ORIGINAL RESEARCH

The Relationship Between Negative Life Events and Nonsuicidal Self-Injury Among Chinese Adolescents: A Moderated-Mediation Model

Yang Zhang[1,]*, Xingbo Suo[2,]*, Yuebing Zhang[1,]*, Shenshuai Zhang[2], Menglan Yang[2], Liju Qian[1], Luning Shang[1], Dong Zhang[1], Fangfang Xu[2], Wu Li[1]

[1]Department of Psychiatry, Shandong Daizhuang Hospital, Jining, People's Republic of China; [2]Department of Psychiatry, Jining Medical University, Jining, People's Republic of China

*These authors contributed equally to this work

Correspondence: Wu Li; Yuebing Zhang, Department of Psychiatry, Shandong Daizhuang Hospital, Jining People's Republic of China, Tel +86-13853706436; +86-15263756906, Email sdsdzyylw@163.com; zhangyuebing2006@163.com

Objective: This study aimed to investigate whether anxiety mediates the relationship between negative life events and nonsuicidal self-injury (NSSI) in adolescents and whether this mediating role is moderated through social support.

Methods: The model consisted of an anonymous questionnaire survey of 506 Chinese adolescents (253 boys and 253 girls, mean age 15.11 years (SD = 1.83, range 11–18 years)). Self-designed questionnaires were used to collect demographic data. The frequency of NSSI, state anxiety, and social support degree of adolescents was assessed by the Adolescent Life Events Scale, the Chinese version of the Beck Anxiety Inventory, and the social support scale, respectively.

Results: Negative life events were significantly and positively correlated with anxiety and the frequency of NSSI, and anxiety was significantly and positively correlated with the frequency of NSSI. The positive association between negative life events and the frequency of NSSI among adolescents was mediated by anxiety after controlling for demographic variables. Furthermore, this mediated relationship was moderated by social support.

Conclusion: Anxiety was a potential mechanism linking negative life events to NSSI in adolescents and low social support important risk factor for amplifying this indirect effect. Our findings provide an empirical basis for reducing NSSI in adolescents.

Keywords: adolescent, non-suicidal self-injury, negative life events, social support

Introduction

Nonsuicidal self-injury (NSSI) refers to the direct injury of one's body tissue without suicidal intent, such as scratching, cutting, and burning oneself.[1,2] NSSI as a public health problem is prevalent in the global adolescent population.[3,4] Previous longitudinal studies have revealed that NSSI begins in early adolescence and peaks in prevalence in mid-adolescence.[5,6] In addition to the clinical population, NSSI has a high prevalence in the community adolescent population. Two independent systematic reviews reported lifetime prevalences of 17.2% and 18% in adolescents, respectively.[7,8] Another meta-analysis from China indicated that approximately 22.37% of Chinese adolescents might develop NSSI at some stage of adolescence.[9] The high prevalence of NSSI seriously endangers the physical and mental health of adolescents and has a huge social burden, which has attracted the attention of researchers. A large number of studies on adolescent NSSI have been published in recent years, and although it has been established that NSSI is associated with complex psychosocial factors, such as anxiety, depression, child abuse, autism, and negative life events,[5,10,11] there is no unified explanation for the occurrence of NSSI. Negative life events refer to changes in individuals' family, work, and/or study environments that may cause negative psychological and physiological outcomes.[12] In the face of overreaction excitement to negative life events, some individuals may use NSSI as

a coping strategy due to impaired regulation of the cognitive state.[13] Studies have confirmed that the prevalence and severity of negative life events are significantly higher in the adolescent population with NSSI than in the adolescent population without NSSI. Cross-sectional studies of Chinese and Italian adolescents with NSSI consistently support a positive association between negative life events and adolescent NSSI.[11,14] A recent cohort study of community-based adolescents assessed distal risk factors at baseline, proximal risk factors for NSSI such as negative life events after 2 years of follow-up, and changes in adolescents' NSSI at the end of 2.5 years of follow-up, with the result that adolescents with NSSI behaviors experienced more negative life events than those without NSSI behaviors.[15] Another multiwave longitudinal study measuring the association between NSSI and negative life events at baseline, 6 months postbaseline, and 9 months postbaseline showed that those who reported NSSI during the nine-month follow-up period had higher mean rates of negative life events.[16] This multiple-time point study has provided greater confidence in the temporal stability of the predictive relationship between the two. Although these studies have discussed the direct role of negative life events in the onset of NSSI in adolescents, it is important to view and understand the issue of NSSI in adolescents from a more comprehensive perspective, considering that the development of the adolescent stage may involves the moderating, mediating role of negative emotions, friendship quality, and other factors.[17,18]

According to General Strain Theory (GST), negative stimuli from multiple sources can lead to negative affective states and cause individuals to adopt violent or deviant behaviors as coping strategies for negative emotions.[19] In addition, the experiential avoidance model (EAM) has suggested that the primary function of NSSI is to avoid negative emotions that the individual does not want to experience, and most studies also consider NSSI to be a nonadaptive way of coping to alleviate negative emotions.[20,21] In other words, negative emotions such as anxiety are not only the result of negative life events but may also be a contributing factor to NSSI. Zhu et al[18] examined how anxiety mediates the pathway between cyber victimization and NSSI, providing insight into the role of anxiety in negative life events. The results suggest that network victimization significantly predicts increased anxiety, which in turn predicts a higher frequency of NSSI as a risk factor. The mediating role of anxiety symptoms may be guided by the NSSI model of emotion regulation.[13,22,23] Therefore, we propose that anxiety may mediate the relationship between negative life events and NSSI in adolescents.

Social support, an important mental health resource, has a more stable influence in moderating negative life events and maladaptive behaviors, among others.[24] It has been shown that social support can moderate the relationship between adolescent child maltreatment experiences and NSSI and that increasing social support may decrease the likelihood of NSSI behaviors.[25,26] This is the same as the findings of Liu et al[27] who found that multidimensional social support from parents, teachers, and peers was an important protective factor for adolescent NSSI. Moreover, adequate social support can facilitate emotional adjustment and avoid the influence of underlying processes such as emotional dysregulation (eg, anxiety, depression) in individuals with NSSI.[24,28] When adolescents experience emotional disturbances due to negative life events, high levels of social support can increase personal self-efficacy and lead to greater understanding, respect, encouragement, courage, and self-actualization, serving as a buffer against negative life events, helping adolescents maintain relative emotional stability even when facing negative life events and reducing the occurrence of negative emotions such as anxiety.[29] However, low levels of social support may also reinforce the association of negative life events with anxiety. As individuals experience more negative life events and lower perceived support, the risk of internalizing mood disorders and externalizing behavioral problems increases.[30] Although adolescents who experience negative life events with increased negative affect may be at higher risk for NSSI and social support may play an important role in this process, a consistent correlation between the four constructs has not been shown.

The purpose of this study is twofold. First, the present study aims to determine whether anxiety mediated the association between negative life events and NSSI in a sample of Chinese adolescents. Given the existing research and empirical evidence, we proposed Hypothesis 1: Negative life events increase anxiety in adolescents, which in turn increases the severity of NSSI. That is, anxiety mediates the association between negative life and adolescent NSSI. Second, we propose Hypothesis 2: The indirect association between negative life events and NSSI through anxiety will vary depending on the level of the adolescent's social support. Specifically, low levels of social support increase the impact of negative life events on anxiety and the occurrence of NSSI behaviors. This study will contribute to a deeper understanding of the impact of negative life events on adolescent NSSI and inform the development of prevention strategies and intervention approaches. The moderated mediation model diagram is shown in Figure 1.
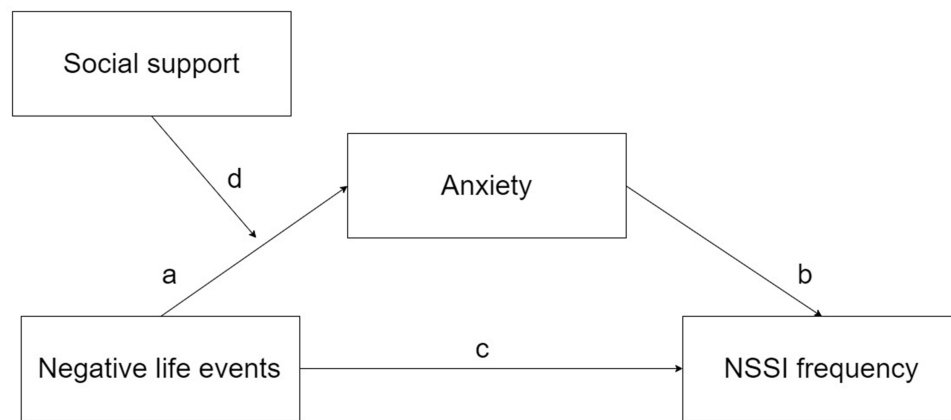
Figure 1 The proposed moderated-mediation model of the relationship between negative life events and non-suicidal self-injury (NSSI).

Materials and Methods

Participants

Participants were selected from six middle schools in Shandong Province, China. A total of 795 questionnaires were returned, of which 506 passed quality control checks. Questionnaires that met the following eligibility criteria were included in the scope of valid questionnaires: first, the questionnaire age input was consistent with the age range of adolescents; second, the questionnaire response questions were complete, and there were no blank items; third, the questionnaire response questions were carefully answered, and there were no obvious contradictions or regularities in the answers (no answers with more than 10 consecutive question choices in one or more scales were consistent); and 427 (84.39%) participants had experienced at least one negative life event in the past year that hurt their lives. Of the total number of participants, 253 (50.00%) were boys. The mean age of the participants was 15.11 years (SD = 1.83, range 11–18).

Data Collection

All data were collected from July to December 2020, and a convenience sampling method was adopted to collect information about adolescents in Shandong Province, China, using paper questionnaires. Researchers received systematic training in data collection to ensure standardization of the data collection process. Paper questionnaires were distributed in the classroom and collected on the spot to improve data completeness. This study was conducted in compliance with the Declaration of Helsinki, and the study was approved by the Ethics Committee of Dai Zhuang Hospital, Shandong Province. Based on the principle of voluntary participation, the adolescents who participated in the study and their relevant responsible persons were fully informed of the protocol regarding the questionnaire. Verbal informed consent was obtained from school administrators, parents, and adolescents themselves before questionnaire collection to indicate their willingness to participate. The ethics committee approved the verbal consent procedure.

Measuring Instrument

The Adolescent Life Events Scale (ASLEC) was developed and revised by Liu et al[31] to assess the psychosocial stress of adolescents. The scale consists of 27 negative life events that may bring about physiological and psychological reactions in adolescents. For each item, the occurrence or nonoccurrence of the event was judged first. If it had occurred, it was rated on five levels (1 = no effect, 2 = mild, 3 = moderate, 4 = severe, 5 = very severe) according to the psychological feelings at the time of the event. A higher total score indicates a greater psychological impact of the negative life event. In this study, the Cronbach coefficient α was 0.968.

The severity of anxiety is rated by the Chinese version of the Beck Anxiety Inventory (BAI), which has been widely used in studies of Chinese populations.[32–34] The scale is a self-report assessment tool that is scored on a four-point Likert scale (0–3) and consists of 21 items. Respondents choose between four options for each question, with higher total scores reflecting more severe anxiety. In this study, the Cronbach coefficient α was 0.942.

The social support scale was developed by Ye et al[35] to assess the social resources received by adolescents and their utilization of the resources available to them. The scale includes three dimensions, subjective support, objective support, and support utilization, with a total of 17 items. The scale was scored on a 5-point Likert scale (1 = does not meet, 2 = somewhat does not meet, 3 = uncertain, 4 = somewhat meets, 5 = meets). A higher total score indicates a higher overall level of social support of the adolescent. In the present study, the Cronbach coefficient α was 0.972.

The adolescent NSSI behavior assessment questionnaire was developed by Wan et al[36] and contains two subquestionnaires, the behavioral questionnaire and the functional questionnaire. In this study, the behavioral questionnaire was used to assess the frequency of 12 nonsuicidal self-injurious behaviors in adolescents who were "intentional (ie, on purpose) and without suicidal intent." The behaviors assessed included pinching oneself, scratching oneself, hitting one's head against a hard object, punching a hard object with one's fist, bruising oneself with a hard object, stabbing oneself, cutting oneself, biting oneself, yanking one's hair out, burning oneself, rubbing one's skin against a rough surface, and carving into the skin. The scale uses a 5-point Likert scale (0 = none, 1 = once, 2 = sometimes, 3 = often, 4 = always) to estimate the number of times each behavior is performed. Higher total scores indicate more frequent nonsuicidal self-injurious behaviors among adolescents. In the present study, the Cronbach coefficient α was 0.928.

Statistical Analyses

All statistical analyses were performed using SPSS 25 software. Descriptive statistics and Spearman's rank correlation were used to analyze the correlations between negative life events, anxiety, social support, and NSSI. The data were then analyzed for mediating and moderating effects using Process, a macro program developed by Hayes.[37] The bootstrapping method was used to test for mediating effects.[38] This method produced 95% bias-corrected confidence intervals from resampling of 5000 data points. Since previous studies suggested that adolescent NSSI is age- and gender-related,[39] in all analyses, we used the gender and age of the participants as control variables.

Results

Descriptive Statistics and Correlation Analysis of the Variables

Descriptive statistics and Spearman correlation coefficients for all study variables are shown in the matrix in Table 1. Correlation analysis determined the relationship between negative life events, NSSI, anxiety, and social support in the study sample. Negative life events were significantly and positively correlated with anxiety ($r = 0.340$, $p < 0.001$) and the frequency of NSSI ($r = 0.294$, $p < 0.001$), and anxiety was significantly and positively correlated with the frequency of NSSI ($r = 0.484$, $p < 0.001$). The correlation between the frequency of NSSI and social support was low, while the correlation between negative life events and social support was high.

Testing for Moderated-Mediation

The results are shown in Table 2. The effect of negative life events on anxiety was statistically significant ($\beta = 0.076$, SE = 0.015, 95% CI [0.047, 0.104]), as was the effect of social support on anxiety ($\beta = -0.083$, SE = 0.021, 95% CI [−0.124, −0.043]). The interaction between negative life events and social support negatively predicted anxiety ($\beta = -0.003$, SE = 0.001, 95% CI

Table 1 Means, SD, and Correlation Matrix (N = 506)

Variable	M	SD	1	2	3	4	5	6
1.Gender	0.500	0.500	–					
2.Age	15.110	1.829	–	–				
3.NSSI	1.280	4.293	0.038	−0.102*	–			
4.Social support	67.500	17.273	0.061	0.008	−0.254***	–		
5.Anxiety	5.250	8.199	0.080	−0.071	0.484***	−0.317***	–	
6.Negative life events	24.540	26.339	−0.079	0.014	0.294***	−0.456***	0.340***	–

Notes: *p* < 0.05 was considered statistically significant; **p* < 0.05, ***p* < 0.001.
Abbreviations: NSSI, nonsuicidal self-injury; M, mean; SD, standard deviation.

Table 2 The Moderated-Mediating Effect of Negative Life Events on NSSI

Variable	Anxiety			NSSI		
	β	SE	95% CI	β	SE	95% CI
Constant	6.466*	2.691	[1.179, 11.752]	1.179	1.236	[−1.251, 3.608]
Gender	1.121	0.655	[−0.166, 2.408]	−0.373	0.300	[−0.963, 0.217]
Age	−0.154	0.178	[−0.504, 0.196]	−0.085	0.081	[−0.245, 0.075]
Negative life events	0.076***	0.015	[0.047, 0.104]	0.020**	0.006	[−0.008, 0.033]
Anxiety				0.301***	0.020	[0.263, 0.340]
Social support	−0.083***	0.021	[−0.124, −0.043]			
Negative life events × Social support	−0.003***	0.001	[−0.004, −0.002]			
R²	0.226			0.490		
F	29.146***			86.571***		

Notes: *p* < 0.05 was considered statistically significant; *p < 0.05, **p < 0.01, ***p < 0.001.
Abbreviations: NSSI, nonsuicidal self-injury; β, standardized regression coefficient; SE, standard error; CI, confidence interval.

[−0.004, −0.002]). In addition, negative life events positively predicted the frequency of NSSI (β = 0.020, SE = 0.006, 95% CI [0.008, 0.033]), and anxiety positively predicted the frequency of NSSI (β = 0.301, SE = 0.020, 95% CI [0.263, 0.340]).

The indirect effect of negative life events on NSSI through anxiety was moderated by social support with an index of moderation of −0.001, 95% CI [−0.002, −0.0001]. The mediating role of anxiety in the relationship between negative life events and NSSI was not significant when the level of social support was above the mean 1 SD, with an index of mediating effect of 0.008, 95% CI [−0.010, 0.029]. Additionally, when the level of social support was below the mean of 1 SD, there was a mediating effect of anxiety on the relationship between negative life events and NSSI, with an indicator of a mediating effect of 0.037, 95% CI [0.014, 0.065].

The study tested the predictive effect of negative life events on anxiety by conducting a simple slope analysis for high, intermediate, and low levels of social support. The results showed that negative life events were positively associated with anxiety at intermediate levels of social support (β simple = 0.076, *p* < 0.001). The effect of negative life events on anxiety was stronger when social support was low (β simple = 0.124, *p* < 0.001). However, when social support was high, the correlation between negative life events and anxiety was not significant (β simple = 0.027, p = 0.194, Figure 2).

Discussion

According to the integrated theoretical model[13] and the social-ecological framework,[40] adolescents' risky behaviors are the result of the interaction of multilevel factors such as individual, family, and society. Individual factors focus on internal characteristics such as mental health, while factors such as family and society focus on external factors such as the environment and changes in social relationships. Although there is growing evidence that negative life events may induce or exacerbate a variety of physical and psychological disorders and lead to a variety of undesirable behaviors, such as suicide, NSSI, and delinquency, few researchers have examined the mechanisms involved in the mediating and moderating effects.[41–43] Therefore, this study developed and evaluated a moderated mediation model to elucidate the role of multilevel factors, including negative life events, anxiety, and social support, in relation to NSSI.

The Mediating Role of Anxiety

Our study found that negative life events were associated with increased anxiety, which in turn further exacerbated the frequency of NSSI. In other words, anxiety mediated the relationship between negative life events and NSSI, which is consistent with Hypothesis 1. Therefore, increased anxiety may be the explanatory mechanism for the relationship between negative life events and NSSI in adolescents.

Our study supports the stress exposure model of psychopathology, which states that when individuals experience stressful life events,[16] they are at increased risk of being in a negative mental health state, predisposing them to use NSSI as a coping strategy and that NSSI may be aimed at alleviating the negative emotions associated with the negative life events. Our results are also consistent with the theory of acceptance commitment therapy.[44] The theory suggests that
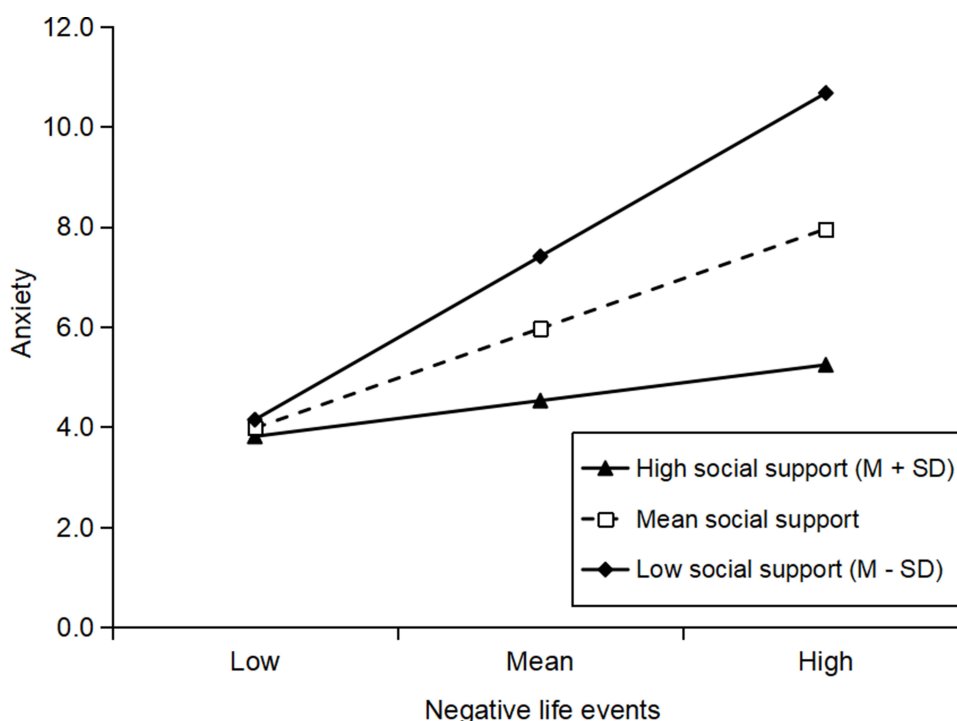
Figure 2 Simple slope analysis showing the moderating influence of social support of the association between anxiety and negative life event.

anxiety and NSSI may be rooted in psychological inflexibility, such as experiential avoidance and cognitive integration. Individuals attribute cognitive fusion to some of their own mistakes, and their behavior is limited by their own negative emotions; experiential avoidance implies that individuals achieve escape from negative emotions and negative events through NSSI. The NSSI briefly relieves anxiety caused by negative life events, and immediate distress reduction maintains dependence on the NSSI through negative reinforcement. A self-perpetuating cycle strengthens the link between negative life events, anxiety, and NSSI. Adolescents are more likely to use NSSI to relieve intolerable negative emotions while facing negative life events due to internal factors such as poor stress tolerance and social problem-solving deficits.[45,46] Future research could further explore the influence of adolescents' intrinsic traits on whether they engage in maladaptive behaviors in response to negative life event stimuli.

In addition to mediating outcomes, each pathway in this mediation model has important implications. First, negative life events had a significant direct effect on both anxiety and the frequency of NSSI. This corroborates previous research[47] that negative life events may be associated with an increase in error-related brain activity (a neurological risk marker for anxiety) that prospectively predicts changes in anxiety symptoms, and notably, negative life events in adolescents may lead to long-term damage that is not easily reversible due to the increased stability of neural circuit organization after the end of adolescence. Prolonged and excessive negative life events such as stress can affect areas of the brain densely populated with glucocorticoid and mineralocorticoid receptors, such as the hippocampus and prefrontal cortex, triggering dysfunction of the HPA axis and leading to greater susceptibility to disorders associated with psychological disorders.[48,49] Studies targeting NSSI have also shown that NSSI is associated with a blunted response of the HPA axis to stress.[50] Adolescence is a critical period for the development of physiological stress systems (eg, the HPA axis).[48] Compared to adults, adolescents may be more likely to develop abnormal HPA axis function and induce NSSI when stimulated by negative life events. Second, anxiety was a positive predictor of the frequency of NSSI in adolescents. However, the relationship between negative emotions such as anxiety and NSSI may be bidirectional, and negative emotions may also be exacerbated by NSSI. Because adolescents often use NSSI as a means to escape negative emotions, they may not develop a tolerance for negative emotions and learn how to manage their negative emotions.[45] Their negative emotions may be exacerbated when they realize that NSSI only temporarily alleviates negative emotions

but does not solve their ultimate problem. Although NSSI may moderate emotions, anxiety may reinforce each other with NSSI in the long run.

The Moderating Role of Social Support

Our study also found a moderating role of social support in the indirect association between negative life events and NSSI in adolescents. Low levels of social support increased the positive correlation between negative life events and anxiety. That is, social support could moderate this mediating model by moderating the relationship between negative life events and anxiety, which is consistent with Hypothesis 2. Adolescents who experienced negative life events and had low levels of social support were more likely to experience anxiety and moderate anxiety caused by negative life events through the NSSI than those who had moderate levels of social support.

Social support is a multidimensional concept that is often thought of as the care, love, and respect that individuals feel from social connections with other individuals, groups, and the larger community.[51,52] Social support can compensate for environmental influences that are detrimental to mental health, such as a lack of social cohesion and economic inequality.[53] For adolescents, social support during adolescence can prevent emotional problems, such as depression and anxiety,[54,55] and help adolescents cope with adversity and stress. In the context of negative life events, adolescents with higher levels of social support are at less risk of experiencing mental health problems,[56] and adolescents with low levels of social support may be more vulnerable to mental health problems. A risk-protective factor model within the framework of resiliency theory suggests that protective factors serve to reduce the negative impact of risk factors on psychological outcomes.[57] In other words, protective factors (ie, social support) may play a moderating role in the relationship between risk factors (ie, negative life events) and psychological outcomes (ie, anxiety symptoms), which is consistent with our findings. Adolescents may be vulnerable to negative life events, and the lack of social support in this context may exacerbate that vulnerability. Such adolescents may be more likely to suffer from mood disorders after stressful events, leading to involvement in behaviors such as NSSI.[46,58] In addition, Tore Aune et al showed that high levels of social support can increase self-efficacy involving cognitive and emotional processes and that when adolescents experience negative life events, high levels of social support in concert with self-efficacy can improve their ability to recover from such events and effectively buffer the effects of negative life events on anxiety.[59] In summary, social support may have achieved a moderating effect on the mediating role of anxiety by influencing adolescents' emotion management adaptations in the face of negative life events.

Limitations and Practical Implications

We must acknowledge several limitations of the present study. First, due to its cross-sectional design, causal relationships between negative life events, social support, anxiety, and NSSI could not be derived. These causal relationships will need to be validated in future longitudinal studies. Second, in addition to the variables addressed in this study, future studies should consider other risk factors to further elucidate the factors and mechanisms associated with NSSI. Third, this study was conducted only among adolescents in Jining, China; thus, the representativeness of our sample may be reduced. Future studies should examine whether these findings can be generalized to other developmental stages as well as to different geographical areas. Finally, we used only self-report questionnaires to measure psychosocial variables in this study, which may have influenced the findings. Future studies should attempt to collect data from different sources (parents, teachers, peers, etc.) to objectively measure mental health to verify the reliability of the results. Despite these limitations, our study has multiple practical implications. First, these results provide evidence that negative life events are a key risk factor associated with NSSI in adolescents. Parents and educators need to be aware of this risk, identify adolescents experiencing negative life events early and reduce the risk of harm through timely intervention at home and school. In addition, families and schools can further enhance adolescents' ability to cope effectively with negative life events by enriching their after-school lives and developing healthy hobbies. Second, anxiety is a key vehicle for linking negative life events to adolescent NSSI, suggesting that anxiety may be a necessary target for intervention. Reducing anxiety in adolescents can help reduce the occurrence of NSSI behaviors. One effective strategy is structured cognitive-behavioral therapy that can significantly improve anxiety symptoms and overall functioning in adolescents.[60] Finally, the findings suggest that low levels of social support can exacerbate the effects of negative life events on anxiety. Therefore,

parents should provide greater emotional support to their adolescents, and schools can positively influence adolescents' mental health by promoting teacher-student relationships and peer relationships.

Conclusions

In this study, an important moderated mediation model was developed with reliable data to identify the potential relationship between negative life events and NSSI in adolescents. The present study suggests that anxiety mediates the association between negative life events and NSSI. Social support plays a moderating role in the association between negative life events, anxiety, and NSSI. This moderated mediation model, which has never been used before, helps expand our understanding of the mechanisms underlying the relationship between negative life events and NSSI. In addition, the results of the current study could be used to develop clinical interventions and management programs for adolescents experiencing negative life events and treating anxiety while increasing social support may help reduce the occurrence of their NSSI behaviors.

Data Sharing Statement

To obtain the data used and/or analyzed for the current study, please contact the corresponding authors.

Funding

Disclosure

The authors declare no conflicts of interests.

References

1. Claes L, Islam MA, Fagundo AB, et al. The relationship between non-suicidal self-injury and the UPPS-P impulsivity facets in eating disorders and healthy controls. *PLoS One.* 2015;10(5):e0126083. doi:10.1371/journal.pone.0126083
2. Claes L, Vandereycken W. *The Self-Injury Questionnaire—Treatment Related (SIQ-TR): Construction, Reliability, and Validity in a Sample of Female Eating Disorder Patients.* Nova Science; 2007.
3. Brown RC, Plener PL. Non-suicidal self-injury in adolescence. *Curr Psychiatry Rep.* 2017;19(3):20. doi:10.1007/s11920-017-0767-9
4. Plener PL, Libal G, Keller F, Fegert JM, Muehlenkamp JJ. An international comparison of adolescent non-suicidal self-injury (NSSI) and suicide attempts: Germany and the USA. *Psychol Med.* 2009;39(9):1549–1558. doi:10.1017/s0033291708005114
5. Jacobson CM, Gould M. The epidemiology and phenomenology of non-suicidal self-injurious behavior among adolescents: a critical review of the literature. *Arch Suicide Res.* 2007;11(2):129–147. doi:10.1080/13811110701247602
6. Plener PL, Schumacher TS, Munz LM, Groschwitz RC. The longitudinal course of non-suicidal self-injury and deliberate self-harm: a systematic review of the literature. *Borderline Personal Disord Emot Dysregul.* 2015;2:2. doi:10.1186/s40479-014-0024-3
7. Swannell SV, Martin GE, Page A, Hasking P, St John NJ. Prevalence of nonsuicidal self-injury in nonclinical samples: systematic review, meta-analysis and meta-regression. *Suicide Life Threat Behav.* 2014;44(3):273–303. doi:10.1111/sltb.12070
8. Muehlenkamp JJ, Claes L, Havertape L, Plener PL. International prevalence of adolescent non-suicidal self-injury and deliberate self-harm. *Child Adolesc Psychiatry Ment Health.* 2012;6(1):1–9. doi:10.1186/1753-2000-6-10
9. Lang J, Yao Y. Prevalence of nonsuicidal self-injury in Chinese middle school and high school students: a meta-analysis. *Medicine.* 2018;97(42): e12916. doi:10.1097/md.0000000000012916
10. Fan YY, Liu J, Zeng YY, Conrad R, Tang YL. Factors associated with non-suicidal self-injury in Chinese adolescents: a meta-analysis. *Front Psychiatry.* 2021;12:747031. doi:10.3389/fpsyt.2021.747031
11. Yang F, Jiang L, Miao J, et al. The association between non-suicidal self-injury and negative life events in children and adolescents in underdeveloped regions of south-western China. *PeerJ.* 2022;10:e12665. doi:10.7717/peerj.12665
12. Xin M, Yang X, Liu K, Naz Boke B, Bastien L. Impact of negative life events and social support on nonsuicidal self-injury among Chinese middle school students. *Am J Mens Health.* 2020;14(4):1557988320937124. doi:10.1177/1557988320937124
13. Nock MK. Self-injury. *Annu Rev Clin Psychol.* 2010;6:339–363. doi:10.1146/annurev.clinpsy.121208.131258
14. Cerutti R, Manca M, Presaghi F, Gratz KL. Prevalence and clinical correlates of deliberate self-harm among a community sample of Italian adolescents. *J Adolesc.* 2011;34(2):337–347. doi:10.1016/j.adolescence.2010.04.004
15. Hankin BL, Abela JR. Nonsuicidal self-injury in adolescence: prospective rates and risk factors in a 2½ year longitudinal study. *Psychiatry Res.* 2011;186(1):65–70. doi:10.1016/j.psychres.2010.07.056
16. Liu RT, Frazier EA, Cataldo AM, Simon VA, Spirito A, Prinstein MJ. Negative life events and non-suicidal self-injury in an adolescent inpatient sample. *Arch Suicide Res.* 2014;18(3):251–258. doi:10.1080/13811118.2013.824835

17. Wang Y, Chen A, Ni H. The relationship between cybervictimization and non-suicidal self-injury in Chinese adolescents: a moderated-mediation model. *Front Psychol*. 2020;11:572100. doi:10.3389/fpsyg.2020.572100

18. Zhu J, Chen Y, Su B, Zhang W. Anxiety symptoms mediates the influence of cybervictimization on adolescent non-suicidal self-injury: the moderating effect of self-control. *J Affect Disord*. 2021;285:144–151. doi:10.1016/j.jad.2021.01.004

19. Agnew R. Foundation for a general strain theory of crime and delinquency. *Criminology*. 1992;30(1):47–88. doi:10.1111/j.1745-9125.1992.tb01093.x

20. Chapman AL, Gratz KL, Brown MZ. Solving the puzzle of deliberate self-harm: the experiential avoidance model. *Behav Res Ther*. 2006;44(3):371–394. doi:10.1016/j.brat.2005.03.005

21. Klonsky ED, Klonsky ED. The functions of deliberate self-injury: a review of the evidence. *Clin Psychol Rev*. 2007;27(2):226–239. doi:10.1016/j.cpr.2006.08.002

22. Özdemir Y, Kuzucu Y, Ak Ş. Depression, loneliness and Internet addiction: how important is low self-control? *Comput Human Behav*. 2014;34:284–290. doi:10.1016/j.chb.2014.02.009

23. Robinson K, Brocklesby M, Garisch JA, et al. Socioeconomic deprivation and non-suicidal selfinjury in New Zealand adolescents: the mediating role of depression and anxiety. *N Z J Psychol*. 2017;46(3):126–136.

24. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull*. 1985;98(2):310–357. doi:10.1037/0033-2909.98.2.310

25. Xu H, Song X, Wang S, Zhang S, Xu S, Wan Y. Mediating effect of social support in the relationship between childhood abuse and non-suicidal self-injury among Chinese undergraduates: the role of only-child status. *Int J Environ Res Public Health*. 2019;16(20). doi:10.3390/ijerph16204023

26. Christoffersen MN, Møhl B, DePanfilis D, Vammen KS. Non-suicidal self-injury–does social support make a difference? An epidemiological investigation of a Danish national sample. *Child Abuse Negl*. 2015;44:106–116. doi:10.1016/j.chiabu.2014.10.023

27. Liu K, Yang X, Xin M. Impact of violent experiences and social support on R-NSSI behavior among middle school students in China. *Int J Environ Res Public Health*. 2021;18(7). doi:10.3390/ijerph18073347

28. Adrian M, Zeman J, Erdley C, Lisa L, Sim L. Emotional dysregulation and interpersonal difficulties as risk factors for nonsuicidal self-injury in adolescent girls. *J Abnorm Child Psychol*. 2011;39(3):389–400. doi:10.1007/s10802-010-9465-3

29. Qi M, Zhou SJ, Guo ZC, et al. The effect of social support on mental health in Chinese adolescents during the outbreak of COVID-19. *J Adolesc Health*. 2020;67(4):514–518. doi:10.1016/j.jadohealth.2020.07.001

30. Votta EA. *Impact of Coping Style, Negative Life-Events, Self-Esteem, and Social Support on the Psychological Adjustment of Homeless Adolescent Males*. Carleton University; 2001.

31. Liu X, Liu L, Yang J, et al. Development and reliability validity testing of the juvenile life events scale. *Shandong Psych Med*. 1997;1:15–19. Chinese.

32. Liang Y, Wang L, Zhu J. Factor structure and psychometric properties of Chinese version of beck anxiety inventory in Chinese doctors. *J Health Psychol*. 2018;23(5):657–666. doi:10.1177/1359105316658971

33. Ke Y, Ng T, Yeo HL, Shwe M, Gan YX, Chan A. Psychometric properties and measurement equivalence of the English and Chinese versions of the beck anxiety inventory in patients with breast cancer. *Support Care Cancer*. 2017;25(2):633–643. doi:10.1007/s00520-016-3452-3

34. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988;56(6):893–897. doi:10.1037//0022-006x.56.6.893

35. Ye Y, Dai, X. Development of social support scale for university students. *Chin J Clin Psychol*. 2006;16:456–458.

36. Wan Y, Liu W, Hao J, Tao F. Development and evaluation on reliability and validity of adolescent non-suicidal self-injury assessment questionnaire. *Chin J Sch Health*. 2018;39:170–173.

37. Hayes AF. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach*. Guilford publications; 2017.

38. Hayes AF, Scharkow M. The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: does method really matter? *Psychol Sci*. 2013;24(10):1918–1927. doi:10.1177/0956797613480187

39. Barrocas AL, Giletta M, Hankin BL, Prinstein MJ, Abela JR. Nonsuicidal self-injury in adolescence: longitudinal course, trajectories, and intrapersonal predictors. *J Abnorm Child Psychol*. 2015;43(2):369–380. doi:10.1007/s10802-014-9895-4

40. Bronfenbrenner U. *The Ecology of Human Development: Experiments by Nature and Design*. Harvard university press; 1979.

41. Anisman H, Zaharia MD, Meaney MJ, Merali Z. Do early-life events permanently alter behavioral and hormonal responses to stressors? *Int J Dev Neurosci*. 1998;16(3–4):149–164. doi:10.1016/s0736-5748(98)00025-2

42. Wang J, Hao QH, Tu Y, et al. The relationship between negative life events and internet addiction disorder among adolescents and college students in China: a systematic review and meta-analysis. *Front Psychiatry*. 2022;13:799128. doi:10.3389/fpsyt.2022.799128

43. Yu C, Xie Q, Lin S, et al. Cyberbullying victimization and non-suicidal self-injurious behavior among Chinese adolescents: school engagement as a mediator and sensation seeking as a moderator. *Front Psychol*. 2020;11:572521. doi:10.3389/fpsyg.2020.572521

44. Hu Z, Yu H, Zou J, Zhang Y, Lu Z, Hu M. Relationship among self-injury, experiential avoidance, cognitive fusion, anxiety, and depression in Chinese adolescent patients with nonsuicidal self-injury. *Brain Behav*. 2021;11(12):e2419. doi:10.1002/brb3.2419

45. Nock MK, Mendes WB. Physiological arousal, distress tolerance, and social problem-solving deficits among adolescent self-injurers. *J Consult Clin Psychol*. 2008;76(1):28–38. doi:10.1037/0022-006x.76.1.28

46. Guerry JD, Prinstein MJ. Longitudinal prediction of adolescent nonsuicidal self-injury: examination of a cognitive vulnerability-stress model. *J Clin Child Adolesc Psychol*. 2010;39(1):77–89. doi:10.1080/15374410903401195

47. Mehra LM, Hajcak G, Meyer A. The relationship between stressful life events and the error-related negativity in children and adolescents. *Dev Cogn Neurosci*. 2022;55:101110. doi:10.1016/j.dcn.2022.101110

48. Lupien SJ, McEwen BS, Gunnar MR, Heim C. Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat Rev Neurosci*. 2009;10(6):434–445. doi:10.1038/nrn2639

49. Pariante CM, Lightman SL. The HPA axis in major depression: classical theories and new developments. *Trends Neurosci*. 2008;31(9):464–468. doi:10.1016/j.tins.2008.06.006

50. Klimes-Dougan B, Begnel E, Almy B, Thai M, Schreiner MW, Cullen KR. Hypothalamic-pituitary-adrenal axis dysregulation in depressed adolescents with non-suicidal self-injury. *Psychoneuroendocrinology*. 2019;102:216–224. doi:10.1016/j.psyneuen.2018.11.004

51. Lin N, Simeone RS, Ensel WM, Kuo W. Social support, stressful life events, and illness: a model and an empirical test. *J Health Soc Behav*. 1979;20(2):108–119. doi:10.2307/2136433

52. Cobb S. Presidential Address-1976. Social support as a moderator of life stress. *Psychosom Med*. 1976;38(5):300–314. doi:10.1097/00006842-197609000-00003

53. Bi S, Stevens G, Maes M, et al. Perceived social support from different sources and adolescent life satisfaction across 42 countries/regions: the moderating role of national-level generalized trust. *J Youth Adolesc*. 2021;50(7):1384–1409. doi:10.1007/s10964-021-01441-z

54. Rueger SY, Malecki CK, Pyun Y, Aycock C, Coyle S. A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychol Bull*. 2016;142(10):1017–1067. doi:10.1037/bul0000058

55. Cavanaugh AM, Buehler C. Adolescent loneliness and social anxiety: the role of multiple sources of support. *J Soc Pers Relat*. 2016;33(2):149–170. doi:10.1177/0265407514567837

56. Chi X, Jiang W, Guo T, Hall DL, Luberto CM, Zou L. Relationship between adverse childhood experiences and anxiety symptoms among Chinese adolescents: the role of self-compassion and social support. *Curr Psychol*. 2022;1–13. doi:10.1007/s12144-021-02534-5

57. Zimmerman MA. Resiliency theory: a strengths-based approach to research and practice for adolescent health. *Health Educ Behav*. 2013;40(4):381–383. doi:10.1177/1090198113493782

58. Rutter M. Psychosocial resilience and protective mechanisms. *Am J Orthopsychiatry*. 1987;57(3):316–331. doi:10.1111/j.1939-0025.1987.tb03541.x

59. Aune T, Juul EML, Beidel DC, Nordahl HM, Dvorak RD. Mitigating adolescent social anxiety symptoms: the effects of social support and social self-efficacy in findings from the Young-HUNT 3 study. *Eur Child Adolesc Psychiatry*. 2021;30(3):441–449. doi:10.1007/s00787-020-01529-0

60. Walter HJ, Bukstein OG, Abright AR, et al. Clinical practice guideline for the assessment and treatment of children and adolescents with anxiety disorders. *J Am Acad Child Adolesc Psychiatry*. 2020;59(10):1107–1124. doi:10.1016/j.jaac.2020.05.005