

Psychological Distress among Adolescents in Chengdu, Sichuan at 1 Month after the 2008 Sichuan Earthquake

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ABSTRACT *A devastating earthquake occurred on May 12, 2008 in Sichuan, China. This study investigated the prevalence and factors in association with psychological problems among secondary school students living in Chengdu (90 km away from the disaster epicenter) in June 2008. In a cross-sectional survey, 3,324 secondary students self-administered a structured questionnaire in classroom setting. Validated scales were used in this study. Among all respondents, 22.3% reported post-traumatic stress disorder (PTSD); 22.6% were probable depression cases; 10.6% reported suicidal ideation; and 14.1% would like to receive psychological counseling. No gender differences were found. While social/emotional support from teachers or peers (OR from 0.40 to 0.78) and exposure to positive news reports (OR from 0.59 to 0.62) were found protective, prior experience of severe mental distress (OR from 1.60 to 2.68) and corporal punishment (OR from 1.31 to 1.58), worry about future aftershocks (OR from 1.64 to 3.11), absence from school when it was not closed (OR from 1.38 to 1.48), exposures to scary or sorrowful disaster media coverage (OR from 1.39 to 2.07), post-disaster visits to affected sites (OR from 1.51 to 1.59), separation from parents (OR= 1.61), etc., were risk factors predictive of some of the aforementioned psychological problems. Negative mental health impacts were prevalent among the respondents. Teachers, parents, and the mass media are all important in maintaining good mental health among adolescents that are indirectly affected by the severe earthquake. The results have important implications for earthquake preparedness and relief work in the future.*

KEYWORDS *Depression, Disaster, Earthquake, Post-traumatic stress disorder*

INTRODUCTION

A Richter scale point 8.0 earthquake occurred in Sichuan, China on May 12, 2008.¹ It claimed 69,227 lives while 17,923 people were reported missing, and 374,643

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people were injured.² Over 10 million people became homeless, and the affected region covered 252,000km².³ The prevalence of post-traumatic stress disorder (PTSD) among child earthquake survivors at the months 6, 18, 36, and 60 were 78%, 70%, 60% and 52%, respectively.⁴⁻⁷ A study showed that, in the absence of therapy, the prevalence of depression among child survivors increased from 35% at month 18 to 75% at month 36.⁸ Some studies showed that adolescents with PTSD were more likely than those without PTSD to possess suicidal ideation and make suicidal attempts.⁹ Co-morbidities of different psychological disorders such as PTSD, depression, and anxiety were observed among adults who experienced earthquake.¹⁰

Previous studies identified a number of factors in association with mental health status of people living in proximity to a disaster site, including severity of the disaster, level of exposure to the disaster, human and material loss to the family, perceived social support, adversity experienced by one's family members and/or acquaintance, personal links with someone living in the affected areas, whether one experienced the disaster in solitude, and one's proximity to the epicenter of the disasters.¹¹⁻¹⁸ In addition, viewing television images of disasters exacerbate PTSD and depression among persons directly affected by disasters.¹⁹

Though no casualties or damaged buildings were reported in the downtown area of Chengdu, the capital city of the Sichuan Province, the city is only about 90 km away from the epicenter of the earthquake and is only 39 km away from Dujiangyan, where 3,091 deaths were reported.²⁰ Chengdu has a population of 10.8 million, including 550,000 students.²¹ Around 12,000 schools in Sichuan were destroyed by the earthquake while teachers and students contributed to >10% of the casualty or missing cases.²²

The diagnosis of PTSD requires the symptoms to persist for at least a month, and untreated acute PTSD cases may become chronic cases.²³ This study investigated the prevalence of mental distress, including PTSD, probable depression, suicidal ideation, and the expressed demand for psychological counseling among 3,324 secondary students in Chengdu about 1 month after May 12, 2008. Potential risk and protective factors associated with the mental health outcomes were investigated. The first hypothesis was that PTSD would be associated with probable depression and suicidal ideation. With respect to PTSD and the other psychological distress outcomes, it was further hypothesized that risk factors associated with such outcomes included: (1) students' prior adverse experiences, (2) direct earthquake-related negative impacts experienced by the students (e.g., left Chengdu to avoid the disaster), and (3) exposure to negative media messages about the earthquake while protective factors included: (1) sense of security obtained from significant others, (2) post-earthquake social support, and (3) exposure to positive media messages about the earthquake. It was also hypothesized that worry about the earthquake and other disasters were also correlated with the negative mental health outcomes. No similar studies have been reported.

SUBJECTS AND METHODS

Study Design

The study population of this cross-sectional survey comprised students from the junior high grades 1 and 2 and senior high grades 1 and 2 in Chengdu, China. Junior high grade 3 and senior high grade 3 students were excluded from the study

as they were preparing for some public examinations. Two secondary schools were invited to join the study. A pilot-tested and anonymous questionnaire was used in the study.

Data Collection

Approval was obtained from the school principals who made an announcement about the study to the students. Participation was absolutely voluntary, and consent was obtained from the students before they filled out the questionnaire, which took about 20 min to complete. The survey took place in the classrooms of the two schools. Research workers, faculty members, and graduate students of the School of Public Health of the Sichuan University, briefed the prospective respondents about the details of the study and answered questions related to the study. Students were ensured about data confidentiality and that the anonymous data would only be analyzed by the researchers. The study was conducted in June, 2008. Ethics approval was obtained from the Institute of Psychology, Chinese Academy of Sciences. The response rate was almost 100%.

Measurements

Psychological Distress Variables (Four Dependent Variables) The 13-item Children's Revised Impact of Event Scale (CRIES) was used to screen PTSD.²⁴ It was translated and back-translated by the authors. An exploratory factor analysis replicated the three-factor structure (intrusion, avoidance, and arousal) and explained 56.0% of the total variance. The Cronbach's α of the overall scale and the three subscales ranged from 0.74 to 0.85. The scale has a cutoff score of 30 and was associated with traumatic exposure, depression, and anxiety.²⁵⁻²⁷ The 27-item Children's Depression Inventory (CDI) is commonly used for measuring severity of childhood depression.²⁸ Each item has three categories (e.g., "I have fun in many things", "I have fun in some things", "Nothing is fun at all") to match with respondents' experience in the past 2 weeks. The Chinese version was fully validated.²⁹ In this study, Cronbach's α value was 0.88. Two other questions were related to suicidal ideation ("Whether you have thought about committing suicide since the May 12 earthquake?") and demand for psychological counseling services ("Since the May 12 earthquake occurred, do you need psychological counseling?").

Pre-earthquake Variables as Potential Risk Factors Pre-earthquake data included demographic background (e.g., age, grade), prior visits to some of the affected sites, and prior adverse experiences (e.g., school bullying, serious illness of oneself or one's relatives, serious accident, severe mental distress, corporal punishment).

Earthquake-Related Variables as Potential Risk or Protective Factors Some variables were related to the direct impacts of the earthquake experienced by the students, including: (1) whether any relatives of the students died, were injured, or had their house collapsed due to the earthquake, (2) absence from school since the earthquake occurred while the school was not closed, (3) whether the student left Chengdu temporarily to avoid the disaster, (4) whether family members left Chengdu temporarily to avoid the disaster, (5) number of nights the student stayed outdoors overnight during the earthquake period, and (6) number of post-earthquake days one lost contact with his/her family, (7) whether one's parents left

Chengdu during the first week after the earthquake occurred, and (8) whether one's parents participated in the rescue work.

Other measures documented the students' responses to the earthquake, including: (1) whether one had traveled to an affected area after the May 12 earthquake, (2) exposure to media reports (e.g., number of times wept while watching news about the earthquake and exposure to scary or sorrowful or touching or encouraging news messages), (3) sense of security obtained from teachers and mutual support among fellow peer students, and (4) perceived social support at post-earthquake time period. Perceived social support was assessed by using the 12-item Multidimensional Scale of Perceived Social Support (MSPSS),³⁰ which showed good psychometric properties and was associated with lower levels of depression and anxiety.³⁰

Worry about Disasters: Potential Correlates A set of variables assessed the degree of worry about future earthquakes and disasters, which are potentially correlated with poor mental health status (worry about aftershocks within the first 2 weeks after the May 12 earthquake, current worry about aftershocks, worry about future earthquakes in Chengdu, and worry to encounter severe disasters in their lifetime).

Statistical Analysis

Four mental distress outcomes (PTSD, probable depression, suicidal ideation, and need for psychological counseling) were used as dependent variables. All potential risk/protective factors (prior adverse experiences, impacts due to the earthquake, and responses to the earthquake) and correlate variables (worry about future earthquakes and disasters) mentioned in the Measures session were used as independent variables. Univariate analyses were first performed to test the significance of the associations between the independent and dependent variables, using Mann–Whitney test or Pearson Chi-square test. Multivariate stepwise logistic regression models, using univariately significant variables as candidates, were then fitted to identify factors that were independently associated with the four mental distress outcome variables. All statistical analyses were performed using SPSS 14.0 (SPSS Inc., Chicago, IL). A p value < 0.05 was considered statistically significant.

RESULTS

Pre-earthquake Data

Of the respondents, 54.3% were male and 61.7% were below 15 years old. Prior to the earthquake, 15.4% of the participants had visited some of the affected sites; high proportions of students had been bullied by their peers (27.2%), experienced death of some relatives (42.7%), severe illness experienced by oneself or one's relatives (39.2%), a severe accident (13.0%), serious mental health distress (33.5%), or corporal punishment (27.8%).

Psychological Distress Status

Among the participants, 22.3% showed PTSD (CRIES >30); 22.6% were probable depression cases (CDI \geq 20); 10.6% reported suicidal ideation; and 14.1% needed psychological counseling. CRIES scores were correlated with CDI scores and suicidal ideation ($r=0.36$ and 0.08 , $p<0.05$). Among those with either PTSD or probable depression ($n=1,172$), 36.8% ($n=431$) had PTSD only, and 36.9% ($n=433$) had probable depression only, while 26.3% ($n=308$) had co-morbidity of the

two problems (data not tabulated). Respectively, 26.4%, 28.3%, and 29.8% of those with PTSD, with probable depression and with suicidal ideation, needed psychological counseling (data not tabulated).

Direct Impacts of the Earthquake

Among all participants, 12.5% were absent from classes even when the school was not closed; 42.3% spent more than three nights overnight in the outdoors since May 12; around 10% left Chengdu temporarily to avoid the earthquake (8.8%) or had some family members doing so (9.4%). Respectively, 2.6%, 2.0%, and 7.5% of the respondents had some relatives in the affected areas that were injured, died, or had their house collapse during the earthquake. About 5% of the students lost contacts with their family for at least 12 h during the earthquake; 82.9% of the students' parents were staying in Chengdu when the earthquake occurred; 12.7% had their parents traveling to the affected areas afterwards; and 38.8% had their parents participate in rescue work.

Participants' Responses to the Earthquake

5.1% of the participants traveled to the affected areas after May 12. Many students obtained a sense of security from their teachers (68.3%) or perceived their fellow students closely supporting each other after May 12 (88.0%). Some age and gender differences were detected (Tables 1). Many respondents (56.4%) wept while watching earthquake-related news and 27.0%, 76.6%, 88.7%, and 71.5% were frequently exposed to some news contents that were scary, sorrowful, touching, or encouraging respectively (Tables 1).

Worry about Future Earthquake and Disasters

Among the respondents, 63.4% worried much about serious aftershocks during the first 2 weeks after May 12; 20.3% were currently worrying about aftershocks; 32.5% anticipated experiencing a serious natural disaster in their lifetime, and around 10% anticipated a severe earthquake to occur in Chengdu in the future.

Factors in Association with PTSD The results of the multivariate analysis showed that those with prior experience of serious mental distress (OR=1.60), those who were absent from school while the school was not closed (OR=1.39), those who left Chengdu temporarily after May 12 to avoid the disaster (OR=1.74), those who visited some affected sites after May 12 (OR=1.51), those who wept for more than three times while watching earthquake news (OR=1.62), and those who were frequently exposed to news contents that were scary (OR=2.07) were at higher risk than others to develop PTSD ($p<0.05$; Table 2). Reversely, higher school grades (OR=0.50 to 0.65, $p<0.05$) was protective of PTSD (Table 2). Moreover, worry about aftershocks within the first 2 weeks after the Sichuan Earthquake and around the time of the survey (OR=1.62 and 3.11, respectively) were correlated with PTSD (Table 2). There was no significant gender difference.

Factors in Association with Depression Multivariate risk factors included prior experience of serious mental health distress and corporal punishment (OR=2.68 and 1.52, respectively), absence from school while the school was not closed (OR=1.46) and frequent exposure to scary news contents about the earthquake (OR=1.66). Protective factors ($p<0.05$) included higher social support (OR=0.21 to 0.34), perceived sense of security obtained from one's teachers (OR=0.60), perceived

TABLE 1 Prevalence of impacts and responses related to the Sichuan Earthquake by gender and age

	Gender			Age			
	All (n = 3,324)	Male (n = 1,758)	Female (n = 1,481)	P (Chi-square)	<15 years (n = 2,014)	≥15 years (n = 1,252)	P (Chi-square)
Direct impacts of the Sichuan Earthquake							
Absence from school since the earthquake while the school was not closed	12.5%	14.1%	10.4%	0.001	13.1%	11.3%	0.127
Temporary departure from Chengdu to avoid the disaster	8.8%	9.6%	8.0%	0.112	8.8%	8.7%	0.897
Family members left Chengdu to avoid the disaster	9.4%	9.7%	9.1%	0.590	9.4%	9.3%	0.933
Number of nights stayed outdoors overnight after the Sichuan earthquake							
0	16.9%	19.0%	13.5%	<0.001	15.4%	18.5%	0.002
1-2	40.8%	39.3%	43.6%		39.9%	43.2%	
3-5	30.1%	29.3%	31.2%		31.5%	28.0%	
≥6	12.2%	12.5%	11.7%		13.2%	10.3%	
Impacts on relatives in the affected areas							
Injured	2.6%	2.6%	2.6%	0.976	2.8%	2.3%	0.373
Died	2.0%	1.7%	2.4%	0.184	2.2%	1.8%	0.496
House collapsed	7.5%	6.7%	8.4%	0.054	7.7%	7.3%	0.652
Number of hours of lost contact with family members after the earthquake occurred							
0	23.8%	24.0%	22.7%	0.034	25.5%	20.1%	0.003
1-12	71.3%	70.1%	73.2%		69.5%	74.8%	
>12	5.0%	5.9%	4.0%		5.0%	5.1%	
Parents stayed in Chengdu during the 1st week after earthquake occurred	82.9%	83.3%	83.2%	0.912	84.8%	80.6%	0.002
Parents went to the affected areas after earthquake occurred	12.7%	14.3%	10.9%	0.004	14.1%	10.5%	0.003
Parents participated in rescue work in Chengdu	38.8%	38.6%	39.4%	0.638	40.6%	36.5%	0.021
Responses to the Sichuan Earthquake							
Had been to some affected areas after the Sichuan Earthquake	5.1%	6.0%	4.2%	0.022	5.5%	4.7%	0.347
Support from parents/teachers/peers							

Perceived sense of security obtained from teachers	68.3%	66.7%	70.5%	0.021	72.6%	61.5%	<0.001
Perceived mutual support among peers	88.0%	84.9%	92.6%	<0.001	87.5%	89.5%	0.084
Impacts from the media							
Number of times weeping when watching the news report about the earthquake							
0	43.7%	59.6%	22.9%	<0.001	42.6%	45.3%	0.338
1-3	40.1%	32.5%	50.3%		40.9%	38.7%	
≥4	16.3%	8.0%	26.8%		16.5%	16.0%	
Exposure to different types of content about the news on the earthquake							
Scary messages							
Never/seldom	73.0%	77.5%	67.5%	<0.001	70.8%	76.8%	<0.001
Quite a lot/very much	27.0%	22.5%	32.5%		29.2%	23.2%	
Sorrowful messages							
Never/seldom	23.4%	31.3%	13.9%	<0.001	23.5%	23.4%	0.983
Quite a lot/very much	76.6%	68.7%	86.1%		76.5%	76.6%	
Touching messages							
Never/seldom	11.3%	15.8%	5.6%	<0.001	10.8%	11.9%	0.353
Quite a lot/very much	88.7%	84.2%	94.4%		89.2%	88.1%	
Encouraging messages							
Never/seldom	28.5%	28.3%	28.7%	0.811	27.2%	30.4%	0.051
Quite a lot/very much	71.5%	71.7%	71.3%		72.8%	69.6%	
Worry about future disasters							
Worry about having aftershocks during the first 2 weeks after the Sichuan Earthquake	63.4%	57.8%	70.6%	<0.001	63.6%	63.7%	0.939
Currently worrying about having aftershocks	20.3%	16.9%	23.9%	<0.001	21.0%	18.7%	0.117
Chengdu would have severe earthquakes in the future	9.1%	8.9%	9.0%	0.961	9.2%	8.5%	0.503
One would encounter severe disasters in lifetime	32.5%	34.5%	30.1%	0.008	30.9%	35.1%	0.014

mutual support among fellow students (OR=0.64), having parents who stayed in Chengdu during the first week after the earthquake (OR=0.77), and frequent exposure to news contents that were touching or encouraging (OR=0.61 to 0.62; Table 3). Significant correlates included worry about aftershocks at the time of the survey (OR=1.80), worry about future earthquakes in Chengdu (OR=1.39), and worry about encountering severe natural disasters in the lifetime (OR=1.62; see Table 3).

Factors in Association with Suicidal Ideation

Significant risk factors in the multivariate analysis included female gender (OR=1.49), higher school grades (reference=junior high grade 1; OR ranged from 1.20 to 1.69), having PTSD (OR=1.40), prior experience of relatives' death (OR=1.31), prior severe mental distress (OR=2.29), prior corporal punishment (OR=1.58), absence from school while the school was not closed (OR=1.48), and having parents visit affected sites after May 12 (OR=1.61). Protective factors included perceived social support (OR=0.50 to 0.55), frequent exposure to news contents that are touching (OR=0.59), and perceived sense of security obtained from the teachers after May 12 (OR=0.40; Table 4). Worry about a severe earthquake in Chengdu in the future (OR=1.94) was a significant correlate of suicidal ideation (Table 4).

Factors in Association with Demand for Psychological Counseling Services

Multivariately significant ($p < 0.05$) factors included having PTSD (OR=2.56), prior experience of severe mental distress (OR=1.83), prior corporal punishment (OR=1.31), current worry about aftershocks (OR=1.64), absence from school while the school was not closed (OR=1.38), having visited some affected areas before and after the Sichuan Earthquake (OR=1.42 and 1.59), frequent exposure to news contents that are sorrowful (OR=1.39), school grades above junior high 1 (OR=0.57 to 0.97), better perceived social support (OR=0.55 to 0.69), perceived sense of security obtained from teachers (OR=0.78), and perceived mutual support among peers since May 12 (OR=0.65; Table 5).

DISCUSSION

The earthquake had substantial impact on the adolescents in Chengdu, and many students worried much about aftershocks or future disasters. Some of the earthquake-related factors (earthquake-related impacts such as leaving Chengdu to avoid the disaster and responses such as exposure to negative earthquake-related news messages) were significantly associated with PTSD. It is hence not a surprise to find out that the prevalence of PTSD was over 20%. A study reported a PTSD prevalence of 44% at 2 years after a bombing occurred, among adolescents who lived close to the disaster site but were not directly involved in the disaster.¹⁵ While untreated PTSD could be problematic, the majority of those with psychological distress, however, did not express a need for psychological counseling. In view of the long-term health consequences for children and the high prevalence of PTSD, screening and proactive counseling services should be offered to students in Chengdu. Longitudinal studies are warranted. Additional attention should be given to students having prior adverse experience or prior mental health problems as

TABLE 2 Factors associated with PTSD (total scores of the Children's Revised Impact of Event Scale ≥ 30)

	Row %	OR _U	<i>P</i>	OR _m (95%CI)
Pre-earthquake data				
Background characteristics				
Age				
<15 years	24.9	1.00		
≥ 15 years	17.7	0.65	<0.001	NS
Grade				
Junior high grade 1	24.4	1.00		1.00
Junior high grade 2	26.6	1.12	0.221	1.18 (0.95–1.47)
Senior high grade 1	16.4	0.61	<0.001	0.65 (0.47–0.90)**
Senior high grade 2	14.0	0.50	<0.001	0.50 (0.36–0.70)***
Previous adversities				
School bullying				
No	20.7	1.00		
Yes	26.2	1.36	0.001	NS
Severe mental distress				
No	18.4	1.00		1.00
Yes	29.8	1.88	<0.001	1.60 (1.32–1.96)***
Corporal punishment				
No	20.1	1.00		
Yes	27.8	1.53	<0.001	NS
Direct impacts of the Sichuan Earthquake				
Absence from school since the earthquake when the school was not closed				
No	21.1	1.00		1.00
Yes	30.3	1.62	<0.001	1.39 (1.06–1.83)*
Temporary departure from Chengdu to avoid the disaster				
No	21.1	1.00		1.00
Yes	35.4	2.05	<0.001	1.74 (1.29–2.36)***
Family members left Chengdu to avoid the disaster				
No	21.4	1.00		
Yes	31.3	1.67	<0.001	NS
Number of nights stayed outdoor overnight after May 12				
0	20.5	1.00		NS
1–2	18.9	0.90	0.433	
3–5	21.7	1.07	0.597	
≥ 6	37.4	2.31	<0.001	
Responses to the Sichuan Earthquake				
Had been to some affected areas after May 12				
No	21.8	1.00		1.00
Yes	32.7	1.75	0.001	1.51 (1.01–2.26)*
Support from parents/teachers/peers				
Parents stayed in Chengdu during the 1st week after earthquake occurred				
No	26.1	1.00		
Yes	21.5	0.78	0.017	NS
Parents went to affected areas after earthquake occurred				
No	21.7	1.00		
Yes	26.8	1.33	0.018	NS
Impact from the media				
Number of times weeping when watching the news report about the earthquake				
0	17.2	1.00		1.00
1–3	23.1	1.45	<0.001	1.22 (0.98–1.51)
≥ 4	30.3	2.09	<0.001	1.62 (1.24–2.12)***

TABLE 2 (Continued)

	Row %	OR _U	<i>P</i>	OR _m (95%CI)
Exposure to different types of content about the news on the earthquake				
Scary messages				
No	17.1	1.00		1.00
Yes	36.3	2.77	<0.001	2.07 (1.69–2.53)***
Sorrowful messages				
No	18.0	1.00		
Yes	23.6	1.41	0.001	NS
Worry about future disasters				
Worry about having aftershocks during the first 2 weeks after the Sichuan Earthquake				
No	12.8	1.00		1.00
Yes	27.7	2.54	<0.001	1.62 (1.28–2.04)***
Currently worrying about having aftershocks				
No	16.0	1.00		1.00
Yes	46.4	4.49	<0.001	3.11 (2.50–3.88)***
Chengdu would have severe earthquakes in the future				
No	21.3	1.00		
Yes	32.9	1.81	<0.001	NS
One would encounter severe disasters in lifetime				
No	20.5	1.00		
Yes	26.2	1.38	<0.001	NS

OR_U univariate odds ratio obtained using logistic regression, OR_m odds ratio obtained from stepwise multivariate logistic regression analysis using univariately significant variables as candidate variables, NS not statistically significant in multivariate analysis

Variables that were not significant for PTSD in the univariate analysis were not tabulated in the table. These variables include gender, having visited affected areas before May 12, prior experience of relatives' death, prior serious illness of oneself or relatives, prior serious accident, impact of the earthquake on one's relatives living in the affected areas (injured, died, and having their house collapse), perceived sense of security from teachers, perceived mutual support among peers, and number of hours of lost contact with family members after the earthquake

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

results indicated that prior adverse experience (e.g., severe mental health distress) was associated with PTSD and the other three mental health variables.

The prevalence of post-earthquake depression and suicidal ideation were respectively around 20% and 10%. One limitation of this study is that no comparable control group data was available. However, PTSD was significantly associated with post-earthquake suicidal ideation (multivariate analysis) and depression (univariate analysis). In the multivariate analyses, relevant earthquake-related experience, responses, and perceptions were also found significantly associated with depression and suicidal ideation, suggesting that the earthquake might have caused or deepened such psychological problems.

The way the media presented the news about the earthquake was critical. The phenomenon of distant trauma has been documented: that exposure to horrifying contents and images of news reports on disasters could have negative impacts on mental health of the general public.^{15,18,31} Similar findings were reported in this study: whether one wept during news watching and frequent exposure to scary news contents were associated with PTSD. The media needs to inform about this phenomenon. The Chinese news media had been restraining itself: only 27% of the respondents were frequently exposed to news contents that were scary while 88.7%

TABLE 3 Factors associated with depression (total score of Children Depression Inventory scale ≥ 20)

	Row %	OR _U	<i>P</i>	OR _m (95%CI)
Pre-earthquake data				
Background characteristics				
Grade				
Junior high grade 1	20.5	1.00		NS
Junior high grade 2	24.5	1.26	0.021	
Senior high grade 1	23.4	1.18	0.191	
Senior high grade 2	22.8	1.15	0.279	
Previous adversities				
School bullying				
No	1.97	1.00		
Yes	29.7	1.73	<0.001	NS
Serious illness of oneself or relatives				
No	21.1	1.00		
Yes	24.2	1.19	0.043	NS
Serious accident				
No	21.2	1.00		
Yes	30.1	1.60	<0.001	NS
Severe mental distress				
No	14.7	1.00		1.00
Yes	37.6	3.49	<0.001	2.68 (2.19–3.27)***
Corporal punishment				
No	18.0	1.00		1.00
Yes	33.8	2.33	<0.001	1.52 (1.23–1.88)***
Direct impacts of the earthquake				
Absence from school since the earthquake when the school was not closed				
No	20.9	1.00		1.00
Yes	32.8	1.85	<0.001	1.46 (1.11–1.92)**
Temporary departure from Chengdu to avoid the disaster				
No	22.1	1.00		
Yes	27.5	1.34	0.036	NS
Number of nights stayed outdoor overnight after May 12				
0	26.2	1.00		NS
1–2	19.4	0.68	0.001	
3–5	21.0	0.75	0.023	
≥ 6	29.0	1.16	0.330	
Number of hours of lost contact with family members after the earthquake occurred				
0	23.2	1.00		NS
1–12	21.2	0.89	0.259	
>12	34.6	1.75	0.003	
Parents stayed in Chengdu during the 1st week after earthquake occurred				
No	28.7	1.00		1.00
Yes	21.3	0.67	<0.001	0.77 (0.60–1.00)*
Parents went to the affected areas after earthquake occurred				
No	21.8	1.00		
Yes	27.5	1.35	0.011	NS
Responses to the earthquake				
Support from parents/teachers/peers				
Perceived sense of security obtained from teachers				
No	36.6	1.00		1.00
Yes	16.0	0.33	<0.001	0.60 (0.49–0.75)***
Perceived mutual support among peers				
No	46.6	1.00		1.00

TABLE 3 (Continued)

	Row %	OR _U	P	OR _m (95%CI)
Yes	19.4	0.27	<0.001	0.64 (0.48–0.85)**
Multidimensional Scale of Perceived Social Support				
<25th percentile	43.5	1.00		1.00
25–75th percentile	17.9	0.28	<0.001	0.34 (0.28–0.43)***
≥75th percentile	10.0	0.14	<0.001	0.21 (0.15–0.28)***
Impact from the media				
Exposure to different types of content about the news on the earthquake				
Scary messages				
No	19.7	1.00		1.00
Yes	29.6	1.72	<0.001	1.66 (1.33–2.07)***
Sorrowful messages				
No	25.9	1.00		
Yes	21.3	0.77	0.008	NS
Touching messages				
No	39.1	1.00		1.00
Yes	20.2	0.39	<0.001	0.62 (0.46–0.85)**
Encouraging messages				
No	31.4	1.00		1.00
Yes	18.7	0.50	<0.001	0.61 (0.49–0.77)***
Worry about future disasters				
Currently worrying about having aftershocks				
No	19.6	1.00		1.00
Yes	33.6	2.05	<0.001	1.80 (1.43–2.26)***
Chengdu would have severe earthquakes in the future				
No	20.6	1.00		1.00
Yes	42.0	2.79	<0.001	1.39 (1.01–1.90)*
One would encounter severe disasters in lifetime				
No	17.4	1.00		1.00
Yes	33.1	2.35	<0.001	1.62 (1.31–2.00)***
Children’s Revised Impact of Event Scale				
CRIES-13<30	16.9	1.00		
CRIES-13≥30	42.1	3.59	<0.001	NS

OR_U univariate odds ratio obtained using logistic regression, OR_m odds ratio obtained from stepwise multivariate logistic regression analysis using univariately significant variables as candidate variables, NS not statistically significant in multivariate analysis

Variables that were not significantly associated with depression in the univariate analysis were not tabulated in the table. These variables included gender, age, having visited some affected areas before the earthquake, prior experience of relatives’ death, family members having left Chengdu to avoid the disaster, impact of the earthquake on one’s relatives living in the affected areas (injured, died, and house collapsed), having parents who participated in earthquake rescue work in Chengdu, having visited some affected areas after May 12, number of times wept while watching the news report about the earthquake, and worry about aftershocks during the first 2 weeks after the May 12

p*<0.05, *p*<0.01, ****p*<0.001

and 71.7% were frequently exposed to touching or encouraging news contents. In this study, positive news messages were protective of developing probable depression and suicidal ideation during the post-earthquake period. Such protective effects have not been well-studied.^{15,32} Future studies are greatly warranted.

Social support, a sense of security that was originated from the teachers as well as peers’ mutual support during the post-earthquake period was not significantly

TABLE 4 Factors associated with suicidal ideation

	Row %	OR _U	<i>P</i>	OR _m (95%CI)
Pre-earthquake data				
Background characteristics				
Gender				
Male	9.3	1.00		1.00
Female	11.7	1.29	0.028	1.49 (1.15–1.94)**
Age				
<15 years	9.6	1.00		
≥15 years	12.1	1.29	0.029	NS
Grade				
Junior high grade 1	8.0	1.00		1.00
Junior high grade 2	13.1	1.73	<0.001	1.69 (1.24–2.31)***
Senior high grade 1	11.5	1.49	0.026	1.34 (0.89–2.01)
Senior high grade 2	10.8	1.39	0.066	1.20 (0.80–1.81)
Previous adversities				
Death of relatives				
No	8.9	1.00		1.00
Yes	12.9	1.51	<0.001	1.31 (1.01–1.69)*
School bullying				
No	9.9	1.00		
Yes	12.6	1.31	0.028	NS
Serious illness of oneself or relatives				
No	9.2	1.00		
Yes	12.7	1.44	0.002	NS
Serious accident				
No	10.2	1.00		
Yes	13.5	1.38	0.039	NS
Severe mental illness				
No	6.6	1.00		1.00
Yes	18.5	3.21	<0.001	2.29 (1.76–2.99)***
Corporal punishment				
No	8.4	1.00		1.00
Yes	16.4	2.14	<0.001	1.58 (1.21–2.07)**
Direct impacts of the earthquake				
Absence from school since the earthquake when the school was not closed				
No	9.5	1.00		1.00
Yes	17.3	2.00	<0.001	1.48 (1.05–2.09)*
Temporary departure from Chengdu to avoid the disaster				
No	10.2	1.00		
Yes	14.6	1.50	0.023	NS
Number of nights stayed outdoors overnight after May 12				
0	10.6	1.00		NS
1–2	9.7	0.91	0.574	
3–5	9.2	0.86	0.401	
≥6	15.7	1.57	0.024	
Number of hours losing contact with family members after the earthquake occurred				
0	10.6	1.00		NS
1–12	10.1	0.95	0.698	
>12	17.0	1.72	0.028	
Parents were in Chengdu in the 1st week after earthquake				
No	14.4	1.00		
Yes	9.8	0.65	0.002	NS
Parents went to the affected area after earthquake				
No	9.9	1.00		1.00

TABLE 4 (Continued)

	Row %	OR _U	P	OR _m (95%CI)
Yes	15.3	1.63	0.001	1.61 (1.15–2.27)**
Responses to the earthquake				
Support from parents/teachers/peers				
Perceived sense of security obtained from teachers				
No	19.4	1.00		1.00
Yes	6.5	0.29	<0.001	0.40 (0.30–0.52)***
Perceived mutual support among peers				
No	20.1	1.00		
Yes	9.4	0.41	<0.001	NS
Multidimensional Scale of Social Support				
<25th percentile	18.8	1.00		1.00
25–75th percentile	8.3	0.39	<0.001	0.50 (0.37–0.66)***
≥75th percentile	7.0	0.32	<0.001	0.55 (0.38–0.80)**
Impact from the media				
Number of times weeping when watching the news report about the earthquake				
0	11.8	1.00		NS
1–3	8.7	0.72	0.013	
≥4	11.4	0.96	0.830	
Exposure to different types of content about the news on the earthquake				
Scary messages				
No	9.5	1.00		
Yes	13.0	1.43	0.004	NS
Touching messages				
No	17.5	1.00		1.00
Yes	9.6	0.50	<0.001	0.59 (0.41–0.85)**
Encouraging messages				
No	14.0	1.00		
Yes	9.1	0.61	<0.001	NS
Worry about future disasters				
Currently worrying about having aftershocks				
No	9.6	1.00		
Yes	14.4	1.58	<0.001	NS
Chengdu would have severe earthquakes in the future				
No	9.3	1.00		1.00
Yes	23.3	2.97	<0.001	1.94 (1.37–2.75)***
One would encounter severe disasters in lifetime				
No	8.3	1.00		
Yes	15.4	2.01	<0.001	NS
Children's Revised Impact of Event Scale				
CRIES-13<30	9.3	1.00		1.00
CRIES-13≥30	15.3	1.76	<0.001	1.40 (1.05–1.85)*

OR_U univariate odds ratio obtained using logistic regression, OR_m odds ratio obtained from stepwise multivariate logistics regression analysis using univariately significant variables as candidate variables, NS not statistically significant in multivariate analysis

Variables that were not significantly associated with suicidal ideation in the univariate analysis were not tabulated in the table. These variables included having visited some affected areas before the earthquake, impact of the earthquake on one's relatives living in the affected areas, having parents participate in the earthquake rescue work, having visited some affected areas after May 12, exposure to sorrowful messages about the earthquake, and worry about having aftershocks in the first 2 weeks after May 12

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 5 Factors associated with expressed demand for psychological counseling

	Row %	OR _U	<i>P</i>	OR _m (95%CI)
Pre-earthquake data				
Background characteristics				
Grade				
Junior high grade 1	16.3	1.00		1.00
Junior high grade 2	11.5	0.67	0.001	0.57 (0.43–0.75)***
Senior high grade 1	12.4	0.73	0.046	0.66 (0.45–0.95)*
Senior high grade 2	15.6	0.95	0.718	0.97 (0.69–1.36)
Had been to some affected areas before the Sichuan Earthquake				
No	13.4	1.00		1.00
Yes	17.9	1.42	0.007	1.42 (1.05–1.92)*
Previous adversities				
School bullying				
No	13.2	1.00		
Yes	16.3	1.28	0.025	NS
Severe mental illness				
No	10.2	1.00		1.00
Yes	21.9	2.48	<0.001	1.83 (1.44–2.31)***
Corporal punishment				
No	12.3	1.00		1.00
Yes	18.8	1.66	<0.001	1.31 (1.02–1.67)*
Direct impacts of the earthquake				
Absence from school since the earthquake when the school was not closed				
No	13.1	1.00		1.00
Yes	20.4	1.71	<0.001	1.38 (1.01–1.89)*
Temporary departure from Chengdu to avoid the disaster				
No	13.5	1.00		
Yes	20.2	1.63	0.002	NS
Number of nights stayed outdoors overnight after the Sichuan Earthquake				
0	13.0	1.00		NS
1–2	11.5	0.87	0.370	
3–5	15.0	1.18	0.296	
≥6	21.2	1.80	0.001	
Impact on relatives in the affected areas				
Casualty				
No	13.8	1.00		
Yes	23.5	1.92	0.012	NS
House collapsed				
No	13.6	1.00		
Yes	19.3	1.52	0.014	NS
Responses to the earthquake				
Had been to some affected areas after the Sichuan Earthquake				
No	13.5	1.00		1.00
Yes	24.4	2.07	<0.001	1.59 (1.00–2.51)*
Support from parents/teachers/peers				
Perceived sense of security obtained from teachers				
No	18.5	1.00		1.00
Yes	12.0	0.60	<0.001	0.78 (0.60–1.00)*
Perceived mutual support among peers				
No	23.4	1.00		1.00
Yes	12.8	0.48	<0.001	0.65 (0.47–0.91)*
Multidimensional Scale of Social Support				
<25th percentile	19.9	1.00		1.00
25–75th percentile	12.8	0.59	<0.001	0.69 (0.53–0.90)**

TABLE 5 (Continued)

	Row %	OR _U	P	OR _m (95%CI)
≥75th percentile	10.7	0.48	<0.001	0.55 (0.39–0.77)**
Impact from the media				
Number of times weeping when watching the news report about the earthquake				
0	12.0	1.00		NS
1–3	13.8	1.17	0.181	
≥4	17.6	1.57	0.002	
Exposure to different types of content about the news on the earthquake				
Scary messages				
No	12.5	1.00		
Yes	18.0	1.54	<0.001	NS
Sorrowful messages				
No	11.5	1.00		1.00
Yes	14.8	1.34	0.022	1.39 (1.05–1.86)*
Worry about future disasters				
Worry about having aftershocks during the first 2 weeks after the May 12				
No	10.2	1.00		
Yes	16.2	1.70	<0.001	NS
Currently worrying about having aftershocks				
No	11.6	1.00		1.00
Yes	24.0	2.42	<0.001	1.64 (1.26–2.13)***
Chengdu would have severe earthquakes in the future				
No	13.3	1.00		
Yes	21.2	1.75	<0.001	NS
One would encounter severe disasters in lifetime				
No	12.4	1.00		
Yes	17.4	1.49	<0.001	NS
Children's revised impact of event scale				
CRIES-13 < 30	10.5	1.00		1.00
CRIES-13 ≥ 30	26.4	3.06	<0.001	2.56 (1.99–3.29)***

OR_U univariate odds ratio obtained using logistic regression, OR_m odds ratio obtained from stepwise multivariate logistics regression analysis using univariately significant variables as candidate variables, *dash* univariately not statistically significant, NS not statistically significant in multivariate analysis

Variables that were not significantly associated with the demand for psychological counseling in the univariate analysis were not tabulated in the table. These variables included gender, age, prior death of relatives, prior serious illness of oneself or relatives, prior serious accident, having family members leave Chengdu after May 12 to avoid the disaster, death of relatives in the earthquake, number of hours losing contact with family members after the earthquake, parents being in Chengdu during the first week after May 12, having parents who visited some affected areas after May 12, having parents who participated in earthquake rescue work, and exposure to touching and encouraging messages related to the earthquake

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

associated with PTSD. Some of these variables were, however, protective of probable depression and suicidal ideation. Similar results were reported in other studies: coping style of seeking social support reduced negative emotion after an earthquake but not PTSD, and social support was related with depression but not PTSD after September 11 attacks.^{33,34} These results imply that risk and protective factors for PTSD and other mental distress might be different. It is apparent that schools play an important role in maintaining students' mental health during the post-earthquake time period. Staying at home when others are going to school might, in fact, intensify the negative emotions related to the disaster.

About 5% of the students went to the badly affected areas after May 12, and this variable was associated with PTSD. Some of these students might have served as volunteers in the affected areas. If such is true, management of future disasters should take this into account and be cautious in allowing adolescents to visit post-disaster sites. Many students might not have been psychologically prepared.

It is important for adolescents to stay with their parents after the occurrence of a natural disaster. Whether parents were in Chengdu during the first week after May 12 and whether parents visited some affected areas after the earthquake were univariately associated with PTSD (though not significant in the multivariate analysis). In the multivariate analysis, the former was associated with depression and the latter was associated with suicidal ideation. Temporary departure from Chengdu to avoid any disaster was a risk rather than a protective factor in association with PTSD and depression after May 12. The trip might have become a traumatic experience.

Worry about aftershocks was strongly associated with PTSD. These and/or other similar variables concerning worry about future earthquake or natural disasters were also significantly associated with some of the other three mental health variables. In this study, these variables were treated as correlates of poor mental health status rather than risk factors. However, worry about aftershock can be alleviated by availability of official information. It is, therefore, still important that the authorities should provide timely post-earthquake reassurance to residents living in the proximal areas.

Some unexpected findings were reported. Unlike other studies, linkage with affected sites (e.g., previous visits to some badly affected areas and whether some relatives were injured, had died, or had houses collapse due to the earthquake) were not significantly associated with PTSD, depression, and suicidal ideation.^{18,31} Further investigations are required to explain these non-significant results.

The study has a number of limitations. First, this is a cross-sectional study, and causal relationships cannot be established. We only managed to survey two schools in June, 2008, as summer vacation was approaching. These two schools are however, quite typical and were not particularly linked to any of the affected areas. No baseline data was obtained before the earthquake occurred so that interpretation of some of the results should be cautioned. Second, there was no control group. The primary purpose of the study was to investigate earthquake-related factors (impact, responses, and worry) in association with PTSD and other mental health outcomes; such questions (e.g., PTSD and earthquake-related impacts and responses) were not applicable to students of a control group who lived far away from the affected areas. Moreover, all students in Chengdu were affected by the earthquake and hence, there was no control group available in Chengdu. Using students from other provinces as a control group may bring along confounding biases as situations such as the level of economic development education may be vastly different from those in Chengdu. Third, the CRIES, though well-validated in other countries, was not fully validated in China. We performed factor analysis and calculated Cronbach's alpha (subscales ranged from 0.74 to 0.85) for our dataset, and the results are satisfactory (data not tabulated).

In summary, this study found the prevalence of PTSD and associated psychological problems among secondary students in Chengdu, an area proximal to the epicenter of the May 12 Sichuan earthquake, was high despite the lack of serious damages and direct mortality in the area.³⁵ Our findings imply public health responses and emergency mental health first aid should be considered for populations beyond the populations that are immediately affected by the natural disaster. Media, the school, and the family all play important roles in safeguarding

the mental health of the adolescents such as delivering reassuring messages about aftershocks, keeping a balance between positive and negative news contents, keeping students in schools, staying together with parents, avoid visiting the disaster sites, enhancing peers' and teachers' support would bring along protective effects. On the other hand, the study revealed only the tip of an iceberg. A previous longitudinal post-disaster study which was conducted in China reported an exposure-related relationship between PTSD and other psychological problems.³⁶ Further studies are greatly warranted to understand the long-term consequences faced by the psychologically affected children. Ultimately, it is important to understand these relationships to design effective programs to safeguard the mental health being of the disaster-affected children.³⁷

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