

# Cumulative Risks and Non-Suicidal Self-Injury in Adolescents: Protective Effect of Personality Strengths

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## Abstract

Non-suicidal self-injury is an important public health problem, which is closely related to suicidal behavior and has attracted wide attention from researchers. This study recruited 1207 adolescents to systematically explore the relationship between cumulative risks and non-suicidal self-injuries using scales and questionnaires. It also compared the influences of various risk factors on self-injurious behaviour and researched the protective effect of personality strengths (mindfulness, hope, openness, grit, and meaning in life) as resilience factors. The results showed that the significant predictive effects of cumulative risks on adolescents' non-suicidal self-injury and adverse childhood experiences are greater predictors of adolescents' non-suicidal self-injury than negative life events. Mindfulness and meaning in life are two protectors co-moderating the effects of cumulative risk on adolescents' non-suicidal self-injury. This study has important implications for a better understanding of resilience. And more intervention and prevention strategies based on personality strengths for individuals experiencing adversity and stress could be effective in improving their psychosocial functioning.

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**Keywords:** Non-suicidal self-injury; cumulative risk; personality strengths; resilience; adolescents

### Introduction

Non-suicidal self-injury (NSSI) is defined as a direct and intentional injury inflicted on one's body tissues without suicidal intent, which is not culturally or socially sanctioned (Ghinea et al., 2020). A wealth

of research confirms that the incidence of NSSI (17%–23%) peaks in adolescence (Gillies et al., 2018) and is significantly higher than in other age groups (Plener et al., 2015). A significant association has been found between NSSI and various psychological disorders, such as depression, anxiety, substance abuse, and personality disorders (Nakar et al., 2016; Ghinea et al., 2019). Additional research suggests that the experience of NSSI may increase the risk of future suicidal ideation and suicidal behaviour in adolescents (Kiekens et al., 2018) and even have a significant contagion effect on NSSI among them (Syed et al., 2020). These severely threaten their socialisation process and future mental health during adolescence (Kruzan & Whitlock, 2019). Given the high prevalence and negative effects of NSSI in adolescents, exploring its influencing or protective factors significant for scientific prevention and effective intervention of NSSI in this population.

The biosocial model suggests that NSSI is an emotional dysregulation and an adverse social environment is a core contributing factor (Crowell et al., 2009). A large body of research has confirmed the impact of adverse environments on NSSI. Adverse childhood experiences are considered independent risk factors for developing NSSI in adolescents (Martin et al., 2017). Additionally, other studies have shown that adolescents' frequent exposure to negative life events easily triggers psychopathological problems and increases the risk of NSSI (Ewing et al., 2019). Recent studies have identified that risk factors tend to co-occur (Evans & Marcynyszyn, 2004), namely a cumulative effect of risk factors (Jiang et al. 2018). One study noted that individuals with a history of child abuse and/or neglect are more likely to develop depression provoked by negative life events (Inoue et al., 2022). Apparently, the cumulative effect of adverse childhood experiences and recent negative life events is inferred to be functional. However, previous studies have focused on a single risk factor, failing to control for the confounding effects of other factors or leaving behind the cumulative effect of these two factors on NSSI, perhaps underestimating the cumulative effect on NSSI. Therefore, this study first aims to construct a cumulative risk model and a different risk model to objectively and accurately reflect the influence of risk factors on NSSI in adolescents.

More data suggest that individuals' exposure to childhood adversity and negative life events fails to predict psycho-behavioural problems in the future, and various adaptive-developmental trajectories may arise (Bonanno et al., 2015; Masten, 2018). Researchers refer to this phenomenon as psychological resilience (Rutter, 2006). The protective model for resilience indicates that protective factors can modify or mitigate the effects of risk factors on psychosocial functioning (Luthar et al., 2000). Personality characteristics, major protective factors, are related extensively to resilience (Bonanno & Diminich, 2013). Some studies have validated that certain personality traits buffer the counterproductive effects of stress/adversity (Longua et al., 2009). According to a three-level model (McAdams, 1995), one subset of personality characteristics that appears promising as resilience factors is personality strengths which are positive trait-like features of personality embodied in thoughts, feelings, and actions and boost positive adjustment and adaptation in individuals (King & Trent, 2013). Individuals possess personality strengths as valuable assets that increase the likelihood of positive outcomes for individuals (Goodman et al., 2017). However, an enduring issue in previous studies is the prominent attention paid to personality traits instead of personality strengths that may influence people's reactions to stress or adversity.

Additionally, it would be impractical to examine all personality strengths simultaneously, and thus, this study exclusively probes personality strengths associated with stress buffering and NSSI. In light of previous research, mindfulness, hope, openness, grit and meaning in life are key and common personality strengths as resilience factors buffering against the effects of risks factors or promote individuals' mental health (Breedvelt et al., 2019; O'Neal et al., 2016; Ostafin & Proulx, 2020; Ropaj, 2023; Vollmann et al., 2016). However, in these studies, personality strengths were often explored in isolation, with no coherent framework to pinpoint. Moreover, no direct evidence from extant studies elaborates that the examined personality strengths can decrease NSSI by alleviating stress/adversity. Others resort to comparisons of multiple personality strengths to clarify which strengths moderate the effects of stress on NSSI and to what extent. The comparison approach allows researchers to determine which personality strengths are most robustly or uniquely correlated with vital outcomes and has been employed in other studies (Sheldon et al., 2015). Therefore, this study's second aim was to explore which personality strength(s) have a protective effect in buffering or modifying

the effects of cumulative stress on NSSI. We hypothesised that almost all personality strengths would be negatively correlated with NSSI, whereas only a minority of them would be expected to have a protective effect on the condition of cumulative risks and NSSI.

## Materials and methods

### 2.1. Participants and procedure

Four secondary schools in China were recruited for this study, and 1,300 students participated in the survey after obtaining consent from school principals, students, and their parents/guardians/caregivers). The Ethics Committee of Northwest Normal University approved this study. To ensure the quality of the data, we set bogus items on the employed scales. The data of 93 people who displayed inconsistency in these items were removed as invalid. The study involved 1,207 valid subjects (588 male respondents, 48.7%; 619 female respondents, 51.3%). The mean age of the subjects was 14.50 years ( $SD = 1.38$ ).

### 2.2. Measures

#### 2.2.1. Cumulative risks

Adverse childhood experiences and negative life events are the two main "co-occurring" causes of NSSI in adolescents, so the cumulative risk index in this study was constructed based on these two risk factors.

##### 2.2.1.1. Negative life events

The Adolescent Life Events Scale developed by Liu (2014) assesses stressful life events experienced by adolescents in the past 12 months. Respondents rated each item based on how much each event impacted their life, from 0 (not occur) to 5 (occurred, and the impact is very serious). Cronbach's  $\alpha$  was .90 for this scale.

##### 2.2.1.2. Adverse childhood experiences

The Adverse Childhood Experiences Questionnaire, translated and revised by Wang (2018), is a comprehensive instrument that examines adverse childhood experiences. The "0" point means no such experiences, while the "1" point is for having experienced. The higher the total score, the greater the number of categories of experienced adversity. Cronbach's  $\alpha$  was .83 in this study.

Modelling approaches to cumulative risk include upsides and downsides (Evans et al., 2013). Since a dichotomous method may lead to the loss of information, this study first standardised the scores for each risk factor and then summed the Z-scores to obtain the total cumulative risk index (Evans et al., 2013). Higher scores represent higher levels of risk experienced by the individuals.

### 2.2.2. Mindfulness

The Child-Adolescent Mindfulness Scale, compiled by Greco (2011), evaluates adolescents' mindfulness levels. Items were rated from 1 (never) to 5 (always) and scored in reverse, with higher total scores indicating higher levels of mindfulness. Cronbach's  $\alpha$  was .85 for this scale.

### 2.2.3. Hope

The 12-item Hope Scale (Snyder et al., 1991) investigates a positive motivational state oriented toward goal achievement. Items were rated from 1 (definitely false) to 4 (definitely true); the higher the score, the higher the level of hope. Cronbach's  $\alpha$  was .88 for this scale.

### 2.2.4. Openness

The Five Factors of Adolescent Personality Questionnaire (Zhou, 2000) measures adolescents' openness to experience. Items were rated from 1 (not at all like me) to 5 (very much like me). A higher score indicated a higher degree of openness to experience. In this study, Cronbach's  $\alpha$  was .87.

### 2.2.5. Grit

The short 8-item Grit Scale (Duckworth & Quinn, 2009) measures a person’s perseverance in facing challenges and ambition to long-run goals. Items were rated from 1 (not at all like me) to 5 (very much like me). A higher score indicates a higher level of grit. Cronbach’s  $\alpha$  was .75 for this scale.

### 2.2.6. Meaning in life

The Meaning in Life Questionnaire (Steger et al., 2006) contains two subscales: life-meaning pursuing and life-meaning experience. Participants rated them on a scale from 1 (absolutely untrue) to 5 (absolutely true). The scale showed excellent reliability ( $\alpha = .82$ ). However, given that existing research suggests that life-meaning-pursuing is a dynamic set of cognitive and behavioural acts rather than personality strengths (Steger et al., 2008), this study employed the subscale of life-meaning experience to merely measure adolescents’ levels of meaning in life.

### 2.2.7. NSSI

The Non-Suicidal Self-Injury Questionnaire (Wan, 2018) explored the presence of self-injuries not aimed at suicide among adolescents in the past year. Respondents completed 12 items from 0 (absolutely untrue) to 4 (absolutely true). The higher the score, the more severe the NSSI. Additionally, it demonstrated excellent internal consistency ( $\alpha = .91$ ).

We controlled for respondents’ sex and age in the regression models. The study standardised all variables to Z-scores, which allowed for regression coefficients interpreted as standardised coefficients.

## Results

Table 1 presents the study variables’ correlations, means, and standard deviations. The results showed that cumulative risk, adverse childhood experiences, and negative life events were negatively associated with personality strength and positively associated with NSSI. Personality strengths were positively associated with each other and negatively associated with NSSI.

**Table 1**

*Descriptive and Correlation Analysis.*

	1	2	3	4	5	6	7
Cumulative risk	1						
Mindfulness	-.52**	1					
Hope	-.30**	.32**	1				
Openness	-.05*	.05*	.55**	1			
Grit	-.31**	.38**	.54**	.37**	1		
Meaning in life	-.26**	.26**	.51**	.33**	.45**	1	
NSSI	.37**	-.27**	-.16**	-.01	-.16**	-.19**	1
<i>M(SD)</i>	0	36.83	23.10	31.41	26.02	18.99	1.17
	1.62	7.35	4.33	7.01	5.54	4.07	3.68

### 3.1. Effects of different risks on NSSI

First, linear regression analysis identified a significant predictive effect of cumulative risk on adolescents’ NSSI,  $\beta = .37$ ,  $p < .05$ ,  $R^2 = .13$ . Second, we calculated the direct effects of negative life events and adverse childhood experiences on NSSI using a multiple regression model. Third, the indirect effects of one risk factor were computed using a stratified regression model after controlling for the other (see Table 2).

Regression analyses revealed that both negative life events and adverse childhood experiences significantly predicted adolescents’ NSSI; however, the greatest predictor of NSSI is adverse childhood experiences for both direct and sole effects ( $I\Delta P^2 = .12$ ,  $I\Delta P^2 = .08$ ). The direct \outcollective effects of negative life events

and adverse childhood experiences are greater than their sole effects. Controlling for the effects of adverse childhood experiences, the explanatory rate for negative life events on NSSI decreases to 40%. Controlling for the effects of negative life events, the explanatory rate of adverse childhood experiences on NSSI decreases to 67%.

**Table 2**

*Effects of Different Risks on NSSI.*

	$\beta 1$	$F$	$I\Delta P^2$	$\beta 2$	$F$	$\Upsilon\Delta P^2$
Negative life events (NLE)	.24**	25.36	.05	.15**	50.37	.02
Adverse childhood experiences (ACE)	.35**	57.40	.12	.31**	50.36	.08

Note.  $\beta 1$  is the regression coefficient of one risk factor for NSSI when the other risk factors are not considered.  $\beta 2$  is the regression coefficient of the risk factor for NSSI after controlling for the other risk factors.  $I\Delta P^2$  is the explanatory rate of a risk factor for NSSI.  $\Upsilon\Delta P^2$  is the explanatory rate of a risk factor for NSSI when both risk factors are included.

### 3.1. Moderating role of personality strengths between cumulative risks and adolescents' NSSI

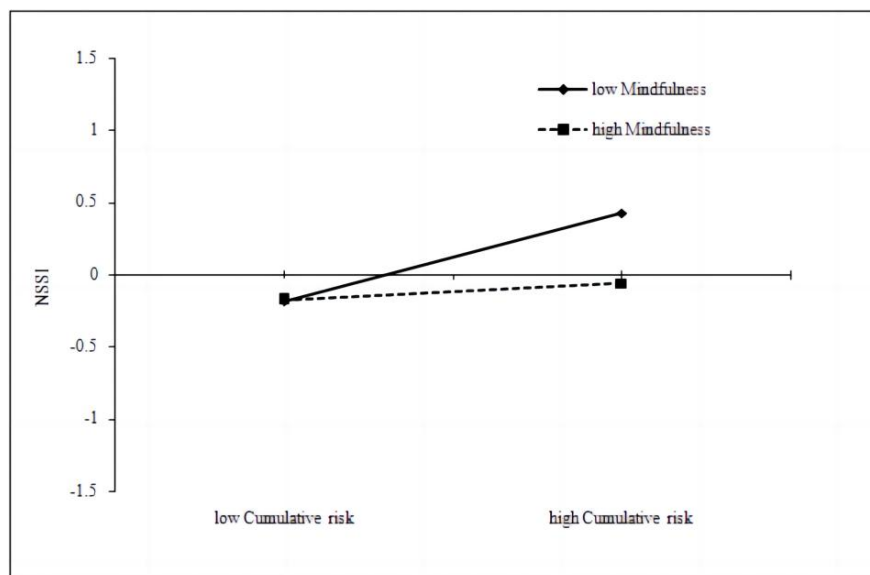
We stratified the regression analyses using models with the five personality strengths. To avoid potential multicollinearity problems, all predictive variables in the regression equation were standardised into interaction terms for cumulative risk  $\times$  mindfulness, cumulative risk  $\times$  hope, cumulative risk  $\times$  openness, cumulative risk  $\times$  grit, and cumulative risk  $\times$  meaning in life. The results (see Table 3) revealed that only mindfulness and meaning in life moderated the positive predictive effect of cumulative risk on adolescents' NSSI.

**Table 3**

*Effects of Personality Strengths on NSSI of Adolescents Under Cumulative Risks.*

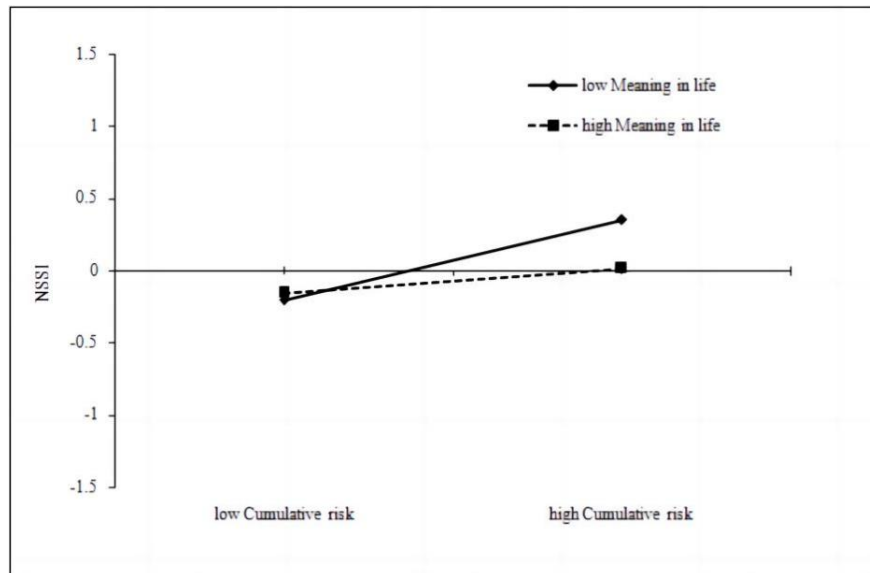
	B	t	95%CI	$\Delta R^2$
The first step				
Cumulative risk	.23	13.39**	[.20,.26]	.13
The second step				
Mindfulness	-.11	-3.16**	[-.17,-.04]	.02
Hope	-.03	-.74	[-.10,.05]	
Openness	.06	1.76**	[-.01,.12]	
Grit	-.01	-.18	[-.07,.06]	
Meaning in life	-.10	-3.19**	[-.16,-.04]	
The third step				
Cumulative risk $\times$ Mindfulness	-.06	-3.70**	[-.09,-.03]	.03
Cumulative risk $\times$ Hope	-.00	-.06	[-.04,.04]	
Cumulative risk $\times$ Openness	.03	-1.45	[-.06,.01]	
Cumulative risk $\times$ Grit	.00	.07	[-.04,.04]	
Cumulative risk $\times$ Meaning in life	-.05	-2.84**	[-.08,-.1]	

Furthermore, a simple slope test examined the moderating effects of mindfulness. Subjects were divided into a low mindfulness group ( $Z$  [?]  $-1SD$ ) and a high mindfulness group ( $Z$  [?]  $1SD$ ) to analyse the predictive effect of the cumulative risk on NSSI (see Figure 1). The results revealed that cumulative risk significantly and positively predicts NSSI in the low mindfulness level group ( $\beta = .21$ ,  $P < .01$ ), while in the high mindfulness level group, cumulative risk failed to predict NSSI ( $\beta = -.06$ ,  $P > .05$ ).



**Fig. 1.** Moderation of Mindfulness on the Relationship Between Cumulative Risks and NSSI.

The moderation analysis of meaning in life followed the same procedure (see Figure 2). The results establish that the predictive effect of cumulative risk on NSSI is significant in the group with higher meaning in life ( $\beta = .02, P < .05$ ). However, the positive predictive effect of cumulative risk on NSSI was significantly enhanced in the group with lower meaning in life ( $\beta = .25, P < .05$ ). This proves that the higher the level of meaning in life, the less the predictive effect of cumulative risk on NSSI.



**Fig. 2.** Moderation of Meaning in Life on the Relationship Between Cumulative Risks and NSSI.

To further investigate the moderating role of mindfulness and meaning in life between cumulative risks and NSSI, this study utilised Models 2 and 3 in PROCESS. First, PROCESS Model 3 was performed with cumulative risk as an independent variable, mindfulness and meaning in life as moderators, and NSSI as a

dependent variable. The outcome showed an insignificant interaction between cumulative risk, mindfulness, and meaning in life ( $\beta = .012, p > .05$ ). The absence of moderated moderation of mindfulness and meaning in life was verified. The results of PROCESS Model 2 are presented in Table 4. It identifies a co-moderating effect of mindfulness and meaning in life. Simple slope analysis further revealed the minimal and insignificant predictive effect of cumulative risks on NSSI ( $\beta = .01, p > .05$ ) when mindfulness and meaning both in life were at high levels ( $Z [?] 1SD$ ). However, the maximal and significant predictive effect of cumulative risks on NSSI ( $\beta = .23, p < .05$ ) in the case of mindfulness and meaning in life at low levels ( $Z [?] 1SD$ ). Thus, the results validate the co-moderating role of mindfulness and meaning in life between the cumulative risk and NSSI, that is, the cumulative effects of these two protective factors.

**Table 4**

*Co-Moderation Analysis.*

	$\beta$	SE	t	95%CI
Cumulative risk	.12	.02	5.41**	[.08,.16]
Mindfulness	-.13	.03	-4.02**	[-.19, -.07]
Meaning in life	-.08	.03	-2.96**	[-.14,-.03]
Cumulative risk $\times$ Mindfulness	-.06	.01	-3.71**	[-.09,-.03]
Cumulative risk $\times$ Meaning in life	-.05	.01	-3.82**	[-.08,-.03]

## Discussion

This study explored the relationship between cumulative risks and adolescents' NSSI, subsequently examined the effects of different risks on adolescents' NSSI, and investigated the protective effect of personality strength as a resilience factor. The results show that cumulative risk significantly predicts adolescents' NSSI, and the effect of adverse childhood experiences on adolescents' NSSI is greater than negative life events. Mindfulness and meaning in life co-moderate the effect of cumulative risks on adolescents' NSSI.

### 4.1. Cumulative risk and NSSI in adolescence

This study revealed that both adverse childhood experiences and negative life events significantly predicted adolescents' NSSI, predominantly in line with previous findings that adverse childhood experiences and negative life events are significant risk factors for the occurrence of adolescents' self-injury. Conversely, it also revealed that adverse childhood experiences than negative life events are stronger predictors of the direct and unique effects of adolescents' self-injury. Adverse childhood experiences can undermine an individual's ability to adapt positively regarding motivation, emotions, and relationships, and a lack of adaptive means spawns alternative compensatory strategies (such as self-injury) to cope with current and future developmental problems (Yates, 2004). By contrast, negative life events familiar to individuals instigate relatively less stressful feelings. According to the generalised unsafety theory of stress (Brosschot et al., 2017), daily life events trigger emotional and mental responses by activating biological pathways throughout the day, and this accumulation may overload individuals with stressful experiences. Therefore, they may gradually become potential stressors (Dokuz et al., 2022). This study suggests that cumulative risk is a significant positive predictor of adolescents' NSSI, which is greater than a single risk's predictive effect. It also notes that adverse childhood experiences and negative life events have greater effects on NSSI than the sole effects. This is consistent with the interpretation of the cumulative risk theory, where risk factors exist and function simultaneously. The greater the exposure to risk factors, the more negative the impact on psychosocial functioning (Evans et al., 2013).

### 4.2. Protective effects of mindfulness and meaning in life

This study discovered that mindfulness and meaning in life, two resilience factors, jointly moderated the relationship between cumulative risks and NSSI. Primarily, the results support the positive effect of mindfulness on stress alleviation, echoing those of empirical studies and meta-analyses (Lindsay et al., 2019). This

is because mindfulness enhances the emotion-regulating process in individuals (Creswell et al., 2014) and helps them adopt a more accepting attitude toward negative feelings (Levitt et al., 2004). A substantial focus on present tasks rather than being trapped in events assists them in avoiding addressing the agony evoked by pressure with self-injury (Nekić & Mamić, 2019). Second, the results show that meaning in life has a positive protective effect on adversity/stress coping, consistent with previous findings (Brian & Travis 2020). Individuals with higher meaning in life tend to seek more meanings from life stressors and adverse experiences (Tugade & Fredrickson, 2004), facilitating them to gain more sense of control and positive emotions in response to such negative incidents (King et al., 2006) as well as turn to adaptive behaviour to address risk factors (Baumeister et al., 2013). The effect of meaning in life is limited and merely mitigates these stressors to a certain extent.

Most importantly, the predictive effect of cumulative risk on NSSI is insignificant when individuals have both personality strengths. This denotes the cumulative effect of personality strength. Specifically, the more personality strengths an individual possesses, the less likely they are to adopt NSSI in the context of cumulative risk. Moreover, a certain portfolio of personality strengths corresponds to the surroundings, and the co-play of such strengths varies from scenario to scenario (Goodman et al., 2017). For instance, mindfulness and meaning in life mitigate the effects of negative life events and adverse childhood experiences on NSSI among adolescents, and other personality strengths similarly function in other psychological indicator and risks. This is consistent with the extant research (Grych et al., 2015). The portfolio of one's personality strengths, other than a single strength or a simple sum of strengths, plays the most crucial role in an individual's adaptation to multifaceted adversities or stressors. It reflects the flexibility and diversity of humans' adaptation networks.

## Limitations

This study has several limitations. First, it examines the effects of childhood adversity and daily life events on adolescents' NSSI but dismisses the effects of other risks on NSSI and varied forms of personality strengths. Furthermore, it is insufficient to understand the developmental characteristics of adolescents' NSSI at a single time point. Future research directions include administering multiple measurement time points, investigating the long-term effects of cumulative risks and personality strength on adolescents' NSSI, and determining the mechanism.

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