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Psychosomatic Conditions of the Children and Adolescents Exposed to 5.12 Wenchuan Earthquake

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Abstract
Background A devastating earthquake registering 8.0 on the Richter Scale struck Wenchuan County in Northwest Sichuan Province in China on May 12, 2008, claiming over 69,200 lives, seriously wounding more than 374,600 people, and rendering more than 18,400 people missing. The epicenter was close to Yingxiu Township in Wenchuan County.
Purpose This study aimed to investigate the psychosomatic conditions of the children and adolescents exposed to the devastating earthquake and explore the risk factors for psychosomatic symptoms.
Method A total of 1,828 participants aged 6 to 16 years, of whom 842 from the affected area and 986 from non-affected area, were administered a Psychosomatic Conditions Scale.
Results Each factor score, total somatic score, total psychological score, and total psychosomatic score of the experimental group were significantly higher than those of the control group ($P<0.001$). Positive correlation was found between the psychological state and somatic symptoms in the experimental group($r=0.157\sim0.489$, $P<0.01$). Respiratory system, cardiovascular system, nervous system, digestive system, urogenital system, emotion, behavior, and language, combined as a panel, were significantly differentiated between the two groups, accounting for 73.4 % of the total difference. In the experimental group, the factor scores of anxiety, behavior, total psychological score, and total psychosomatic score of the girls were obviously higher than those of the boys ($P<0.01\sim0.05$); most somatic factors and psychological factors, total somatic score, total psychological score, and total psychosomatic score of the elder adolescents were significantly higher than those of the younger children ($P<0.01\sim0.05$).
Conclusion The children and adolescents exposed to 5.12 earthquake greatly suffered from terrible psychosomatic conditions, among whom the elder girls had more severe symptoms, particularly in terms of anxiety and behavior.

Keywords Psychosomatic symptoms · Influence factors · Children · Adolescent · 5.12 earthquake

Introduction

Being notorious for the most devastating earthquake in the past six decades, Wenchuan earthquake wreaked overwhelming

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havoc on Wenchuan County and the surrounding area. There were reportedly 69,227 people killed, 374,643 people injured, 18,403 people missing, and more than 5,300 children confirmed dead or missing [1–3]. As of this date, no official authority has ever released the number of physically injured children, letting alone the number of subsequently psychologically afflicted. How would they cope with the psychological impact induced by the traumatic event and deal with the horrendous memories and complicated post-disaster adversities for many years to come? Earthquake is a commonly occurring natural disaster. Many people affected by traumatic and life-threatening events, such as earthquake, flood, and war, would develop posttraumatic stress disorder (PTSD) [4, 5] and psychosomatic disorder (PSD) [6–8]. In recent years, the definition of PSD has been changing according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) and International Classification of Diseases (ICD). Generally speaking, the term PSD is referring to physical symptomatology appeared to be caused or influenced or worsened by psychological factors rather than by underlying physical illnesses [9]. PSD requires psychological factors and physical symptoms to be constantly and closely connected with each other. Some studies on PSD have been carried out among different populations, such as pregnant women [10], psychiatric patients [11], and also children or adolescents [12–16]. Among the few studies on PSD in children and adolescents, one has found that psychosomatic symptoms in youth were reported to be related to stress in the school setting [17]. Another study implied that the quality of family relations had been constituting a source of tension between the children and parents, which might play a role in the development of psychosomatic symptoms in children [14]. Whereas, there has been hardly any studies that explore the psychosomatic conditions in children and adolescents exposed to life-and-death traumatic events. To this effect, we investigated the psychosomatic state of children and adolescents exposed to Wenchuan earthquake with a psychosomatic conditions scale, aiming to find out the differences of psychosomatic conditions of children in the earthquake-stricken area and the non-stricken area, and to identify major risk factors for psychosomatic symptoms among children and adolescents exposed to the devastating earthquake.

Methods

Participants

A final convenient sample of 842 children and adolescents (413 boys, accounting for 49.05 %, and 429 girls, accounting for 50.95 %) aged between 6 and 16 years (mean=11.48, SD=2.30) from the earthquake-stricken area completed a psychosomatic conditions scale by group testing. All these participants were victims who went through the whole earthquake period. Those who did not experience the earthquake or who were unable to complete the procedure due to physical or psychological problems were excluded from the study. The control group (n=986) was composed of randomly selected age- and gender-matched children and adolescents from Changzhou, Jiangsu Province, a non-affected area. This group included 442 boys (accounting for 44.83 %) and 544 girls (accounting for 55.17 %) aged between 6 and 16 years (mean =11.49, SD=2.35) who had not gone through the earthquake or did not report any traumatic experience in their lifetime nor did they report any psychiatric problems.

Procedure

A military team of investigators, including ten members with professional background in psychology, psychiatry, or nursing, arrived at Wenchuan County about 2 weeks after the earthquake struck. Official data on local children and adolescents aged between 6 and 16 was subsequently obtained by contacting local residential authorities. Phone calls were made to notify those children and their parents or guardian whose household had fixed telephone line about the study and extended invitations to them. For those who could not be reached by phone, door-to-door investigations were carried out for notification. One week later, with every effort exerted, almost all local children (some of them with their parents or guardians for psychological security concern) were called in to a large classroom in a public school for group testing. All participants were then given verbal explanations of the study and the rating scale and also reassurance of confidentiality before the procedure. All the investigators were present during the rating procedure in case of any questions raised by the children or any emergency. The whole rating process took about 30 min. All the questionnaires were collected back, and all participants went home safely. All participants in the control group were recruited from Changzhou Blue Sky Experimental School. The rating procedure in the control group was carried out in the same way. The response rate was 94.3 % in Wenchuan and 98.5 % in Changzhou after removing invalid questionnaires based on the following criteria: incomplete, randomly filled out, unanimously filled out, and lying factor score exceeding average plus 1.96 times of standard deviation. Written informed consents were obtained from all participants or their guardians both in Wenchuan and in Changzhou. This study was approved by the ethical medical committee of the No.102 Hospital of Chinese People's Liberation Army.

Measurements

Both the two groups were administered a psychosomatic conditions scale, which comprised 42 items concerning

psychological states and somatic symptoms, along with a series of demographic questions about their gender, age, ethnicity, educational levels, and death of relatives. The rating scale was developed by the Prevention and Treatment Center of Psychological Diseases of the Chinese People's Liberation Army [18]. The scale consisted of two primary domains, namely somatic factors and psychological factors, the former of which including six factors (skeletal musculature, respiratory system, cardiovascular system, nervous system, digestive system, and urogenital system) and the latter of which also including six factors (sleep, emotion, anxiety, behavior, affection, and language). In addition, there was a lying subscale with five items in this scale for lying detection. There were altogether 42 dichotomized items (including the five lying items), with *yes* scoring 1 and *no* scoring 0. Higher scores indicated worse psychosomatic conditions. Its test-retest reliability coefficient was 0.82, and its factors' correlation coefficient with Chinese Psychosomatic Health Scale ranged from 0.60 to 0.78 ($P<0.01$). Each factor score, total somatic score, total psychological score, and total psychosomatic score were calculated in this study. This rating scale was used only to evaluate the psychosomatic conditions of the children and adolescents; the scale was not intended for a clinical diagnosis of PSD.

Data Analysis

Statistical analyses were performed in SPSS version 17.0. Independent sample t test and $\chi 2$ test were used to compare the age and gender between the experimental group and the healthy control group. Independent sample t test was again used to compare the single-factor score and total score between the two groups. Pearson's correlation analysis was performed to investigate the correlation between physical factors and psychological factors. Univariate regression analysis was employed to explore the factors that significantly differentiated between the two groups. Multivariate regression analysis was performed to find out the factors other than psychosomatic factors that significantly contributed to the total psychosomatic score with the maximum limit for adding a variable being 0.10 and the minimum limit for removing a variable being 0.05. Finally, independent sample t test was used to compare the participants with different gender and ages in the experimental group in terms of all psychosomatic factors. $P<0.05$ was considered statistically significant.

Results

Demographic variables of the experimental group and the healthy control group were compared, and there were no significant differences between the two groups in age ($t=-0.115$, $P=0.908$) and sex ratio ($\chi^2=3.085$, $P=0.079$). Comparisons between the two groups in each factor, total somatic, psychological, and psychosomatic score were performed. Each and every single factor, total somatic score, total psychological score, and total psychosomatic score of the experimental group were significantly higher than those of the controls ($P<0.001$) (see Table 1). We performed Pearson's correlation analysis between somatic factors and psychological factors in the experimental group. The results revealed that all six somatic factor scores were significantly positively related to all six psychological factor scores, with the correlation coefficients ranging from 0.157 to 0.489($P<0.01$) (see Table 2). With the aim of exploring the factors that most significantly differentiated between the experimental group and the control group, we carried out stepwise logistic regression analysis with the two groups as dichotomous dependent variables and all factors as independent variables. The Cox and Snell r^2 and Nagelkerke r^2 were 0.250 and 0.333, respectively. We found that eight factors, namely respiratory system, cardiovascular system, nervous system, digestive system, urogenital system, emotion, behavior, and language, combined as a panel, significantly differentiated between the two groups, accounting for 73.4 % of the total difference (see Table 3). Among the eight factors, respiratory system and emotion were the two most significant factors. In order to identify significant risk factors for psychosomatic conditions in the experimental group, we performed stepwise linear regression, taking gender, age, educational level, and deprivation of relatives as independent variables and the total psychosomatic score as dependent variable. The result demonstrated that gender ($t=1.979$, $P=0.048$) and age ($t=3.903$, $P<0.001$) were entered into the regression function. For further investigation of the differences between

Table 1 Comparisons of the two groups in all factor scores

Factors	Experimental group (mean, SD) ($n=842$)	Control group (mean, SD) ($n=986$)	t value	P value
Skeletal musculature	0.64 (0.970)	0.32 (0.771)	7.955	0.000
Respiratory system	0.77 (1.057)	0.40 (0.851)	8.056	0.000
Cardiovascular system	0.65 (0.761)	0.20 (0.507)	14.558	0.000
Nervous system	2.40 (1.892)	1.02 (1.581)	16.631	0.000
Digestive system	1.57 (1.579)	0.56 (1.035)	15.863	0.000
Urogenital system	0.35 (0.693)	0.06 (0.309)	11.217	0.000
Sleep	0.96 (1.110)	0.47 (0.828)	10.691	0.000
Emotion	1.04 (1.359)	0.42 (0.903)	11.328	0.000
Anxiety	0.96 (1.245)	0.33 (0.702)	13.006	0.000
Behavior	1.27 (1.444)	0.43 (0.919)	14.559	0.000
Affection	0.58 (0.802)	0.22 (0.531)	10.969	0.000
Language	0.65 (0.832)	0.38 (0.691)	7.437	0.000
Total somatic score	6.38 (4.881)	2.58 (3.757)	18.416	0.000
Total psychological score	5.46 (5.142)	2.24 (3.482)	15.396	0.000
Total psychosomatic score	11.84 (9.241)	4.82 (6.735)	18.284	0.000

Table 2 Correlation between somatic factors and psychological factors of the experimental group

	Sleep	Emotion	Anxiety	Behavior	Affection	Language
Skeletal musculature	0.276**	0.389**	0.232**	0.337**	0.326**	0.296**
Respiratory system	0.334**	0.406**	0.322**	0.423**	0.339**	0.301**
Cardiovascular system	0.439**	0.442**	0.413**	0.445**	0.384**	0.339**
Nervous system	0.431**	0.456**	0.426**	0.489**	0.440**	0.400**
Digestive system	0.333**	0.391**	0.340**	0.415**	0.342**	0.344**
Urogenital system	0.244**	0.270**	0.157**	0.267**	0.214**	0.241**

**$P<0.01$

different gender and ages, we compared all factor scores between different gender subgroups and age subgroups. The experimental group was divided into two subgroups according to age section, namely the lower age subgroup, including participants aged from 6 to 12 years ($n=558$), and the higher age subgroup, including participants aged from 13 to 16 years ($n=284$). Significant differences were found in the experimental group in terms of age or gender. Results in Table 4 indicate that all psychosomatic disorder factor scores of girls were higher than those of boys, among which the anxiety, behavior, and total psychological score and total psychosomatic score were significantly higher ($P<0.01$ or $P<0.05$). The higher age subgroup had significantly higher scores in all other factors except for digestive system, sleep, and language (see Table 4).

Discussion

Most studies on psychosomatic disorders were carried out to investigate the relationship of psychosomatic symptoms and stress. Potential sources of stress in children and adolescents normally include schoolwork, peer pressure, poor coping abilities, family problems, chronic diseases, or disability in parents, family moves, and psychiatric disorder in parents.

Table 3 Univariate regression for differentiation between the two groups

Factors	B	Std. error	Wals	*P* value	Exp(B)
Respiratory system	−0.332	0.079	17.852	0.000	0.717
Cardiovascular system	0.614	0.121	25.877	0.000	1.848
Nervous system	0.211	0.043	23.911	0.000	1.235
Digestive system	0.308	0.056	30.626	0.000	1.361
Urogenital system	0.854	0.137	39.147	0.000	2.350
Emotion	−0.157	0.071	4.883	0.027	0.855
Behavior	0.295	0.069	18.020	0.000	1.343
Language	−0.498	0.097	26.521	0.000	0.607
Constant	−1.195	0.079	231.501	0.000	0.303

Dummy variable for the experimental group was 1 and for the control group was 0

The prevalence rate for psychosomatic complaints in children and adolescents has been reported to be between 10 and 25 % [19, 20]. In this study, we explored the relationship of psychosomatic symptoms and acute traumatic event in children and adolescents. The results showed that the psychosomatic factor scores of the experimental group were significantly higher than those of the control group. Relevant studies indicated that extreme natural disasters contributed to psychosomatic symptoms among children and adolescents [21, 22]. A longitudinal research on orphans afflicted by Tangshan earthquake reported by Zhang B. et al. [23] revealed that psychosomatic disorders among the orphans following the earthquake were greatly higher than those from non-earthquake-stricken areas. Higher psychosomatic symptom scores for the experimental group can be explained by many difficult challenges, such as witnessing tragic scenes, going through sadness and devastation resulted from deprivation of relatives, and suffering from feelings of helplessness. We thus might conclude that traumatic events, such as earthquakes, do precipitate psychosomatic problems. As defined by psychosomatic disorders, psychological factors and physical symptoms should be constantly and closely connected with each other. In our study, we found strong correlation between somatic symptoms and psychological status, which has been reported in other studies previously.

The result of our study revealed that eight factors, mainly including the five somatic systems and emotion, behavior, and language, significantly differentiated between the two groups. This conclusion would help in diagnosing PSD among children exposed to extreme traumatic events in terms of major clinical symptoms. We also found that age and gender were two major general factors that would influence psychosomatic conditions. In particular, compared with the boys, the girls had significantly higher scores on the states of anxiety and behavior, which may be resulted from their greater sensitivity to acute stress. This accords well with the conclusion of another study [24]. Women are also more likely to experience more high impact trauma, thus more likely to develop PTSD than men [25]. In comparison with lower age subgroup, older age subgroup scored relatively higher in psychosomatic symptoms. This might be because older children tend to have excessive attention, pessimistic expectations, and negative

Table 4 Comparisons of psychosomatic factor scores of the subjects with different gender and ages

Factors	Different gender		Different ages	
	Girls (mean, SD) (n=429)	Boys (mean, SD) (n=413)	Higher age group (mean, SD) (n=284)	Lower age group (mean, SD) (n=558)
Skeletal musculature	0.65 (0.969)	0.64 (0.972)	0.85 (1.053)$^{\triangle\triangle}$	0.54 (0.909)
Respiratory system	0.78 (1.067)	0.75 (1.048)	0.87 (1.129)$^{\triangle}$	0.72 (1.016)
Cardiovascular system	0.68 (0.746)	0.63 (0.777)	0.73 (0.753)$^{\triangle}$	0.61 (0.763)
Nervous system	2.52 (1.935)	2.27 (1.841)	2.62 (1.863)$^{\triangle}$	2.28 (1.897)
Digestive system	1.65 (1.619)	1.50 (1.534)	1.64 (1.559)	1.54 (1.589)
Urogenital system	0.32 (0.650)	0.39 (0.734)	0.24 (0.549)$^{\triangle\triangle}$	0.41 (0.749)
Sleep	1.01 (1.131)	0.92 (1.086)	0.98 (1.134)	0.96 (1.098)
Emotion	1.10 (1.432)	0.98 (1.352)	1.26 (1.407)$^{\triangle\triangle}$	0.93 (1.321)
Anxiety	1.10 (1.432)**	0.81 (0.996)	1.10 (1.550)$^{\triangle}$	0.89 (1.053)
Behavior	1.41 (1.501)**	1.12 (1.369)	1.54 (1.476)$^{\triangle\triangle}$	1.13 (1.410)
Affection	0.62 (0.816)	0.54 (0.786)	0.68 (0.825)$^{\triangle}$	0.53 (0.787)
Language	0.66 (0.795)	0.63 (0.870)	0.66 (0.803)	0.64 (0.847)
Total somatic score	6.57 (5.052)	6.18 (4.695)	6.93 (4.946)$^{\triangle}$	6.10 (4.829)
Total psychological score	5.91 (5.258)*	5.00 (4.984)	6.21 (5.216)$^{\triangle\triangle}$	5.08 (5.067)
Total psychosomatic score	12.48 (9.550)*	11.17 (8.872)	13.14 (9.282)$^{\triangle\triangle}$	11.18 (9.159)

*P<0.05; **P<0.01 (comparisons between boys and girls) and $^{\triangle}$ P<0.05; $^{\triangle\triangle}$ P<0.01 (comparisons between different ages)

cognitive perception on traumatic events. This result is consistent with another study, which concluded that children were less likely to experience PTSD after trauma than adults, especially if they were under 10 years of age [25]. Another study showed that psychosomatic symptoms peak at age 7 in boys and at age 6 and 16 in girls [26]. We hypothesize that age and stress sensitivity might be constitutional traits with a normal distribution among the general population (traumatized or not), which may act as a susceptibility factor leading to psychosomatic symptoms. The theory that psychosomatic conditions were greatly affected by biological, psychological, and social factors [27] was verified by this study, and we might conclude that psychosomatic symptoms were induced by interaction of intrinsic factors and extrinsic factors. Not all individuals would develop psychosomatic symptoms after being exposed to traumatic events. Various factors could lead to the development and persistence of psychosomatic symptoms. Individuals with greater stress sensitivity are shown to assess traumatic events to be much more stressful, rendering them more vulnerable to the down effects of stressful life events and trauma reminders. Traumatic experience that only leads to a transitory increase of anxiety and horror would elicit greater distressful reactions in such individuals, contributing to the development of psychosomatic symptoms.

The findings of our study may have implications on early detection of high-risk groups of psychosomatic symptoms. Children and adolescent survivors of trauma with worse psychosomatic status may be less motivated to accept anxiety-provoking treatments such as cognitive behavior therapy (CBT), and they may avoid coming into contact with treatment services or drop treatment prematurely. Clinicians with an awareness of the significance of psychosomatic status, therefore, would have an advantage in engaging trauma survivors with psychosomatic symptoms into treatment, thus preventing development of psychosomatic disorders.

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