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Original Research

Negative life events and post-traumatic stress disorder symptoms: a moderated mediation model of only-child status and depressive symptoms

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ABSTRACT

Objectives: Post-traumatic stress disorder symptoms (PTSS) and depressive symptoms are the most common adolescent psychological effects from earthquakes, with negative life events significantly influencing PTSS prolongation. However, the underlying mediating and moderating mechanisms that connect negative life events with PTSS remain unclear. The purpose of this study was to investigate (i) the mediating role of depressive symptoms on negative life events and PTSS and (ii) the moderating role of only-child status in the direct and indirect relationship between negative life events and PTSS, 3 years after the 2013 Ya'an earthquake in China.

Study design: Quantitative study using data from the Ya'an earthquake.

Methods: Three years after the 2013 Ya'an earthquake, 4402 adolescent survivors in Lushan county were surveyed using the Adolescent Self-Rating Life Events Check list to assess the psychological effects of negative life events in the previous 12 months. In addition, the short Mood and Feeling Questionnaire and The Children's Revised Impact of Event Scale were used to assess depressive symptoms and PTSS severity, respectively.

Results: After controlling for gender and age, negative life events were found to be significantly positively associated with PTSS. The mediation analyses revealed that depressive symptoms mediated the association between negative life events and PTSS; however, the moderated mediation analysis found the association was much weaker for only children.

Conclusion: The findings supported and clarified the interrelations and associations between negative life events, depressive symptoms and PTSS. The conditional process analyses found that only-child status moderated not only the direct associations but also the relationship between negative life events and depressive symptoms. Our findings highlight the need for intervention programmes targeting adolescents, especially for children with siblings.

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Introduction

On the 20th of June 2013, the strongest earthquake in China since the 2008 Wenchuan earthquake struck Ya'an city, Sichuan Province. The 7.0 Richter scale earthquake epicentre was in Lushan County and was felt in a 125,000 km^2 area, resulting in 217 deaths, 11,470 injuries and mental health problems in many adult and adolescent survivors.

Post-traumatic stress disorder (PTSD) has been found to be one of the most prevalent psychological disorders after traumatic or catastrophic events and has been observed to be the most common mental health disorder after earthquakes.[1–3] PTSD is characterised by persistent hyper arousal, recurrent intrusive re-living of events, reactive numbness symptom clusters and negative thoughts and moods.[4] Around 25% of earthquake survivors have been found to suffer from post-earthquake PTSD,[5] with the disorder sometimes becoming chronic and the symptoms lasting years after the exposure. Large sample studies have found that postearthquake negative life events can prolong disaster-related psychological sequelae, such as PTSD symptoms (PTSS) and depressive symptoms for several years in untreated adolescent survivors.[6] Of the many factors that can affect PTSS, postdisaster negative life events, such as poor parent–child relationships or a death in the family, have been found to significantly predict PTSS.[7,8] However, few studies have examined the specific PTSS development mechanisms following these negative life events. According to the depressogenic model, depressive symptoms may contribute to PTSS;[9] for example, Backholm and Björkqvist found that depressive symptoms played a mediating role between the exposure to potentially traumatic events and PTSS.[10] As a result of China's one-child policy from 1978 to 2015, many couples living in urban areas had only one child; therefore, most children were only children. Compared to children with siblings, 6 months after the 2008 Wenchuan earthquake in China, only children were found to be less likely to be experiencing depressive symptoms or PTSS.[11]

Given this foreknowledge, the current study examined the mediating role that depressive symptoms play in negative life events and PTSS in adolescents who experienced the 2013 Ya'an earthquake in Sichuan Province, China, and whether the indirect and direct relationships between negative life events and PTSS were different in only children and children with siblings.

Negative life events and PTSS: the mediating role of depressive symptoms

It has been found that the number and severity of negative life events after an earthquake, such as traumatic life-threatening experiences and significant life stressors or stressful events,[12] can prolong PTSS.[7,13] Postearthquake negative life events, such as poor parent–child relationships and low socio-economic levels, have also been found to act as secondary stress sources that can affect mental health and also lead to PTSS.[14,15] A study on adolescent survivors of the Wenchuan earthquake found that those who had lower income levels, lived in temporary housing and had less social support were at a higher risk of PTSS.[16] Urban residents who had experienced assaultive trauma and/or and marital conflict had a higher risk of severe PTSS.[17,18] Mulder et al. also found that both non-traumatic and traumatic life events were equally associated with PTSS.[19] However, despite these findings, there has been little in-depth research on the associations between negative life events and PTSS.

One potential associated mechanism may be depressive symptoms. Previous studies have found that negative life events can increase a person's risk of depression;[20,21] for example, a meta-analysis by Kraaij et al. found that almost all types of negative life events had a modest but significant relationship to depressive symptoms in elderly people.[22]

Several theories have been proposed for the relationship between negative life events and depressive symptoms. For example, Abramson et al. developed a hopelessness theory, in which it was suggested that maladaptive cognitive styles may increase the likelihood of depression because of the tendency to blame negative life events on stable and global factors and to see negative life events as evidence of personal worthlessness.[23] Joiner et al. also suggested that negative cognitive styles could result in feelings of hopelessness, which could then lead to depression and stress.[24]

Research has also found associations between depression and PTSS. PTSS and depression are highly comorbid, with Kessler et al. finding a comorbidity rate as high as 48%.[25] There have been several explanations offered for the strong PTSS-depression comorbidity; for example, Aderka et al. suggested that depression increased PTSS vulnerability following trauma.[26] In addition, Backholm and Björkqvist found that the severity of the depressive symptoms mediated the relationship between trauma history and the PTSS level in a study of the relationships between potentially traumatic events, PTSS and depression in a sample of Finnish news journalists.[10]

The moderating role of only-child status

Many urban couples were only allowed one child during China's one-child policy from 1978 to 2015. The resource dilution model implies that as the number of children increases, the resources parents are able provide to each child decreases,[27,28] with resources such as parental attention possibly falling even more rapidly the more children there are in a family.[29] Attachment theory states that security in infants is related to a caregiver's availability and responsiveness;[30] therefore, as parents of only children are more anxious when raising their child,[31] they show greater responsiveness to the child's needs, which has been found to facilitate healthier development.[32] Therefore, it was expected that only children would have greater resources to buffer the effects of negative life events than children with siblings. For example, Fan et al. found that only children had a smaller risk of developing PTSD and depressive symptoms than children with siblings 6 months after the Wenchuan earthquake in China,[11] and Zhang et al. also found that children with siblings was a predictor for PTSD symptom severity 12 and 18 months after the Wenchuan earthquake.[33]

The aims of this study, therefore, were to investigate the relationships between negative life events, depressive symptoms and PTSS in a sample of middle school students who had experienced the 2013 Ya'an earthquake using a moderated

mediation model. First, we tested the mediating effect of depressive symptoms on the relationship between negative life events and PTSS, and then we tested the moderating effects of only-child status on the direct and the indirect relationships between negative life events and PTSS. The conceptual model is shown in Fig. 1. Based on the previous research, the following hypotheses were proposed:

Hypothesis 1. Depressive symptoms mediate the association between negative life events and PTSS.

Hypothesis 2. Only-child status moderates the relationships between negative life events and PTSS and between negative life events and depressive symptoms.

Methods

Study design

A cross-sectional anonymous study on adolescent survivors of the 2013 Ya'an earthquake was conducted from mid-June to mid-July 2016 at four junior middle schools, for which a cluster sampling strategy was adopted. The research team was made up of psychologists, psychotherapists and local teachers. Before conducting the survey, the research team explained the aims and significance of the study to the participants and sent letters to their parents asking for informed consent. Consent was received for 4839 students, all of whom took part in the research and completed the questionnaires in class. This study was approved by the Ethics Review Committee of Sichuan University and the principals of the participating schools. Informed consent was obtained from each participant, in which it was emphasised that the confidentiality of each participant would be protected, and they had the right to withdraw from the study at any time. Participants were not paid.

Participants

Participants were sampled from four different junior middle schools in Ya' an, Sichuan Province, China. The inclusion criterion was that they had experienced the complete earthquake process, and the exclusion criterion was an unfinished questionnaire. A total of 4839 students completed the questionnaires, and after excluding 437 incomplete questionnaires, 4402 valid questionnaires were included in the data analyses, a return rate of 90.97%. The sample was made up of 2136 (48.52%) boys and 2266 (51.48%) girls, aged between 12 and 17 years (mean 14.84 ± 1.214 years), of which 2363 were only children and 2039 were children with siblings (Table 1).

Measures

Short mood and feelings questionnaire

The Short Mood and Feelings Questionnaire (SMFQ) self-report scale has been one of the most commonly used instruments for the assessment of the child and adolescent depression severity.[34] To measure the extent to which the symptom clusters meet the diagnostic standard for depression in the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV), the scale has 13 items on affective and cognitive symptoms experienced in the previous 2 weeks, with a common response format: 0 = never; 1 = sometimes and 2 = always. The Chinese SMFQ version has been found to have excellent reliability and validity.[35] Total scores range from 0 to 26, with a score of 11 being commonly used as the optimally efficient cut-off point for a clinical diagnosis of depression. In this study, the internal consistency of the total scale was 0.820.

Table 1 – Sociodemographic characteristics of the study sample (N = 4402).

Characteristic	N	%
Gender		
Male	2136	48.5
Female	2266	51.5
Age (years)		
12–14	1703	38.69
15–17	2699	61.31
Only child		
Yes	2363	53.7
No	2039	46.3

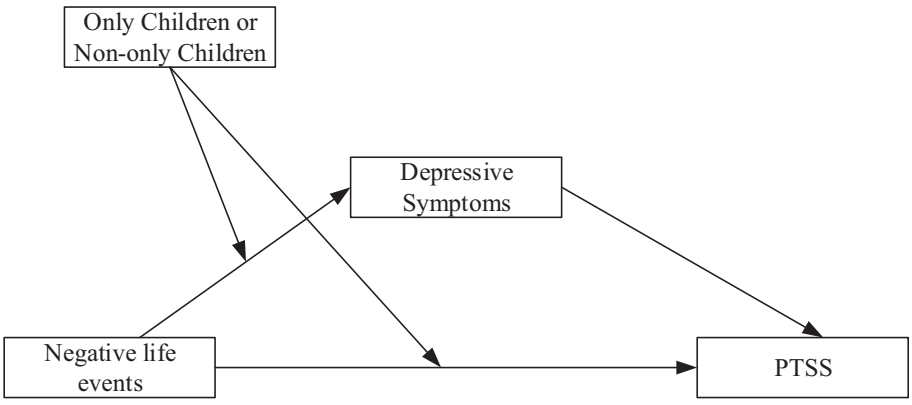

Fig. 1 – The proposed moderated mediation model. PTSS, post-traumatic stress disorder symptoms.

Adolescent self-rating life events check list

The Adolescent Self-Rating Life Events Check list (ASLEC) was developed to evaluate the psychological effects of negative life events. The scale consists of 27 items, organised under the following six categories: interpersonal relationships, learning pressure, being punished, bereavement, pressure on health and adaptation and others.[36] Participants were asked to recall whether or not each event had occurred in the previous 12 months. If such an event had occurred, participants then rated the psychological effects of that event on a scale of 1–5: 1 = no effect (1 point); 2 = light effect (2 points); 3 = medium effect (3 points); 4 = severe effect (4 points) and 5 = extreme effect (5 points). Thus, higher scores indicate a greater effect. If the participant had not experienced the event, 0 points were given. This scale has been widely used in the field of adolescent mental health research in China.[11] In this study, the scale demonstrated excellent internal consistency ($\alpha = 0.913$).

Children's revised impact of event scale

The Children's Revised Impact of Event Scale (CRIES-13) was developed to assess PTSS in children.[37] Jing et al. revised the Chinese version and proved that it was a viable assessment tool for PTSD in children who had experienced the 2008 Wenchuan earthquake.[38] The questionnaire includes 13 items clustered under the following three subscales: avoidance, re-experiencing and arousal (which are similar to the clusters in the DSM-IV criteria for PTSD). Participants were asked to rate how serious they felt about the items on four levels: not at all (0); rarely (1); sometimes (3); and often (5); with the total score being between 0 and 65 and with a suggested cut-off score of 30.[39] This scale also showed good internal consistency ($\alpha = 0.809$) in the present study.

Statistical analyses

The statistical analyses were conducted using SPSS version 22.0, and descriptive statistics computed for all variables.

A t-test was conducted to determine the effects of being an only child or a child with siblings on negative life events, depressive symptoms and PTSS, and correlation analyses were performed to examine the degree of association between PTSS, negative life events and depressive symptoms. The analysis of the mediation effects was in line with Hayes's PROCESS macro for SPSS in Model 4, with the PROCESS macro for SPSS in Model 59 being used to examine the moderated mediation model.[40]

Results

Characteristics of negative life events in adolescents

Table 2 shows the mean scores for the PTSD and depression symptoms in the only children and non–only children. Probable PTSD was diagnosed in 880 (19.99%) students, of which 332 were only children, and 548 were children with siblings. Depression prevalence was diagnosed in 949 (21.56%) students, of which 418 were only children, and 531 were children with siblings. Children with siblings scored higher than only children for depressive symptoms, PTSS, negative life events and arousal, but there were no significant differences found for intrusion and avoidance.

Table 2 – Descriptive statistics and t-test results among variables

Variables	Total (n = 4402)	Non-only child	Only child	t
NLE	55.13 (17.75)	56.71 (17.11)	53.77 (18.18)	5.51**
Depression	7.77 (4.45)	7.99 (3.78)	7.58 (4.95)	3.13**
PTSS	23.16 (8.85)	23.61 (8.14)	22.78 (9.40)	3.08**
Avoidance	6.70 (3.25)	6.78 (3.01)	6.62 (3.44)	1.73
Arousal	9.61 (4.08)	9.86 (3.85)	9.40 (4.25)	3.71**
Intrusion	6.86 (3.46)	6.96 (3.38)	6.76 (3.52)	1.88

NLE, negative life events; PTSS, post-traumatic stress disorder symptoms.
The values in brackets is mean score(+/−SD).
**P < 0.01.

The correlation analyses found that PTSS, negative life events and depressive symptoms were all positively correlated (Table 3). The correlation coefficients between PTSS and negative life events, PTSS and depressive symptoms and negative life events and depressive symptoms, respectively, were 0.63, 0.46 and 0.40, all of which were at a significant alpha level of 0.01. A further examination of the relationships between the PTSS subscale and negative events found that negative life events were mainly related to intrusion ($r = 0.61$, $P < 0.001$), followed by arousal ($r = 0.50$, $P < 0.001$) and avoidance ($r = 0.43$, $P < 0.001$). The PTSD subdimension was found to be significantly positively related to depression, with arousal having the highest association with depression ($r = 0.53$, $P < 0.001$), followed by avoidance ($r = 0.30$, $P < 0.001$) and intrusion ($r = 0.28$, $P < 0.001$).

Testing for the mediation effect

In Hypothesis 1, it was surmised that depressive symptoms mediated the relationship between negative life events and PTSS. To examine this hypothesis, Model 4 of the PROCESS macro was used with gender and age being included as the covariates.[40]

The mediation analyses are shown in Table 4. As can be seen, negative life events were found to be positively associated with depressive symptoms ($a = 0.39$, $P < 0.001$), and

Table 3 – Correlations among variables.

No.	Variables	1	1a	1b	1c	2	3	4
1	PTSS	1.00						
1a	Intrusion	0.83**	1.00					
1b	Avoidance	0.81**	0.58**	1.00				
1c	Arousal	0.82**	0.50**	0.46**	1.00			
2	Depression	0.46**	0.28**	0.30**	0.53**	1.00		
3	NLE	0.63**	0.61**	0.43**	0.50**	0.40**	1.00	
4	OC or NOC	−0.05**	−0.03	−0.03	−0.06**	−0.05**	−0.08**	1.00

NLE, negative life events; PTSS, post-traumatic stress disorder symptoms; NOC, non–only children; OC, only children.
**P < 0.01.

Table 4 – Testing the mediation effect of negative life events (NLE) on post-traumatic stress disorder symptoms (PTSS).

Predictors	Model 1 (PTSS)		Model 2 (depression)		Model 3 (PTSS)	
	b	t	*b*	T	*b*	t
Gender	−0.05	−3.96***	−0.09	−6.39***	−0.03	−2.18*
Age	−0.05	−3.95***	−0.00	−0.07	−0.05	−4.11***
NLE	0.62	52.69***	0.39	28.24***	0.52	42.75***
Depression					0.25	20.29***
R^2	0.40		0.16		0.45	
F	957.67***		287.42***		888.27***	

*P < 0.05, ***P < 0.001.

depressive symptoms were found to significantly predict PTSS ($b = 0.25$, $P < 0.001$). Finally, after controlling for gender and age, negative life events were found to be positive predictors of depressive symptoms ($b = 0.52$, $P < 0.001$), which indicated that depressive symptoms completely mediated the relationship between negative life events and PTSS; ab = 0.10, 95% confidence interval (CI) = 0.08–0.11; with the mediation effect accounting for 15.68% of the total effect. Therefore, Hypothesis 1 was supported.

Test of the moderated mediation model

In Hypothesis 2, it was surmised that being an only child moderated the direct association between negative life events and PTSS and the association between negative life events and depressive symptoms (Fig. 2). To examine this moderated mediation model, model 8 of the Process Macro developed by Hayes was employed with 5000 bias-corrected bootstrap samples, and three regression models were formulated to examine the moderated mediation effect.[40] In model 1, the moderating effect of only-child status on the relationship between negative life events and PTSS was explored; in model 2, the moderating effect of only-child status on the relationship between negative life events and depressive symptoms was estimated; and in model 3, the moderating effect of only-child status on the relationship between depressive symptoms and PTSS was determined. Hayes suggested that moderated mediation was established if one or both of two patterns existed: (a) the path between negative life events and depressive symptoms was moderated by only-child status (first stage moderation); and/or (b) the path between depressive symptoms and PTSS was moderated by only-child status (second stage moderation).[40] In each model, gender and age was controlled. The related results are summarised in Table 5.

As shown in Table 5, in model 1, the negative life event scores were found to be positive predictors of the PTSS scores ($b = 0.56$, $P < 0.001$), and this effect was moderated by only-child status ($b = -0.19$, $P < 0.001$). For descriptive purposes, the predicted PTSS was plotted against the negative life events separately for the only children and non–only children (Fig. 3). The simple slope tests indicated that for the Ya'an earthquake, non–only child adolescents and higher levels of negative life events were significantly associated with higher levels of PTSS ($b_{\text{simple}} = 0.56$, $P < 0.001$). However, for the only-child adolescent Ya'an earthquake survivors, while higher levels of negative life events were also found to be significantly associated with PTSS, the effect was much weaker ($b_{\text{simple}} = 0.37$, $P < 0.001$). Model 2 indicated that negative life events had significant associations with depressive symptoms ($b = 0.12$, $P < 0.001$) and that this effect was moderated by only-child status ($b = -0.05$, $P < 0.001$). The separate simple only-child and non–only-child slopes representing the relationship between negative life events and depressive symptoms showed that for non–only-child adolescents, higher levels of negative life events were associated with higher levels of depressive symptoms ($b_{\text{simple}} = 0.12$, $P < 0.001$); however, for only-child adolescents, while higher levels of negative life events were associated with higher levels of depressive symptoms, ($b_{\text{simple}} = 0.07$, $P < 0.001$), the association was much weaker (Fig. 4). The bias-corrected percentile bootstrap results further indicated that the indirect effect of negative life

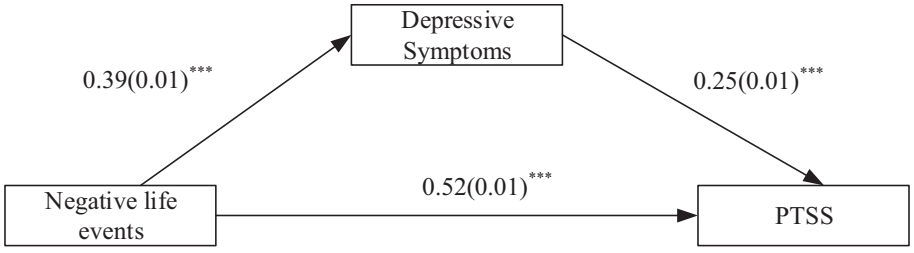

Fig. 2 – The mediation of depressive symptoms. The link between negative life events and post-traumatic stress disorder symptoms (PTSS) is mediated by depressive symptoms. Path values are the path coefficients (standard errors). All covariates (i.e. age and gender) were controlled during this analysis. ***P<0.001.

Table 5 – Testing the moderated mediation effect of negative life events (NLE) on post-traumatic stress disorder symptoms (PTSS).

Predictors	Model 1 (PTSS)		Model 2 (depression)		Model 3 (PTSS)	
	b	*t*	*b*	*T*	*b*	*t*
Gender	−0.05	−3.94***	−0.08	−6.18***	−0.03	−2.27*
Age	0.05	−3.95***	0.00	0.26	−0.05	−4.20***
NLE	0.56	31.23***	0.12	6.06***	0.52	42.68***
OC or NOC	−0.16	−4.17***	−0.10	−9.02***	0.01	1.30
NLE × OC or NOC	−0.19	−4.73***	−0.05	−2.46 **	−0.00	−0.24
Depression					0.25	19.69***
R^2	0.40		0.22		0.67	
F	582.12**		245.08***		592.43***	

NOC, non–only child; OC, only child.
* $P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

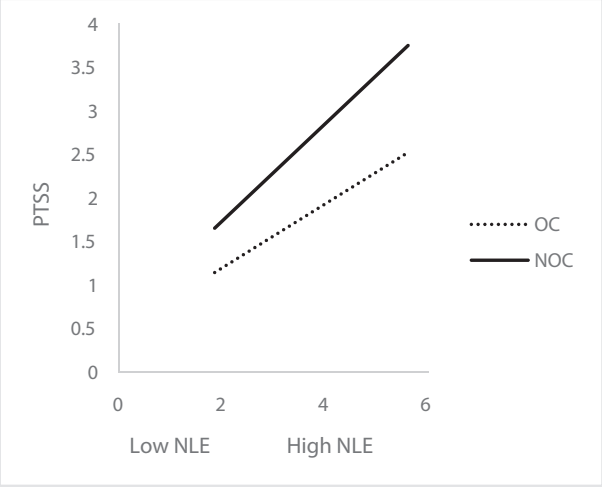

Fig. 3 – Interaction effect of only-child status and negative life events (NLE) on post-traumatic stress disorder symptoms (PTSS). High and low levels of negative life events represent one standard deviation above and below the mean. NOC, non–only children; OC, only children.

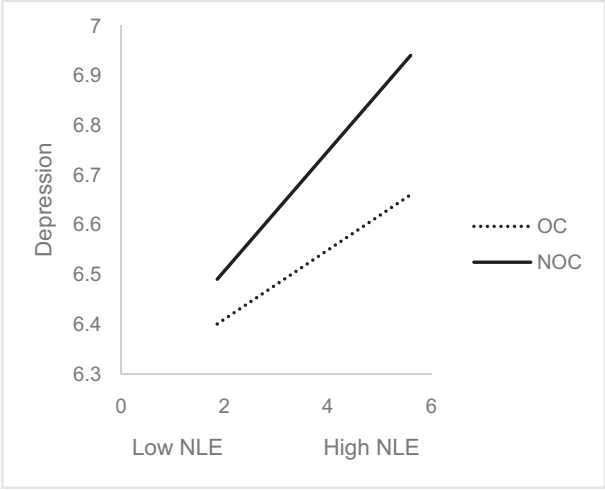

Fig. 4 – Interaction effect of only-child status and negative life events (NLE) on depression. High and low levels of negative life events represent one standard deviation above and below the mean. NOC, none–only children; OC, only children.

events on adolescent PTSS via depressive symptoms was moderated by only-child status, with the index of moderated mediation being −0.05, standard error (SE) = 0.01, 95% CI = −0.05 to −0.07. For non–only-child adolescents, the indirect effect of negative life events on PTSS via depressive symptoms was significant ($b = 0.07$, $SE = 0.01$, 95% CI = 0.06, 0.08). In contrast, for only-child adolescents, the indirect effect was much weaker ($b = 0.02$, SE = 0.00, 95% CI = 0.01, 0.02). Therefore, Hypothesis 2 was also supported.

Discussion

Research has identified that there is a significant impact of stressful life events on PTSS;[41–43] however, the mediating and moderating mechanisms were unclear. This study used a moderated mediation model to examine whether negative life events were indirectly associated with PTSS via depressive symptoms and whether this relationship was moderated by being an only child. It was found that depressive symptoms mediated the relationship between negative life events and PTSS and that the association was weaker for only children compared to children with siblings. These findings shed light on 'how' and 'for whom' negative life events are connected with PTSS.

The results of the t-tests indicated that children with siblings had significantly higher depressive symptoms and PTSS scores than only children, suggesting that adolescents from only children backgrounds were less likely to have PTSS and depressive symptoms than non–only children; this is in agreement with findings from the Wenchuan earthquake studies.[11,33] The results of the current study indicated that children with siblings needed additional intervention after the Ya'an earthquake. Compared with non–only children, only children have been found to receive greater family support, which is one of the protective factors against PTSD.[44] Resource

dilution theory states that the more children in a family, the lower the quality of resources, such as teaching and attention, the parents can provide.[27] Therefore, as only children possibly received higher levels of parental responsiveness, attention and concern compared with non–only children,[31] the only children had a greater sense of security and greater psychological confidence, which helped minimise the effects of any negative life events.[45] Another reason for these results may be that children with siblings may be at a higher risk of family injuries/deaths than only children, which could increase their risk of developing PTSS.[33]

Mediating role of depressive symptoms

Depressive symptoms were found to mediate the relationship between negative life events and PTSS, indicating that depressive symptoms may be one of the reasons adolescents are more likely to develop PTSS in response to negative life events. This study was the first to document the mediating role of depressive symptoms between negative life events and PTSS in earthquake studies. These findings extend previous studies by revealing possible reasons for the increase in adolescent PTSD from negative life events and support the findings by Backholm and Björkqvist that depression mediated the relationship between potentially traumatic events and PTSD in news journalists.[10]

Two separate links were observed in the mediation model. The relationship between negative life events and depressive symptoms lent support to the hypothesis suggested by Lazarus and Folkman that as major life events tended to be discrete events, they often induce many minor life events, which in turn trigger or exacerbate the severity of the physical and/or psychiatric symptoms.[46] The results were also in line with the stressor-specific model that implies that specific stressors, such as home life or peer pressure, are associated with depression.[47] The relationship found between depressive symptoms and PTSS also supports the depressogenic model, which predicts that depression can cause or exacerbate PTSS;[48] that is, depression may derail attempts to exercise the self-regulatory processes needed to engage in distress-provoking activities and therefore may contribute to the continuation of both depressive symptoms and PTSS.[49]

Moderating role of only-child status

Our findings confirmed that being an only child moderated the indirect effect of negative life events on PTSS. Specifically, it was found that being an only child moderated the effect of negative life events and depressive symptoms and that the association was much weaker in only children. In China, owing to the one child policy, only children are more likely to be born in an urban area, and their parents were more likely have a higher level of education.[50] Therefore, it is possible that only children have more parental resources than non–only children,[27,51] which may decrease their risk of depressive symptoms.[52] Furthermore, the direct effect of negative life events on PTSS was also found to be moderated by being an only child; specifically, children with siblings were found to have a higher risk of developing PTSS than only children, which is consistent with previous findings.[11,33] It was surmised that this was possibly because only children received greater support from their parents, while non–only children had to share their parental support with their siblings. It is also possible that the non–only children may have experienced more family injuries/deaths than only children and thus had an increased risk of developing PTSS.[33]

Overall, the main contributions of this study were to employ a moderated mediation model that incorporated both the depressogenic PTSD model and the resource dilution model. The integrated model was an innovative extension of the traditional depressive PTSD model and addressed the critical issue of 'what works for whom', revealing that depressive symptoms were one of the primary mediation mechanisms and that only-child status was a possible moderator for the impact of negative life events on PTSS.

Limitations

There were several limitations in this study. First, the study relied on a single self-reported measure for PTSS and depressive symptoms. Because of the social bias towards mental health problems, Chinese people tend to deny mental health issues;[53] therefore, further in-depth interviews by professional psychiatrists are needed to clarify the relationships between negative life events and current mental illness symptoms. Second, it was not possible to establish causal links because of the cross-sectional nature of the study, and it also possible that there were reverse relationships between the three variables of interest. The findings of this study could also have been affected by other variables not explored here, such as earthquake exposure, socio-economic status, or parenting styles; therefore, a more detailed longitudinal study is needed to fully explore the psychological mechanisms between PTSS and negative life events. Third, different negative life events (such as peer pressure) have different effects on adolescent depressive symptoms and PTSS; therefore, future studies should examine the associations between domain-specific stressors and PTSS and depressive symptoms.

Despite these limitations, the results of this study have important implications for mental health interventions for earthquake survivors. First, because of the significant effects of negative life events on PTSS, adolescent exposure to negative life events after earthquake events should be minimised. Second, as depressive symptoms were associated with PTSS, identifying emerging depressive symptoms in adolescents could lead to better and more focused PTSS interventions. Third, as this study clearly revealed that only-child status moderated the first stage relationship and the direct relationship between negative life events and PTSS, providing mental health assessments and interventions for children with siblings after earthquake events could reduce PTSS severity.

Author statements

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Ethical approval

This study was approved by the Ethics Review Committee of Sichuan University and the principals of the participating schools. Informed consent was obtained from each participant, in which it was emphasised that the confidentiality of each participant would be protected, and they had the right to withdraw from the study at any time.

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Competing interest

The authors declare no conflicts of interest or disclosures related to this work.

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