



The Prevalence of PTSD Symptoms and Depressive Symptoms and Related Predictors in Children and Adolescents 3 Years After the Ya'an Earthquake

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Abstract

The objectives of this study were to investigate the prevalence of post-traumatic stress disorder (PTSD) symptoms and depressive symptoms in teenage survivors three years after the Ya'an earthquake to assess the differences between left-behind (LBC) and non-left-behind (non-LBC) children, and to explore predictors for PTSD symptoms and depressive symptoms. The participants were assessed using children's revised impact of event scale (CRIES) and short mood and feelings questionnaire (SMFQ), after which *t* tests, Chi square tests, and a multivariate logistic regression were conducted to examine the differences in the LBC and identify the associated predictors. It was found that the PTSD and depressive symptom prevalences were 13.10% and 20.75%, with the LBC having a significantly higher prevalence than the non-LBC. The PTSD and depression symptoms tended to be highly comorbid ($r = .52, p < .001$). Being female, being aged less than 15, having siblings, being an LBC, and having higher exposure were found to be associated with PTSD and depressive symptoms.

Keywords Children and adolescents · Depressive symptoms · Posttraumatic stress disorder · Earthquake · Left-behind children

Introduction

A catastrophic earthquake measuring 7.0 on the Richter scale occurred on April 20, 2013 in Ya'an, Sichuan Province, China. The Ministry of Civil Affairs reported that 196 people were killed, approximately 11,470 were injured, and 34 million were affected. The devastating earthquake not only brought about great economic losses but also caused psychological problems in many of the survivors. Posttraumatic stress disorder (PTSD) has been the most studied condition in the aftermath of disasters [1] and can appear weeks

or even months after the initial shock [2]. The diagnostic and statistical manual of mental disorders (5th edition) [3] states that traumatic event survivors often show PTSD symptoms such as mental numbness, increased alertness, and problems with cognition and memory. PTSD can be very serious and can significantly damage a person's ability to function in society [4].

PTSD was first posited in the 1980s by Terr [5], after which research has confirmed that compared to adults, children and adolescents are more emotionally vulnerable to the serious effects of disasters due to their developmental status [6], resulting in severe psychological and developmental consequences [7]. Therefore, after a disaster such as an earthquake, children and adolescents are the more psychologically vulnerable population [8]. An increasing number of studies have reported PTSD prevalence rates and predictors for adolescent survivors. The PTSD prevalence reported in children and adolescent earthquake survivors has been found to range from 4.5 to 95% [9–12]. In a study on adolescents, Zhang et al. found that the PTSD symptoms changed gradually over time after an earthquake, with females and children with siblings being the most likely to exhibit PTSD symptoms [13]. A previous Wenchuan earthquake study

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revealed that home damage as well as injury to self or family members were also adolescent PTSD predictors [14]. From a meta-analysis of PTSD predictors, Trickey et al. found subjective peri-trauma factors and post-event factors were likely to play a major role in determining whether a child developed PTSD after exposure to a traumatic event [15]. In a survey on adolescents after the Wenchuan earthquake, Fan et al. found that 15.8% and 24.5% of the participants reported PTSD and depression symptoms [16]. Therefore, even three years after the Ya'an earthquake in 2013, child and adolescent earthquake survivors could still be suffering from mental health problems. Liu et al. found that the prevalence rates between 6 and 12 months for mental health issues were 14.5% and 16.1% for depression, and 11.2% and 13.4% for PTSD, suggesting that posttraumatic mental health problems in children after natural disasters may reach epidemic proportions and remain high for long periods [17].

Previous studies have provided evidence that females may be more susceptible to psychological disorders. Compared to male survivors, female survivors have been consistently found to be at higher risk. Several studies have reported that being female was a predictor for PTSD [14, 18, 19]. Guo et al. found that being female was associated with PTSD during the early period following an earthquake [20], and Zhang et al. also found that being female was a predictor for PTSD symptoms after an earthquake; therefore, gender could be seen to be a long-term predictor for PTSD [13].

To control population growth, a one-child family planning policy was promulgated by the Chinese government at the end of 1970s. After that time, most families in urban areas had only one child. A few studies have investigated the differences in mental health between an only child and a child with siblings after traumatic events; however, the findings on the mental health differences in only children have not been consistent; for example, Fan et al. found that only children were less likely to have PTSD and depression than children with siblings after an earthquake [16]. However, several previous studies reported that compared to children with siblings, only children tended to have a higher level of depression [21, 22].

China has had a rapidly developing economy for the past 15–20 years. At the end of the 1970s, reforms were implemented to open up China to the outside world to create opportunities for better paying jobs and a better standard of living; as a result, millions of adults have been migrating every year from their hometowns to higher-income regions [23], leaving their children at home. It was calculated that there were about 61 million children left at home by migrant parents in 2012 [24], which has led to the special Chinese phenomenon of left-behind children (LBC). LBC are defined as children under 18 left behind at their original residence when one or both parents migrate to other places for work and have not lived with

their children for at least 6 months [25]. While almost all LBC are raised by grandparents or other family members, it has been found that disruptions in physical proximity can shake these children's sense of security, causing significant and long-lasting psychological distress [26, 27]. As a result, it has been surmised that there may be mental health differences between LBC and non-LBC after traumatic events. A previous study on 4857 LBC found that the total prevalence for depression was 24.8% [23]. Cheng and Sun reported that compared with their age-matched-peers, LBC had higher rates of depression [28]. Most previous studies have also found a higher prevalence of psychological and behavioral problems in LBC [29–32]; however, few studies have focused on the post-traumatic mental health of LBC. Compared to non-LBC, LBC were more likely to have physical and mental problems after they suffered from earthquake [33–35].

Therefore, the aims of this study were: (a) to research the prevalence of PTSD symptoms and depressive symptoms in children and adolescents three years after exposure to the Ya'an earthquake with a special focus on LBC; and (b) to examine possible PTSD and depressive symptom predictors, with gender, age, being an only-child or an LBC and exposure degree being considered the main risk factors.

Methods

Procedures

This study was supported by the related schools and complied with the principle of voluntariness. Data collection was performed three years after the Ya'an earthquake, with the earthquake affected children being selected through cluster sampling. The study investigators were Master's degree candidates from Sichuan University, all of whom had taken part in a training course on data collection and personal information protection measures. This study was approved by the Human Ethics Committee of Sichuan University.

Participants

The participants for the present study, all of whom had experienced the 2013 earthquake, were selected from schools in the earthquake affected areas in Lushan County, Ya'an city. A total of 4140 students ranging from 12 to 18 years old took part in this study. After excluding invalid questionnaires, 3962 (95.70%) students [1691 males (42.68%)] completed the questionnaires, with an overall age distribution of 14.98 ± 1.44 .

Measures

The general information form focused on sociodemographic characteristics; age, gender, child with/without siblings, LBC, and the period of time that LBC parents had been living away from home.

To assess the degree of exposure, this study referred to Xu and He, and Xu and Liao [36, 37] for the exposure item assessments. A 2-point scale was used (yes = 1 and no = 0) to measure whether the following situations had been encountered as a result of the earthquake: experienced the earthquake and perceived a threat; personal injuries; injuries to family members, relatives or friends; experienced both the Wenchuan and Ya'an earthquakes; witnessed other people trapped by the earthquake; experienced the deaths of family members, relatives or friends; experienced loss of or damage to personal or family property; witnessed other people injured or killed; received agency support; and relocated to temporary housing. The total score for exposure ranged from 0 to 9, with higher scores reflecting greater exposure. Based on an examination of the frequency distribution, respondents were coded as having one of three exposure degrees; low exposure (0–1), moderate exposure (2–3), and high exposure (4–9). The Cronbach's α was 0.81.

The *short mood and feelings questionnaire (SMFQ)* was used for the depressive symptoms assessment. The SMFQ has 13 items, with each item scored from 0 to 2 (never = 0, sometimes = 1 and always = 2). Total SMFQ scores can range from 0 to 26, with a cut-off score of 11 considered to be a sign of depression. The SMFQ has been validated and found to have good convergent validity and reliability [38, 39]. The internal reliability Cronbach's α for the SMFQ was 0.84.

Finally, the PTSD symptoms in the children were assessed using the *Children's Revised Impact of Event Scale (CRIES-13)*, which is a brief screening instrument [40]. The Chinese version of the CRIES-13 has been proven to be a valid scale [41]. CRIES-13 has 13 items, divided into avoidance, intrusion, and hyperarousal, which assesses symptoms consistent with DSM-IV diagnoses on a 4-point scale: not at all = 0; rarely = 1; sometimes = 3; and often = 5; with total scores ranging from 0 to 65. Previous studies have suggested a cut-off score of 30 points [40, 42]. The Cronbach's α coefficient for the CRIES-13 was 0.88.

Statistical Analysis

Descriptive statistics; means, SDs, and ranges; were calculated for the variables, *t* tests were used to examine whether there were any gender or LBC differences in the PTSD and depressive symptom scale scores, and Chi square tests were performed to examine the univariate associations between PTSD and depressive symptoms, child and family

characteristics, and the degree of exposure. Multivariate logistic regression analyses were then conducted to examine the associations between the various sociodemographic variables, PTSD symptoms, and depressive symptoms. The interactions for the LBC and non-LBC were specifically examined to test the research hypotheses. All analyses were performed using SPSS 22.0.

Results

Of the 3962 participants, 42.68% were male with a mean age of 14.97 years ($SD = 1.42$), and 57.32% were female with a mean age of 14.99 years ($SD = 1.46$). Of the sample, 39.68% were only children, 36.70% were LBC, 44.17% showed a moderate exposure degree, and 31.32% showed a high exposure degree. The sociodemographic characteristics for the study sample are summarized in Table 1.

The CRIES-13 measure for PTSD symptoms had scale scores ranging from 1 to 65 with a mean of 15.03 ($SD = 12.29$). The mean score was significantly higher for females ($M = 15.88$, $SD = 12.38$) than for males ($M = 13.88$, $SD = 12.07$), $t(3692) = 5.09$, $p < .001$; and significantly higher for LBC ($M = 16.11$, $SD = 13.78$) than for non-LBC ($M = 14.40$, $SD = 11.29$), $t(3692) = 4.23$, $p < .001$, with the Cohen's *d* respectively being 0.39 and 0.40. Using a scale score of 30 as the cutoff, 519 (13.10%) children were identified as having possible PTSD symptoms.

The total SMFQ scores for depressive symptoms ranged from 0 to 26 with a mean of 8.59 ($SD = 5.16$). On average, females reported higher scores than males, with means of

Table 1 Sociodemographic characteristics of the study sample ($N = 3962$)

Characteristic	n	%
Gender		
Male	1691	42.68
Female	2271	57.32
Age		
< 15	1547	39.05
≥ 15	2415	60.95
Only child		
Yes	1572	39.68
No	2390	60.32
Left-behind children		
Yes	1454	36.70
No	2508	63.30
Exposure degree		
Low exposure	971	24.51
Moderate exposure	1750	44.17
High exposure	1241	31.32

8.85 ($SD=5.21$) and 8.23 ($SD=5.08$), and $t(3692)=3.80$, $p<.001$, and the LBC scored higher than the non-LBC, with means of 10.41 ($SD=4.88$) and 7.53 ($SD=5.03$), and $t(3692)=17.53$, $p<.001$, and with the Cohen's d being 0.17 and 0.16. With a scale score of 11 as the cutoff, 822 (20.75%) children were identified as having possible depressive symptoms.

Chi square tests were conducted to examine the univariate associations between PTSD and depressive symptoms, child and family characteristics, and the degree of exposure. As shown in Table 2, being female, being less than 15 years old, being a child with siblings, being an LBC, and having a high degree of exposure were found to be significantly associated with increased PTSD symptom prevalence. In this study, however, age was not found to be significantly associated with depressive symptoms. A significant interaction was

Table 2 Symptoms of PTSD and depression associated with child and family characteristics and the degrees of earthquake exposure among adolescents ($N=3962$)

Variable	PTSD (n=519)		Depression (n=822)	
	n (%)	χ^2	n (%)	χ^2
Gender		9.00**		7.61**
Male	190 (11.16%)		316 (21.12%)	
Female	329 (14.56%)		506 (25.99%)	
Age		4.65*		0.16
< 15	225 (14.54%)		341 (22.04%)	
≥ 15	294 (12.17%)		481 (19.92%)	
Only child		45.29***		15.49***
Yes	136 (8.79%)		277 (17.89%)	
No	383 (15.87%)		545 (22.58%)	
Left-behind children		9.49**		41.59***
Yes	222 (15.05%)		381 (25.83%)	
No	297 (11.94%)		441 (17.73%)	
Exposure degree		6.25*		76.40***
Low exposure	150 (10.28%)		239 (16.38%)	
Moderate exposure	217 (13.24%)		429 (26.17%)	
High exposure	152 (17.59%)		154 (17.82%)	

PTSD posttraumatic stress disorder

* $p<.05$, ** $p<.01$, *** $p<.001$

Table 3 Comorbidity between PTSD and depression ($N=3962$)

Comorbidity	Overall (N=3962) n (%)	Male (n=1691) n (%)	Female (n=2271) n (%)	χ^2	LBC (n=1454) n (%)	Non-LBC (n=2508) n (%)	χ^2
PTSD and depression	257 (6.49%)	89 (5.26%)	168 (7.40%)	7.28**	63 (4.33%)	194 (7.74%)	17.57***

LBC left-behind children, PTSD posttraumatic stress disorder

* $p<.05$, ** $p<.01$, *** $p<.001$

found between the LBC and the non-LBC, and there were also significant PTSD and depressive symptom prevalence differences between the LBC and non-LBC.

The correlation coefficient (r) between the CRIES-13 and the SMFQ indicated that both scales were positively correlated, with the correlation coefficient between PTSD and depressive symptoms being 0.52 ($p<.001$). The prevalence of comorbid PTSD and depressive symptoms in the LBC and the non-LBC are shown in Table 3. Of the 3962 participants, 4.33% LBC and 7.74% non-LBC reported both PTSD and depressive symptoms, with the comorbidity of PTSD and depressive symptoms being more prevalent in the LBC.

Multivariate logistic regression analyses were performed to examine the independent associations between demographics, family characteristics, and the degree of exposure and PTSD and depressive symptoms. All factors in Table 2 were put into the multivariate logistic regression, the results of which are shown in Table 4. Participants who were female, aged less than 15, had siblings, and were an LBC were found to be significantly associated with and increased probability of PTSD and depressive symptoms. Female participants were found to be 1.31 times more likely than males to develop PTSD symptoms and 1.21 times more likely than males to have depressive symptoms. Older children (age ≥ 15 years) were found to be less likely than younger children (age < 15 years) to have PTSD and depressive symptoms (OR 0.76, 95% CI 0.63–0.92 and OR 0.82, 95% CI 0.70–0.97, respectively). Compared to only children, participants who had siblings were 2.68 and 2.56 times more likely to have PTSD and depressive symptoms, and the LBC were found to be more prone than the non-LBC to develop PTSD and depressive symptoms. There was a significant interaction found for degree of exposure; that is, participants who had had high exposure were more likely to have PTSD and depressive symptoms than those who had had low or moderate exposure (OR 1.90, 95% CI 1.47–2.45 and OR 3.39, 95% CI 2.68–4.29).

Discussion

This study examined the PTSD and depression prevalence in a large sample ($N=3962$) three years after the 2013 Ya'an earthquake. The aim of the study was to examine the PTSD

Table 4 Associated of PTSD and depression with child and family characteristics and the degrees of earthquake exposure among adolescents ($N=3962$)

Variable	PTSD OR (95% CI)	Depression OR (95% CI)
Gender		
Male	1.00	1.00
Female	1.31 (1.08, 1.60)**	1.21 (1.03, 1.42)*
Age		
< 15	1.00	1.00
≥ 15	0.76 (0.63, 0.92)**	0.82 (0.70, 0.97)*
Only child		
Yes	1.00	1.00
No	2.68 (2.13, 3.37)***	2.56 (2.13, 3.07)***
Left-behind children		
Yes	1.00	1.00
No	0.71 (0.59, 0.86)***	0.55 (0.47, 0.65)***
Exposure degrees		
Low exposure	1.00	1.00
Moderate exposure	1.10 (0.88, 1.39)	0.85 (0.70, 1.02)
High exposure	1.90 (1.47, 2.45)***	3.39 (2.68, 4.29)***

PTSD posttraumatic stress disorder

* $p < .05$, ** $p < .01$, *** $p < .001$

and depressive symptom prevalence in teen survivors who had experienced the earthquake, with a special focus on the differences between the LBC and the non-LBC. The need to detect and mitigate the predictors related to PTSD and depressive symptoms is necessary because of the reported detrimental effects of earthquakes on the mental health of children, and especially on LBC.

PTSD and Depression Greater in the LBC

It was found that the PTSD symptom prevalence was 13.10%, which was consistent with previous studies. Some studies have reported a PTSD prevalence ranging from 2.5 to 66.7% in children and adolescents after an earthquake [10, 11, 14, 16, 43–45]. In this study, the depression prevalence in survivors was 20.75%, which was also consistent with previous studies. Similar studies have reported that depression prevalence in adolescent earthquake survivors ranges from 13.6 to 76% [12, 16]. As hypothesized, it was found that LBC were more prone to report PTSD and depressive symptoms than non-LBC, which may indicate that LBC may also have a higher risk of other psychological problems after experiencing traumatic events. Pan et al. conducted a survey on students after an earthquake and found that 29.6% and 44.8% of participants respectively reported PTSD and depression, with both being highly comorbid [46]. Previous studies have found high rates of PTSD and depression

in child and adolescent survivors of traumatic events [47, 48], which suggests that a focus on the unique presentation of each individual when assessing multiple disorders could improve the understanding of trauma reactions [49]. Similar studies have also found post-disaster symptoms in children [50, 51], especially in LBC [35]. Jiang et al. found that LBC were more prone to have severely PTSD symptoms than non-LBC [35]. Further research is needed to confirm the risk of other psychological problems in the LBC. As individual responses to trauma vary widely due to differences in coping styles and resilience [52], it could be speculated that being an LBC correlates with a higher risk of trauma and lower resilience levels because of reduced familial and social support, which could lead to a greater vulnerability to mental health problems when faced with traumatic events.

Comorbidity Between PTSD and Depression in LBC

The correlation coefficient between PTSD and depression was 0.52, which was consistent with a few previous studies, such as Acierno et al., which found that approximately half the children who reported PTSD also reported depression [53]. A study of Wenchuan earthquake survivors that examined PTSD and depression found that of the adolescents diagnosed with PTSD, 24.5% also reported depression [16]. PTSD was also found to be comorbid with depression in the LBC, with 63 LBC and 194 non-LBC reporting both PTSD and depressive symptoms ($\chi^2 = 7.28$, $p < .005$). As a result of parental migration as well as possible physical abuse, emotional neglect, and exploitation, the LBC are more likely to develop psychological disorders when faced with traumatic events.

Influence of Sociodemographic Factors on PTSD and Depression in Adolescents

The univariate analysis indicated that age, being an only child, being an LBC, and having high exposure all indicated a higher risk of reporting PTSD and depressive symptoms. Further, female participants, children under 15, children with siblings, the LBC, and higher exposure were all found to be associated with PTSD and depressive symptoms. However, only children were found to have a lower risk of developing psychological disorders than those who had siblings. It has been surmised that children with siblings may have witnessed more family members die or be injured and may have experienced greater property loss or home damage. Further, aside from direct exposure, they may have had additional indirect exposure to the trauma through their siblings' and other family members' stories, which could have increased their overall post-earthquake exposure. It was also found that the LBC had a higher risk of mental health problems. As a large number of LBC are raised by their grandparents

or other relatives, they may suffer from a lack of support and care from their parents and may be at a greater risk of mental health problems. In other words, the lack of the parental care at a crucial growth stage may have had an adverse effect on their cognitive functions [54]. It has been previously found that children who suffer trauma often experience a disruption in their attachment to their primary caregiver [55]. Several recent studies have found that LBC were more likely to have mental health problems; For example, Shen et al. conducted a cross-sectional survey and reported that the depression prevalence in LBC with both parents away was higher than for children with only one parent away and no parents away [30]. Wang et al. examined the predictors and protective factors for depression and found that the total depression prevalence in LBC was 24.8% [56]. A meta-analysis based on a mental health test also found that LBC reported greater mental health problems than non-LBC, with parental migration being an important predictor for LBC developmental outcomes [57].

Limitations

There were several limitations in this study. First, although the sample was large, this was a cross-sectional study, with the participants selected from several rural schools; therefore, it is uncertain whether our findings can be generalized to urban adolescents. Second, important information about caregivers such as education level, income, and health status were not collected. Third, as the LBC may have experienced other traumatic events before the earthquake, these events may have affected the results of the present study; therefore, to ensure more accurate results, it is necessary to investigate the influence of pre-trauma events in the future. Fourth, this study mainly examined the prevalence of psychological symptoms in the LBC and the non-LBC. However, many only children and children with siblings are also LBC or non-LBC; therefore, further research is needed to distinguish and test these relationships. Fifth, the age at which the children were left-behind could also be a potential risk factor for post-disaster psychological disorder(s); therefore, further research is required to clarify this risk.

Summary

The current study reported the prevalence of PTSD and depressive symptoms in teenage survivors three years after the Ya'an earthquake, and explored the PTSD and depression predictors. The CRIES-13 and the SMFQ were used as screening instruments, and *t* tests, Chi square tests, and a multivariate logistic regression were conducted to examine the differences in the LBC and identify the associated

predictors. Compared to other children, the LBC were found to be at a higher risk of PTSD and depressive symptoms after an earthquake experience than the non-LBC. Therefore, specific care should be taken, and interventions developed to reduce the risk of these children developing psychological problems.

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References

- Zeng EJ, Sliverstein LB (2011) China earthquake relief: participatory action work with children. *School Psychol Int* 32:498–511
- Neria Y, Nandi A, Galea S (2008) Post-traumatic stress disorder following disasters: a systematic review. *Psychol Med* 38:467–480
- American Psychiatric Association (2001) Diagnostic and statistical manual of mental disorders, 5th edn. American Psychiatric Association, Washington, DC
- Lamprecht F, Sack M (2002) Posttraumatic stress disorder revisited. *Psychosom Med* 64:222–237
- Terr LC (1983) Chowchilla revisited: the effects of psychic trauma four years after a school-bus kidnapping. *Am J Psychiat* 140:1543–1550
- Kolaitis G, Kotsopoulos J, Tsiantis J, Haritaki S, Rigizou F, Zacharaki L et al (2003) Posttraumatic stress reactions among children following the Athens earthquake of September 1999. *Eur Child Adoles Psy* 12:273–280
- Fairbank JA, Fairbank DW (2009) Epidemiology of child traumatic stress. *Curr Psychiat Rep* 11:289–295
- Bonanno GA, Brewin CR, Kaniasty K, La Greca AM (2010) Weighing the costs of disaster: consequences, risk, and resilience in individuals, families, and communities. *Psychol Sci Public Interest* 11:1–49
- Yan F, Chen Y, Jin W, Tang X, He J, Jiao M et al (2013) Analysis of prevalence of PTSD and its influencing factors among college students after the Wenchuan earthquake. *Child Adol Psych Men* 7:1
- Wang L, Long D, Li Z, Armour C (2011) Posttraumatic stress disorder symptom structure in Chinese adolescents exposed to a deadly earthquake. *J Abnorm Child Psychol* 39:749–758
- Ziaaddini H, Nakhiae N, Behzadi K (2009) Prevalence and correlates of PTSD among high school students after the earthquake disaster in the City of Bam, Iran. *Am J Applied Sci* 6:130–132
- Salcioğlu E, Başoğlu M (2008) Psychological effects of earthquakes in children: prospects for brief behavioral treatment. *World J Pediatr* 4:165–172
- Zhang Z, Ran MS, Li YH, Ou GJ, Gong RR, Li RH et al (2012) Prevalence of post-traumatic stress disorder among adolescents after the Wenchuan earthquake in China. *Psychol Med* 42:1687–1693
- Ma X, Liu X, Hu X, Qiu C, Wang Y, Wang Q et al (2011) Risk indicators for post-traumatic stress disorder in adolescents exposed to the 5.12 Wenchuan earthquake in China. *Psychiat Res* 189:385–391
- Trickey D, Siddaway AP, Meiser-Stedman R, Serpell L, Field AP (2012) A meta-analysis of risk factors for post-traumatic

- stress disorder in children and adolescents. *Clin Psychol Rev* 32:122–138
16. Fan F, Zhang Y, Yang Y, Mo L, Liu X (2011) Symptoms of posttraumatic stress disorder, depression, and anxiety among adolescents following the 2008 Wenchuan earthquake in China. *J Trauma Stress* 24:44–53
 17. Liu M, Wang L, Shi Z, Zhang Z, Zhan K, Shen J (2011) Mental health problems among children one-year after Sichuan earthquake in China: a follow-up study. *Plos One* 6:e14706
 18. Alisic E, Jongmans MJ, Van WF, Kleber RJ (2011) Building child trauma theory from longitudinal studies: a meta-analysis. *Clin Psychol Rev* 31:736–747
 19. Ye YL, Liu Y, Chen M, Zhang JH, Yang C, Liu XX et al (2011) Trajectory and the related factors of PTSD in secondary school students after earthquake. *Chin J Sch Health* 32:166–167
 20. Guo J, Wu P, Tian DH, Wang XH, Zhang WJ, Zhang XL et al (2014) Post-traumatic stress disorder among adult survivors of the Wenchuan Earthquake in China: a repeated cross-sectional study. *J Anxiety Disord* 28:75–82
 21. Wu D, Tang J (2002) Morality and personality of children in single and non-single child family. *Chin Ment Health J* 16:454–456
 22. Zhao K, Zhao G (1996) Mental health characteristics among only-child students. *Chin J Sch Health* 17:394–397
 23. Wang L, Feng Z, Yang G, Yang Y, Dai Q, Zhao M (2015) The epidemiological characteristics of depressive symptoms in the left-behind children and adolescents of Chongqing in China. *J Affect Disord* 177:36–41
 24. Guo J, Chen L, Wang X, Liu Y, Chui CH, He H et al (2012) The relationship between internet addiction and depression among migrant children and left-behind children in China. *Cyberpsychol Behav Soc Netw* 15:585–590
 25. Zhou FL, Duan CR (2006) Literature review on studies on left behind children [in Chinese]. *Popul Res* 3:60–65
 26. Armsden GC, Greenberg MT (1987) The inventory of parent and peer attachment: individual differences and their relationship to psychological well-being in adolescence. *J Youth Adoles* 16:427–454
 27. Vanore M, Mazzucato V, Siegel M (2015) ‘left behind’ but not left alone: parental migration & the psychosocial health of children in Moldova. *Soc Sci Med* 132:252–260
 28. Cheng J, Sun YH (2015) Depression and anxiety among left-behind children in China: a systematic review. *Child Care Health Dev* 41:515–523
 29. Qu Y, Jiang H, Zhang N, Wang D, Guo L (2015) Prevalence of mental disorders in 6–16-year-old students in Sichuan province, China. *Int J Environ Res Pub Health* 5:5090–5107
 30. Shen M, Gao J, Liang Z, Wang Y, Du Y, Stallones L (2015) Parental migration patterns and risk of depression and anxiety disorder among rural children aged 10–18 years in China: a cross-sectional study. *BMJ Open* 12:e7802
 31. Gao Y, Li LP, Kim JH, Congdon N, Lau J, Griffiths S (2010) The impact of parental migration on health status and health behaviors among left behind adolescent school children in China. *Bmc Public Health* 10:1–10
 32. Fan F, Su L, Gill MK, Birmaher B (2010) Emotional and behavioral problems of Chinese left-behind children: a preliminary study. *Soc Psychiatry Psychiatr* 45:655–664
 33. Wei Q (2011) Comparison of physical constitution between left-behind and non left-behind children in disaster area of earthquake. *Chinese Journal of School Health* 32:321–323
 34. Zhang XR, Guo HX, Yang ZL (2015) Mental health among pre-school children who had experienced lushan earthquake. *Chin J Sch Health* 36:1634–1637
 35. Jiang X, Jian HE, Wang C, Pan WM, Keng LI, Kang FY (2013) Influence of migrant working parents on post-traumatic stress disorder of their left-behind children. *J Lanzhou Univ Med Sci* 39:65–67
 36. Xu J, He Y (2012) Psychological health and coping strategy among survivors in the year following the 2008 wenchuan earthquake. *Psychiatr Clin Neurosci* 66:210–219
 37. Xu J, Liao Q (2011) Prevalence and predictors of posttraumatic growth among adult survivors one year following 2008 sichuan earthquake. *J Affect Disord* 133:274–280
 38. Cheng PX, Cao FL (2009) Reliability and validity of the short mood and feelings questionnaire in Chinese adolescents. *Chin Ment Health J* 23:60–62
 39. Angold A, Costello EJ (1995) The development of a questionnaire for use in epidemiological studies of depression in children and adolescents. *Int J Met Psychiatr Res* 5:237–249
 40. Perrin S, Meiserstedman R, Smith P (2005) The children’s revised impact of event scale (CRIES): validity as a screening instrument for PTSD. *Behav Cogn Psychother* 33:487–498
 41. Lau JT, Yeung NC, Yu XN, Zhang J, Mak WW, Lui WW (2013) Validation of the Chinese version of the children’s revised impact of event scale (cries) among Chinese adolescents in the aftermath of the Sichuan earthquake in 2008. *Compr Psychiatr* 54:83–90
 42. Jing L, Chen T, Wang D, Zhu C, Situ M, Fang H et al (2010) The reliability and validity research of the children’s revised impact of event scale of Chinese edition (in Chinese). *Chin J Behav Med Brain Sci* 19:654–657
 43. Ge Y, Wu J, Sun X, Zhang K (2011) Enhanced mismatch negativity in adolescents with posttraumatic stress disorder (PTSD). *Int J Psychophysiol* 79:231–235
 44. Liu X, Yang Y, Yuan P, Zhan X, Han Y, Cao Y et al (2010) A study of the relationship between mental health and menstrual abnormalities in female middle school students from post-earthquake Wenchuan. *Biosci Trends* 4:4–8
 45. Liu ZY, Yang YF, Ye YL, Zen ZQ, Xiang YJ, Yuan P (2010) One-year follow-up study of post-traumatic stress disorder among adolescents following the Wenchuan earthquake in China. *Biosci Trends* 4:96–102
 46. Pan X, Liu W, Deng G, Liu T, Yan J, Tang Y et al (2015) Symptoms of posttraumatic stress disorder, depression, and anxiety among junior high school students in worst-hit areas 3 years after the Wenchuan earthquake in China. *Asia Pac J Public Health* 27:1985–1994
 47. Kadak MT, Nasiroglu S, Aydin A, Nasiroglu S, Aydin A, Nasiroglu S, Aydin A, Nasiroglu S, Aydin A (2013) Prevalence of PTSD, Depression and Anxiety Symptoms among Adolescents 6 Months after Van-Ercis Earthquake 2011. *European Psychiatry. Conference: 21st European Congress of Psychiatry, EPA 28*
 48. Derivois D, Cénat JM, Joseph NE, Karray A, Chahraoui K (2017) Prevalence and determinants of post-traumatic stress disorder, anxiety and depression symptoms in street children survivors of the 2010 earthquake in Haiti, four years after. *Child Abuse Neglect* 67:174
 49. Price M, Van SK (2015) Examination of the interrelations between the factors of PTSD, major depression, and generalized anxiety disorder in a heterogeneous trauma-exposed sample using DSM 5 criteria. *J Affect Disord* 186:149
 50. Acharya S, Bhatta DN, Assannangkornchai S (2017) Post-traumatic stress disorder symptoms among children of Kathmandu 1 year after the 2015 earthquake in Nepal. *Disaster Med Public Health* 8:1–7
 51. Takeo F, Junko Y, Hiroaki H, Hirofumi M, Keizo N, Makiko O (2016) Symptoms of post-traumatic stress disorder among young children 2 years after the Great East Japan earthquake. *Disaster Med Public Health* 11:207–215
 52. Southwick SM, Charney DS (2012) The science of resilience: implications for the prevention and treatment of depression. *Science* 338:79–82

53. Acierno R, Ruggiero KJ, Galea S, Resnick HS, Koenen K, Roitzsch J et al (2007) Psychological sequelae resulting from the 2004 florida hurricanes: implications for postdisaster intervention. *Am J Public Health* 97:S103–S108
54. Waters TE, Ruiz SK, Roisman GI (2016) Origins of secure base script knowledge and the developmental construction of attachment representations. *Child Dev* 88:198–201
55. Esch AK (2013) Disorganized attachment and trauma in children. *Social Work Master's Clinical Research Papers*. 174
56. Wang L, Feng Z, Yang G, Yang Y, Dai Q, Hu C et al (2015) The epidemiological characteristics of depressive symptoms in the left-behind children and adolescents of Chongqing in china. *J Affect Disord* 177:36–41
57. Zhao F, Yu G (2016) Parental migration and rural left-behind children's mental health in China: a meta-analysis based on mental health test. *J Child Fam Stud* 25:3462–3472