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# Relevant factors contributing to risk of suicide among adolescents

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## Abstract

**Background** Adolescent suicide is a major public health concern; therefore, this study evaluated the factors related to suicide risk in adolescents.

**Methods** A questionnaire-based, cross-sectional survey was conducted in Beijing, China. Participants completed general information questionnaires developed for this study: the Patient Health Questionnaire-9; Generalized Anxiety Disorder 7-item; Revised Adverse Childhood Experience Questionnaire; Self-Hate Scale; Adolescent Non-Suicidal Self-Injury Assessment Questionnaire; and the Chinese version of the five-item MINI, suicide module. SPSS 22.0 software was used for the data statistics and Spearman's correlation analysis, and the significance of the mediating effect was tested using the non-parametric percentile bootstrapping method with bias correction.

**Results** Girls had a higher risk of suicide than boys ( $\chi^2 = 16.443$ ). Adolescents with suicide risk compared to those without suicide risk were more likely to experience depression ( $z = 19.359, p < .001$ ), anxiety ( $z = 19.958, p < .001$ ), adverse childhood experiences ( $z = 17.866, p < .001$ ), self-hate ( $z = 18.926, p < .001$ ), and non-suicidal self-injury ( $z = 21.593, p < .001$ ). In the mediation analysis, adverse childhood experiences directly affected suicide risk; the direct effect was 0.135, with 50.94% of the variance explained ( $p < .001$ ). Adverse childhood experiences indirectly affected suicide risk through self-hate; the indirect effect was 0.130, with 49.06% of the variance explained ( $p < .001$ ).

**Conclusions** Sex, depression, anxiety, adverse childhood experiences, self-hate, and non-suicidal self-injury were associated with suicide risk in adolescents. Self-hate mediated the relationship between adverse childhood experiences and suicide risk. Suicide prevention efforts should focus on reducing the negative impact of these risk factors. This study provides important evidence-based support for adolescent suicide prevention and intervention strategies.

**Clinical trial number** Not applicable.

**Keywords** Adverse childhood experience, Self-hate, Non-suicidal self-injury, Suicide risk

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## Background

This study discusses the risk factors for adolescent suicide to prevent youth suicide and reduce the teen suicide rate. Adolescent suicide is a complex and sensitive topic, and its incidence is influenced by numerous factors, including the social environment, cultural background, and personal psychological health. Current research on adolescent suicide presents common trends and concerns. First, from a global perspective, adolescent suicide is a serious public health concern. According to international studies, the incidence of adolescent suicides is increasing, especially in developed countries. According to a study in 21 countries, the teen suicide ideation report rate ranged from 7.5 to 17.5% [1]. In the United States, nearly 16.7% and 10% of adolescents have reported suicide plans and attempts, respectively. Recent research in Burkina Faso also found that 14% of teenagers reported having suicidal ideation in the past 12 months [2]. Adolescent suicide is a serious problem in China. A survey in Shanghai found that 5.85% of primary and secondary school students had planned suicide, and 1.71% had attempted it [3]. A meta-analysis showed that from 2010 to 2021, the suicide mortality of Chinese children aged 5–14 years increased by nearly 10% per year on average, and the suicide rate of those aged 15–24 years increased by approximately 20% per year [4]. In 2021, people in China aged 15 to 24 years had a suicide mortality rate of approximately 3.53/100,000 [5]. This indicates that many youths commit suicide every year. Suicide-related behaviours in adolescents endanger individual health and cause serious harm to their families and society, especially for those with psychiatric comorbidities such as attention-deficit/hyperactivity disorder, autism spectrum disorder, depression, bipolar disorder, and substance use disorder. These coexisting psychiatric conditions add to the complexity of mental health challenges faced by adolescents, often resulting in significant impairment in their quality of life and prognosis [6].

Adverse childhood experiences have a profound impact on adolescent mental health and suicide risk [7]. These experiences may include domestic violence, sexual abuse, parental divorce, or the death of a loved one [8]. Such events can both cause physical harm and indelible psychological trauma. These traumas may lead to negative emotions such as low self-esteem, helplessness, and anger in adolescents, increasing the risk of suicide [9].

Additionally, self-hate is an important factor in adolescent suicide risk. Adolescents may develop strong feelings of self-hate when they have doubts about their own worth and abilities, or when they are devalued and rejected by others [10]. This emotion can lead them to feel like a burden and unworthy of love, leading to suicidal thoughts.

Adverse childhood experiences can lead to suicidal behaviours in adolescents; however, the relationship among suicide risk, self-hate, and adverse childhood experiences is unclear. Therefore, this study hypothesised that self-hate mediated the relationship between adverse childhood experiences and suicide risk. This study aimed to identify suicide risk factors and explore the relationship among adverse childhood experiences, self-hate, and suicide risk in adolescents to provide reference for the prevention and intervention of suicide in adolescents.

## Methods

### Participants

A cross-sectional questionnaire survey was conducted from September to December 2023 in Rizhao City, Shandong Province. A total of 7136 questionnaires were distributed and 357 invalid questionnaires were excluded. Inclusion criteria were aged 12–18, either sex, and agreeing to participate voluntarily. Exclusion criteria were not providing informed written consent, incomplete questionnaire content, and an excessively short answer time. Finally, 6779 valid questionnaires were obtained, with an effective recovery rate of 95%, including 3877 girls (57.20%) and 2902 boys (42.80%). The participants were aged 12–18 years (average 15.7 years). This study was approved by the Beijing Huilongguan Hospital Ethics Committee (2021-18-division). Participation was voluntary, and written informed consent was obtained. For participants younger than 16 years of age, informed consent was obtained from a parent or legal guardian. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

### Design

This study used an online survey in the form of a questionnaire star. Before administering the questionnaire, the research content was explained, and informed consent was obtained from parents via electronic signatures. Respondents were then required to read the study content again before proceeding with the questionnaire. Only after agreeing could they then begin completing the questionnaire. The questionnaire comprised the following sections.

### General information questionnaire

This included items about age, sex, grade (junior/senior high school), and only child (yes/no) among others.

### Patient health questionnaire–9 (PHQ-9)

The PHQ-9 was used to assess depression. It contains nine items; responses to each item are scored from 0 (no) to 3 (almost every day), with a total score ranging from 0 to 27 points. The higher the score, the more serious the depression. A score of 0–4 points indicates no obvious

depression, 5 to 9 indicates mild depression, 10 to 14 indicates moderate depression, 15 to 19 indicates severe depression, and  $\geq 20$  points indicates extremely severe depression. In this study, a score of  $< 5$  was defined as no depression and a score of 5 or more as depression. The internal consistency of the scale was good; Cronbach's  $\alpha$  coefficient was 0.85 [11, 12].

#### Generalized anxiety disorder 7-item (GAD-7)

The GAD-7 contains 7 items; each item is scored from 0 (not at all) to 3 (almost every day). The total score ranges from 0 to 21 points; the higher the score, the more severe the anxiety. Scores ranging from 0 to 4, 5 to 9, 10 to 14, and 15 to 21 are defined as no, mild, moderate, and severe anxiety, respectively. In this study, scores  $< 5$  were defined as no anxiety, and scores  $\geq 5$  were defined as anxiety. The internal consistency of the scale was good; Cronbach's  $\alpha$  coefficient was 0.92 [13, 14].

#### Revised adverse childhood experience questionnaire

This scale contains 14 items measuring adverse experiences that occurred before the age of 18, including physical, emotional, and sexual abuse, neglect, being ignored, parents' separation/divorce, domestic violence, drug abuse, family, family psychiatric disorders, family violence, crime, and witnessing community partner bullying or injury, isolation, or exclusion; and other problems such as low socioeconomic status. A higher score indicates more adverse childhood experiences. This scale has good internal consistency, with a Cronbach  $\alpha$  coefficient of 0.784 [15, 16].

#### Self-hate scale (SHS)

The SHS has seven items, with response options of 1, 'strongly disagree'; 2, 'disagree'; 3, 'somewhat disagree'; 4, neither agree nor disagree; 5, somewhat agree; 6 agree; and 7, strongly agree. The higher the scale score, the higher the self-hate level of the participant. The scale had good internal consistency, and the Cronbach  $\alpha$  coefficient was 0.945 [17, 18].

#### The adolescent non-suicidal self-injury assessment questionnaire (ANSAQ)

The ANSAQ contains a subscale assessing specific self-injury behaviours and a subscale assessing the function of these behaviours; that is, the reason for performing them. The function subscale is divided into selfish social (items 3, 6, 8–11, 13–15, and 18), negative reinforcement (items 4, 5, 7, 12, and 19), and emotional expression (items 1, 2, 16, and 17) dimensions. The score for each dimension is the sum of items. Responses to each item are scored on a five-point Likert scale (never, occasionally, sometimes, often, always); the higher the score, the more severe the

self-injury. This scale has good internal consistency, with a Cronbach's  $\alpha$  coefficient of 0.921 [19, 20].

#### Chinese version of the MINI 5.0

The suicide module of the MINI was used to assess the risk of suicide. The module comprises 6 items: Five questions concern the previous month, and the sixth concerns one's entire life. The following questions are asked, (1) Did you feel you would be better off dead or wish you were already dead? A 'yes' answer is scored 1 point; (2) Did you want to hurt yourself? A 'yes' answer is scored 2 points; (3) Did you contemplate suicide? A 'yes' answer is scored 6 points; (4) Did you have a suicide plan? A 'yes' answer is scored 10 points; (5) Did you try to commit suicide? A 'yes' answer is scored 10 points; (6) In your life, have you ever attempted suicide? A 'yes' answer is scored 4 points. The final cumulative score for the above answers was used to assess the risk of suicide: 0 indicates no risk of suicide, 1–5 indicates low risk, 6–9 indicates moderate risk, and  $> 10$  indicates high risk. Referring to previous studies, those scoring 0–5 points were classified as the no suicide risk group and those scoring 6–10 points were classified as the suicide risk group [21, 22].

#### Statistical methods

Single-sample Kolmogorov–Smirnov tests and histograms were used to assess the normality of the data distribution. SPSS 22.0 was used for the data analysis; the count data were described using the frequency and composition ratio (%), and comparisons between the groups were performed using the chi-square test. Normally distributed measurement data were described using mean  $\pm$  standard deviation, whereas non-normally distributed measurement data were described using the median (P25, P75) (M). Independent sample *t*-tests and Mann–Whitney *U* tests were used for comparison between the groups. Correlations were examined using the Spearman correlation analysis. To account for confounding variables, we employed propensity score matching (PSM) using the R package *MatchIt*. After estimating the propensity scores, we conducted 1:1, 1:5, 1:10 nearest-neighbour matching without replacement to assess the robustness of our results. To explore the mediation effect of self-hate in the relationship between adverse childhood experiences and suicide risk, we used adverse childhood experiences as an independent variable, self-hate as an intervening variable, and suicide risk as a dependent variable in path analysis. Using SPSS AMOS 22.0 for the path analysis, the confidence intervals (5000 replications) for the indirect and mediating effects were assessed using bootstrapping. All statistical tests were two-sided, and significance was set at 0.05.

**Table 1** Demographic information of adolescents with or without risk of suicide

	Without risk of suicide <i>n</i> = 6585	With risk of suicide <i>n</i> = 194	<i>t</i> / $\chi^2$	<i>p</i>
Sex (female)	3476 (52.8)	131 (67.5)	16.443	< 0.001
Age (years)	15.9 (1.4)	15.9 (1.5)	0.565	0.572
Grade			3.168	0.674
Junior Grade 1	1083 (16.4)	40 (20.6)		
Junior Grade 2	820 (12.5)	24 (12.4)		
Junior Grade 3	370 (5.6)	8 (4.1)		
Senior Year 1	1971 (29.9)	53 (27.3)		
Senior Year 2	1970 (29.9)	58 (29.9)		
Senior Year 3	371 (5.6)	11 (5.7)		
Only-child status	5791 (87.9)	176 (90.7)	1.381	0.288

**Table 2** Comparison of depression, anxiety, adverse childhood experiences, self-hate, and non-suicidal self-injury score

	Without risk of suicide <i>n</i> = 6585	With risk of suicide <i>n</i> = 194	<i>z</i>	<i>p</i>
PHQ total score	1.0 [0, 2.0]	4.0 [2.2, 5.0]	19.359	< 0.001
GAD score	1.0 [0, 2.0]	4.0 [2.0, 6.0]	19.958	< 0.001
ACE score	0 [0, 2.0]	4.0 [3.0, 6.0]	17.866	< 0.001
SHS total score	2.0 [0, 9.0]	24.0 [15.2, 32.0]	18.926	< 0.001
NSSI				
Total behaviour score	0 [0, 2.0]	13.0 [6.0, 22.8]	21.593	< 0.001
Self-interested social	5.0 [0, 15.0]	19.0 [12.0, 24.0]	12.558	< 0.001
Negative self-reinforcement	1.0 [0, 5.0]	9.0 [4.0, 11.0]	14.930	< 0.001
Emotional expression	4.0 [0, 7.0]	7.0 [4.0, 9.0]	8.679	< 0.001

PHQ, Patient Health Questionnaire-9; GAD, Generalized Anxiety Disorder-7; ACE, adverse childhood experience; SHS, Self-Hate Scale; NSSI, non-suicidal self-injury

## Results

### Comparison of demographic data between adolescents with or without risk of suicide

Statistically significant differences were observed between adolescents with or without risk of suicide in terms of sex ( $\chi^2 = 16.443$ ,  $p < .001$ ): girls had a higher suicide risk than males. No significant differences were found between adolescents with or without the risk of suicide in terms of age ( $\chi^2 = 0.565$ ,  $p > .05$ ), grade ( $\chi^2 = 3.168$ ,  $p > .05$ ), and only-child status ( $\chi^2 = 1.381$ ,  $p > .05$ ) (Table 1).

### Comparison of depression, anxiety, adverse childhood experiences, self-hate, and non-suicidal self-injury among adolescents with and without suicide risk

Adolescents with suicide risk were more likely than those without suicide risk to experience depression ( $z = -19.359$ ,  $p < .001$ ), anxiety ( $z = -19.958$ ,  $p < .001$ ), adverse childhood experiences ( $z = -17.866$ ,  $p < .001$ ), self-hate ( $z = -18.926$ ,  $p < .001$ ), and non-suicidal self-injury (NSSI;  $z = -21.593$ ,  $p < .001$ ) (Table 2). Owing to the significant difference in sample sizes between the groups with and without suicide risk, and the sex imbalance between these two groups in the original data, we used PSM to strictly control for sex and age. Matching was performed at 1:1, 1:5, and 1:10 ratios between the group with suicide risk and the group without suicide risk. The analysis

results remained consistent with those from the original data (Supplementary Tables 1–3).

### Comparison of adverse childhood experiences, self-hate, and non-suicidal self-injury among adolescents with and without suicide risk

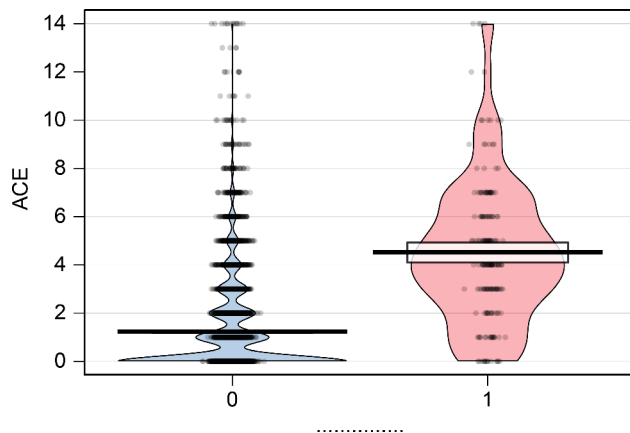
Adolescents with risk of suicide had higher and more concentrated scores on adverse childhood experiences, self-hate, and NSSI than adolescents without suicide risk (Figs. 1, 2 and 3).

### Correlational analysis

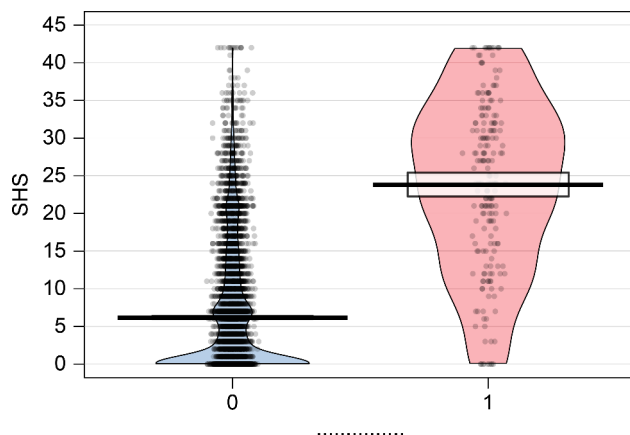
Depression was positively correlated with anxiety ( $r = .69$ ,  $p < .001$ ), adverse childhood experiences ( $r = .40$ ,  $p < .001$ ), self-hate ( $r = .53$ ,  $p < .001$ ), and NSSI ( $r = .44$ ,  $p < .001$ ). Anxiety was positively correlated with adverse childhood experiences ( $r = .38$ ,  $p < .001$ ), self-hate ( $r = .51$ ,  $p < .001$ ), and NSSI ( $r = .42$ ,  $p < .001$ ). Adverse childhood experiences were positively correlated with self-hate ( $r = .46$ ,  $p < .001$ ) and NSSI ( $r = .47$ ,  $p < .001$ ).

### Relationship between adverse childhood experiences and adolescent suicide risk: the mediating role of self-hate

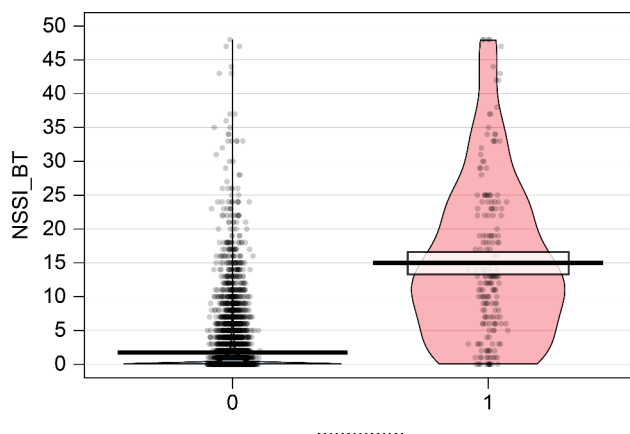
Adverse childhood experiences were used as the independent variable, suicide risk as the dependent variable, and self-hate as a mediating variable. The path analysis model demonstrates a good fit, as indicated by the



**Fig. 1** Adverse childhood experience scores in adolescents with or without the risk of suicide. Note: The Y-axis represents the ACE scores, while the X-axis represents suicide risk, with '0' indicating no risk and '1' indicating risk



**Fig. 2** Self-hate scale scores in adolescents with or without the risk of suicide. Note: The Y-axis represents the SHS scores, while the X-axis represents suicide risk, with '0' indicating no risk and '1' indicating risk



**Fig. 3** NSSI-total scores in adolescents with or without the risk of suicide. Note: The Y-axis represents the NSSI-total scores, while the X-axis represents suicide risk, with '1' indicating risk and '0' indicating no risk

**Table 3** Adverse childhood experiences and the mediating effect of suicide risk model

	Normalised coefficient	Amount of variance explained	95% CI	p
Total effect	0.265		0.230–0.300	< 0.001
Direct effect	0.135	50.94%	0.095–0.177	< 0.001
Indirect effect	0.130	49.06%	0.109–0.151	< 0.001

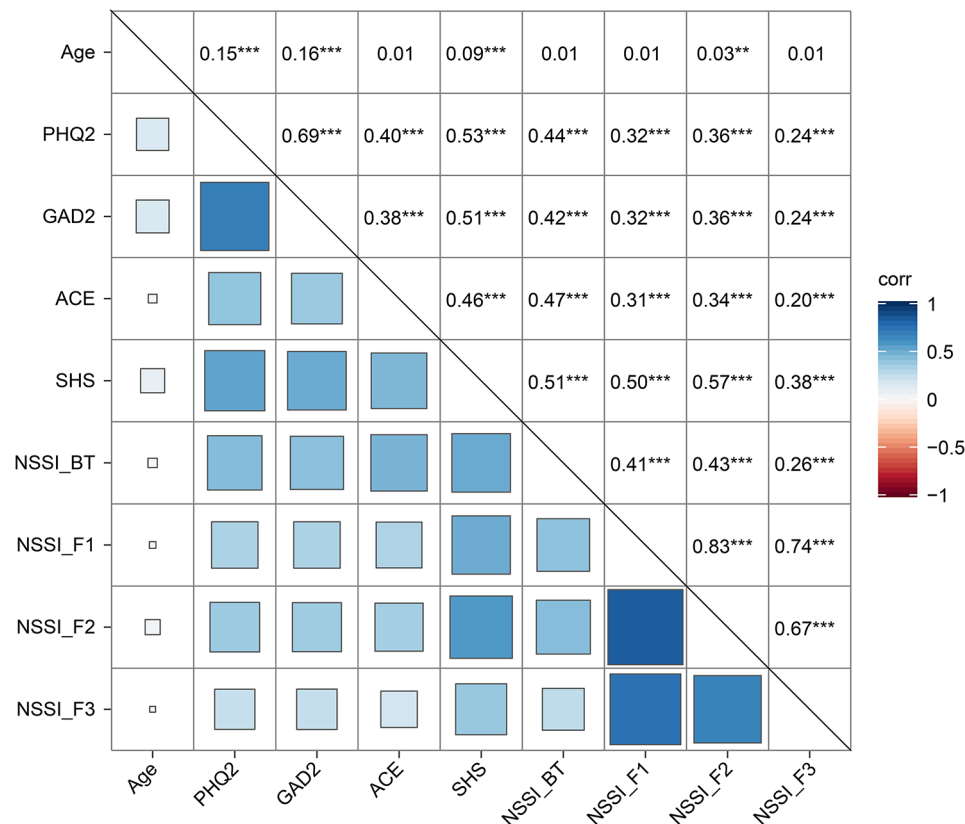
CI, confidence interval

Comparative Fit Index (CFI)=1, Chi-Square/degrees of freedom (CMIN/DF)=0, Goodness of Fit Index (GFI)=1, and Root Mean Square Residual (RMR)=0. The total, direct, and indirect effects of adverse childhood experiences on suicide risk were significant as the 95% confidence intervals did not contain 0. Adverse childhood experiences directly affect the risk of suicide; the direct effect was 0.135, and the amount of variance explained was 50.94% ( $p < .001$ ). Adverse childhood experiences indirectly affect the risk of suicide through self-hate; the indirect effect was 0.130, and the amount of variance explained was 49.06% ( $p < .001$ ) (Table 3).

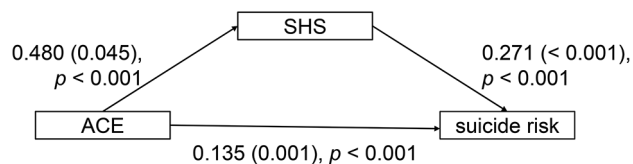
## Discussion

This study examined the characteristics of adolescent suicide risk. Consistent with previous research results [23], adolescent suicide risk was higher among female teenagers. Female teenagers are more likely to commit suicide owing to psychological, social, cultural, and personal factors. Female adolescents may be more susceptible to mental health problems such as depression and anxiety, which may cause suicidal thoughts and behaviour [24]. Female adolescents often face multiple pressures from society and expectations related to academic performance, appearance, and social pressures. These pressures may cause them to feel helpless, frustrated, and anxious, thus increasing their risk of suicide [25]. The social expectations of women are usually more rigid and demanding, and female teenagers may be more likely to feel the corresponding pressure [26] and, therefore, be suicidal. The home environment and interpersonal relationships in female adolescents' mental health have a significant effect on the risk of suicide. Family conflict, neglect, abuse, and other negative factors may cause female teenagers to feel loneliness, helplessness, and despair [27]. In addition, bad relationships such as bullying, rejection, or isolation may also increase the risk of suicide among female teenagers [28]. Female teenagers may face more biological challenges and changes, such as menstruation, pregnancy, and childbirth. These physiological changes could lead to higher emotional fragility and sensitivity, and thus, they are more susceptible to the influence of suicidal thoughts [29]. In some cultures, girls are likely to be viewed as vulnerable groups, and





**Fig. 4** Correlation between different variables



**Fig. 5** Adverse childhood experiences and the mediating effect of self-hate score in the suicide risk model. Note: Each associated relationship between the black solid lines represents the degree of correlation with the standardized coefficient (standard error) and p-values

their rights and interests may be ignored. In this cultural context, female teenagers may be more likely to feel self-abasement, helplessness, and despair, thus increasing their risk of suicide [30]. It is suggested that greater attention should be paid to female adolescents in clinical practice. By strengthening mental health education, providing psychological support, and improving family and social environments, a healthier and safer growth environment can be created for female adolescents. There were no significant differences in age, grade, or only-child status between adolescents with or without suicide risk. This does imply that these characteristics are completely unrelated to suicide risk but rather that they did not show sufficient differences to distinguish between the two groups of adolescents in this study. This contrasts with previous studies, suggesting that this study has some limitations.

Future research should consider expanding the scope of this study (See Figs. 4 and 5).

Adolescents with suicide risk had higher scores for depression, anxiety, adverse childhood experiences, self-hate, and NSSI than those without suicide risk. Depression is a common mental health problem that is closely associated with suicide risk. Specifically, more severe depressive symptoms, such as persistent sadness, loss of interest and vigour, and sleep and appetite change, can lead to despair and helplessness, thereby increasing suicide risk [31]. Anxiety is a common mental health problem that is correlated with suicide risk [32]. Suicide risk may be associated with higher anxiety levels, such as excessive worry, nervousness, and fear. Anxiety may increase the psychological burden and make one more prone to suicidal thoughts [33]. Adverse childhood experiences may have a significant influence on the mental health of teenagers [34]. These experiences could lead to the formation of negative self-perceptions and lack of security and trust, thereby increasing suicide risk [35]. Self-hate refers to negative evaluations and views of oneself, which may make it difficult to accept and love oneself. This self-hate may elicit helplessness and despair, thus making suicidal thoughts more likely [36]. NSSI may be a means for adolescents to express pain, seek attention, or cope with stress [37]. NSSI and concomitant

difficulties in dealing with negative emotions may further increase the risk of suicide [38, 39].

In summary, teenagers at risk of suicide face more complex psychological and emotional difficulties. Comprehensive and professional support, including psychological counselling, family support, and social engagement, is crucial to help these adolescents overcome their difficulties, rebuild a positive outlook on life, and develop more adaptive coping mechanisms.

When discussing the impact of adverse childhood experiences on the risk of suicide, we evaluated two paths: (1) adverse childhood experiences directly predict the risk of suicide; (2) adverse childhood experiences indirectly predict the risk of suicide through the mediation of self-hate. First, adverse childhood experiences directly predict suicide risk because experiences, such as domestic violence, abuse, neglect, parents' mental health problems, drug or alcohol abuse, etc., have a profound impact on individual psychological health [40], thus increasing the risk of suicide. Second, adverse childhood experiences may indirectly predict suicide risk through the mediation of self-hate. After experiencing adverse childhood events, individuals may develop a negative self-perception, making it difficult for them to accept and love themselves, resulting in a mood of self-hate. This mood further increases the risk of suicide [41] because it can make individuals feel self-abased, helpless, and desperate, thus making them more likely to have suicidal thoughts and behaviours. In suicide prevention efforts, it is necessary to emphasise the impact of adverse childhood experiences and take effective measures to reduce their negative effects. This includes providing psychological support and interventions to help individuals build positive self-perceptions and emotional responses. Additionally, addressing self-hate as a mediating factor is critical. This involves helping individuals build a positive self-image and self-esteem, reducing self-loathing, and thereby lowering suicide risk.

Our study has some limitations. First, as a cross-sectional study, it does not capture the full psychological process from the occurrence of adverse childhood experiences to suicidal behaviour, as the effects of such experiences are not immediate. Future studies should employ longitudinal designs and focus on specific populations to better explore this progression. Second, being a subjective study, reporting bias was inevitable. We suggest that future research use a mixed-methods approach, incorporating qualitative techniques such as interviews or focus groups, to provide deeper insight into the emotional underlay and inner experiences of youth related to suicide. Other factors associated with youth suicide, such as cyberbullying, Internet use, and substance abuse, were not addressed in this study and should be explored more thoroughly and comprehensively in future research.

Finally, this study was conducted within a China-centred context, and future research should expand the discussion to include findings from other cultures. This would help shed light on how cultural differences shape adolescent perceptions and responses to NSSI, thereby enhancing the global relevance of this study.

#### Abbreviations

ANSAQ	The adolescent non-suicidal self-injury assessment questionnaire
GAD-7	Generalized Anxiety Disorder 7-Item
MINI	Chinese version of the Mini International Neuropsychiatric Interview
NSSI	Non-suicidal self-injury
PHQ-9	Patient health questionnaire-9
SHS	Self-hate scale

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12888-024-06421-8>.

Supplementary Material 1

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#### Author contributions

Lingfei Cheng: Conceptualization, Methodology, Validation, Data curation, Writing - original draft, Funding acquisition; Weijie Song, Yanli Zhao, and Hongxin Zhang: Investigation, Methodology, Data curation; Jian Wang: Data curation, Investigation, Methodology; Jingyu Lin and Jingxu Chen: Conceptualization, Project administration, Supervision, Writing - review and editing. All authors read and approved the final manuscript.

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#### Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

#### Declarations

##### Ethics approval and consent to participate

This study was approved by the Beijing Huilongguan Hospital Ethics Committee (2021-18-division). Participation was voluntary, and written informed consent was obtained. For participants younger than 16 years of age, informed consent was obtained from a parent or legal guardian. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

##### Consent for publication

Not applicable.

##### Competing interests

The authors declare no competing interests.

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