</sup> which was developed by Shuiyuan in 1994, was used to measure three clusters of individual social relations including objective support, subjective support, and support utilization. For the sample, Cronbach's  $\alpha$  for the three clusters were 0.89 to 0.94 and the test-retest reliability was 0.92.<sup>14</sup>

The Simplified Coping Style Questionnaire (SCSQ)<sup>15</sup> was developed by Yaning in 1998. Positive coping cluster and negative coping cluster were included in the questionnaire (20 items) to measure the patients' coping style. The final result of one person's coping style equals the differential between the standard scores of positive coping and negative coping. For the sample, Cronbach's  $\alpha$  for the questionnaire was 0.90; the test-retest reliability was 0.89.<sup>15</sup>

The Revised Eysenck Personality Questionnaire Short Scale for Chinese (EPQ-RSC)<sup>16</sup> was used to assess psychoticism (P), neuroticism (N), extraversion (E), and lie-detection (L). For our sample, test-retest reliability for psychoticism, neuroticism, extraversion, and lie-detection were 0.67, 0.88, 0.80, and 0.78, respectively. The Guttman Split-half and Cronbach's  $\alpha$  were greater than 0.70 except for psychoticism, for which the values were from 0.51 to 0.60.<sup>16</sup>

The diagnosis of PTSD was made according to DSM-IV criteria,<sup>12</sup> which included 17 symptoms scored as 0 = none, 1 = slight, 2 = moderate, 3 = severe, and 4 = extreme. Symptom scores of 2 or higher were defined as positive. The 17 symptoms of PTSD which were in accordance with the 17 items of PCL-C were further divided into 3 groups, representing 3 diagnostic criteria B, C, and D. Criterion B

symptoms represented the re-experiencing cluster, and subjects were defined as B symptom positive if they showed one or more positive items in the B group. Criterion C symptoms represented the avoidance cluster, and subjects were defined as C symptom positive if they showed 3 or more positive items in the C group. Criterion D symptoms represented the hyperarousal cluster, and subjects were defined as D symptom positive if they showed two or more positive items in the D group. In addition, criteria A and E were used for the diagnosis of PTSD. Criterion A represented exposure to an extreme traumatic stressor involving direct personal experience of an event, witnessing an event, learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member or another close associate (A1), and the person's response to the event must involve intense fear, helplessness, or horror (A2). All subjects in our study witnessed the 1998 flood, experienced the threat of death or injury from the flood, and were diagnosed with PTSD in the 1999 survey. Also, all the probable PTSD-positive subjects met the A2 criterion. Criterion E represented a disturbance lasting more than 1 month. Subjects were diagnosed as having PTSD if Criteria A, B, C, D, and E symptoms were all positive.

**Statistical Analysis**

To examine the differences in demographic, psychological, stressor-related variables, and personality, we conducted chi-square tests and t-tests. Relationships between demographic, psychological, stressor-related variables, personality, and PTSD were examined by using multivariate logistic regression analysis. A stepwise procedure was used in the regression modeling process, with the entry threshold set at  $p < 0.05$  and the exit threshold set at  $p < 0.10$  for all variables. All analyses were performed with SPSS version 18.0 (IBM Corp, Armonk, NY).

**RESULTS**

A total of 2 counties, 10 towns, 22 villages, 97 households, and 123 individuals aged 16 years and older were selected for the study. Out of a total of 123 subjects interviewed, 118 were interviewed and had complete data, yielding a response rate of 95.9%. This included 59 males (50%) and 59 females (50.0%), with an average age of  $57.09 \pm 10.05$  years (mean  $\pm$  SD). Of the 118 subjects, 110 were married (93.2%) and 108 were farmers (91.5%). Of the 118 PTSD patients diagnosed in 1999, 17 were diagnosed as having chronic PTSD in this survey, yielding a prevalence rate of 14.4%.

Table 1 shows the bivariate associations between key covariates and chronic PTSD. None of the variables were significantly associated with chronic PTSD ( $p > 0.05$ ).

Table 2 describes the mean score and standard deviation among study participants with different PTSD prognoses.

**TABLE 1**

	Distribution of Chronic PTSD in Different Groups <sup>a</sup>				P Value <sup>b</sup>
	Sample		Chronic PTSD		
	No.	%	No.	%	
Age, years					>0.05
16–49	24	20.3	6	5.1	
50–59	44	37.3	5	4.2	
60–69	36	30.5	5	4.2	
≥ 70	14	11.9	1	0.8	
Gender					>0.05
Male	59	50.0	9	7.6	
Female	59	50.0	8	4.8	
Marital Status					>0.05
Unmarried	8	6.8	2	1.7	
Married	110	93.2	15	12.7	
Education					>0.05
Primary or less	65	55.1	7	5.9	
Elementary school	35	29.7	4	3.4	
High school or higher	18	15.2	5	4.2	
Annual Income per Capita (Yuan)					>0.05
≤3000	21	17.8	4	3.4	
3000–9999	67	56.8	9	7.6	
≥10,000	30	25.4	4	3.4	
Persistent Stressors					>0.05
Positive	19	16.1	5	4.2	
Negative	99	83.9	12	10.2	

<sup>a</sup>Abbreviation: PTSD, post-traumatic stress disorder.

<sup>b</sup>Two-tailed chi-square test.

**TABLE 2**

	Distribution of Scores in Different PTSD Prognosis Groups <sup>a</sup>			P Value <sup>b</sup>
	PTSD prognosis			
	Healed	Chronic		
Disasters Stressors Score	2.65 ± 2.10	4.71 ± 2.39	<0.001	
Social Support Score	22.73 ± 4.93	17.82 ± 4.05	<0.001	
Coping Style Score	0.37 ± 0.70	0.27 ± 0.63	>0.05	
P Scale Score	50.48 ± 8.66	50.40 ± 6.44	>0.05	
E Scale Score	53.34 ± 10.33	48.63 ± 12.78	>0.05	
N Scale Score	46.32 ± 9.83	56.73 ± 10.04	<0.001	
L Scale Score	56.99 ± 7.67	55.43 ± 7.19	>0.05	

<sup>a</sup>Abbreviation: PTSD, post-traumatic stress disorder; P, psychoticism; E, extraversion; N, neuroticism; L, lie-detection. Values are mean  $\pm$  SD.

<sup>b</sup>Two-tailed t-test.

Compared to the healed PTSD patients, the chronic PTSD patients had a higher disaster stressors score, a higher N scale score, and a lower social support score ( $p < 0.001$ ). However, the coping style score, P scale score, E scale score, and L scale score were not significantly different between different PTSD prognosis groups.

Table 3 shows the results of multivariate logistic regression analysis. Taking PTSD prognosis as the dependent variable

TABLE 3

**Relationship Between PTSD Prognosis and Related Determinants<sup>a</sup>**

Characteristic	b	SE	Wald	P	OR	95% CI
Disasters Stressors	0.551	0.180	9.409	0.002	1.736	1.220–2.469
Social Support	-0.165	0.072	5.241	0.022	0.848	0.737–0.977
Neuroticism	0.083	0.037	5.066	0.024	1.086	1.011–1.168

<sup>a</sup>Abbreviations: CI, confidence interval; OR, odds ratio; PTSD, post-traumatic stress disorder.

and the demographic, disaster stressors, persistent stressors, social support, coping style, and personality (13 variables in all) as independent variables, respectively, a multivariate regression analysis was done, and the persistent stressors were controlled. The result showed that disaster stressors and neuroticism were risk factors of chronic PTSD, whereas social support was a protective factor. The odds ratio (OR) of PTSD prognosis was 1.74 (95% confidence interval [CI]: 1.22-2.47) for disaster stressors, 1.09 (95% CI: 1.01-1.17) for neuroticism and 0.85 (95% CI: 0.74-0.98) for social support.

## DISCUSSION

PTSD is a common psychological disorder in disaster-affected populations. The incidence of PTSD has been widely used to evaluate the psychological impact of natural disasters, accidents, and wars. The number of studies focusing on the long-term prognosis of PTSD in disaster contexts is limited, however.<sup>17</sup> To our knowledge, this is the first study to explore the prevalence and determinants of chronic PTSD among flood victims 16 years after the disaster.

Our study found that the overall prevalence of chronic PTSD in the current sample was 14.4%. This rate is lower than that found in teachers (25.5%)<sup>18</sup> and youths (26.6%)<sup>19</sup> 3 years after the Wenchuan earthquake. It is also lower than the rate of PTSD reported in severe acute respiratory syndrome (SARS) patients (25.5%)<sup>20</sup> at 30 months after their diagnosis was confirmed. Differences in the severity of the disasters and the length of time after a trauma may account for the differences in chronic PTSD prevalence observed in different studies.

Our study showed that disaster stressors, social support, and neuroticism of personality were determinants of chronic PTSD. Flood victims who had higher disaster stressors and lower social support were more likely to have a worse PTSD prognosis. This compares well with findings of Zhigang et al.<sup>21</sup> One explanation is that the levels of disaster stressors are associated with the intensity of trauma in the disaster.<sup>22</sup> High intensity of trauma will lead to serious psychological effect.<sup>23</sup> Moreover, social support may

influence the way a person copes with stress and the effectiveness of these coping efforts and may motivate individuals to seek assistance when it is needed.<sup>24</sup> Strong social support may facilitate psychological recovery from disaster and affect not only the occurrence of PTSD but also its prognosis.

Many studies have revealed the relationship between personality and PTSD.<sup>25</sup> Yanjie et al<sup>26</sup> found that neuroticism of personality was positively associated with each factor of PTSD in a survey of young students in the Wenchuan earthquake area. Li et al<sup>27</sup> investigated the survivors of vehicle accidents and showed that neuroticism was a predictor of PTSD. All of the studies above focused on the relationship between personality and the occurrence of PTSD, however; few paid attention to chronic PTSD. Our findings concur with the results from previous studies about PTSD in disasters and indicate that neuroticism is a determinant of not only PTSD but also its prognosis.

## Limitations

The limitations of this study include the following. First, the cross-sectional study design did not account for fluctuations in the course of PTSD in the affected population over time. Second, the use of self-report measures and trained investigators may have impacted diagnostic validity. Also, the regression analysis may not have controlled for other potentially relevant factors. Furthermore, the study findings were based on observations in a Chinese population and may not be applicable to other populations. Finally, the disaster stressors and persistent stressors were arbitrarily defined and may not necessarily reflect the real influence of floods and adverse life events.

## CONCLUSIONS

Disaster stressors, nervousness, and social support acted as risk factors that significantly influenced the onset of chronic PTSD in victims following a flood disaster in Hunan, China. The results of this study have important implications for the screening, prevention, and treatment of chronic PTSD in adults long after exposure to a flood. From a public health perspective, these findings indicate that more clinical attention should be paid to PTSD patients who suffer high intensity of trauma, characterized by nervousness traits or a shortage of social support. Medical resources should be made available in less developed and high-risk populations, such as in the Chinese countryside, with particular attention to chronic PTSD.

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### Acknowledgments

This project was supported by the Specialized Research Fund for the Doctoral Program of Higher Education (20130162110054).

Published online: June 1, 2015.

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