

RESEARCH ARTICLE

Family function and adolescent depression:
Serial mediation by resilience and positive
copingYuwei Xia^{1†}, Bin Zhang^{1†}, Peiying Li¹, Tianhong Zhou^{2*}, Ling Sun^{1*}, and Fuqiang Mao^{3*}¹Department of Child and Adolescent Psychology, Tianjin Anding Hospital, Tianjin Medical University, Tianjin, China²Department of Clinical Psychology, Tianjin Women and Children's Healthcare Center, Tianjin, China³Department of Psychiatry and Psychology, Tianjin Medical University, Tianjin, China

Abstract

Background: The high prevalence of depression among adolescents has become a significant public health concern, with relapse rates remaining high even after treatment. While family function is consistently linked to depression, the cross-sectional statistical associations linking family-level contextual factors to individual clinical outcomes remain incompletely characterized.

Objective: We aimed to examine the cross-sectional associations of resilience and positive coping within the relationship between family function and depressive symptoms among adolescents with depressive disorder.

Methods: A total of 200 adolescents with depressive disorder were recruited from Tianjin Anding Hospital. After screening, 145 valid questionnaires were included for final analysis. Trained investigators administered four widely used standardized scales to measure family function, individual resilience, coping style, and depression. The bootstrap approach was utilized to conduct mediation analysis.

Results: The mean BDI-II score was 36.02 (SD = 14.02). Family function was negatively associated with the severity of depression ($\beta = -0.570, p < 0.001$). Meanwhile, it also exhibited statistical correlational linkage with depression via the serial associational chain of resilience and positive coping ($\beta = -0.701, p < 0.001$).

Conclusion: Resilience and positive coping were significant statistical mediators in the cross-sectional association between family function and depression.

Keywords: Adolescents; Depression; Family function; Resilience; Positive coping

[†]These authors contributed equally to this work.

***Corresponding authors:**

Fuqiang Mao
(maofq@tmu.edu.cn);
Ling Sun
(sunling@tmu.edu.cn);
Tianhong Zhou
(zhoutianhong2022@163.com)

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1. Introduction

Adolescent depressive disorder, classified as a mood disorder, stems from a complex interplay of genetic, neurobiological, and psychosocial factors.¹ Adolescence is a period of heightened susceptibility and peak risk for the onset of major depression. In this age group, the clinical presentation often includes atypical manifestations, such as irritability, aggressive behavior, and academic decline, and is associated with various adverse long-term outcomes in adulthood.² The lifetime prevalence of depression in adolescents is approximately 12%.³ This disorder substantially increases the risk of suicide, which has

become a leading cause of death in adolescents worldwide.⁴ However, there is currently no curative treatment for this condition.⁵ Even with adequate pharmacotherapy at recommended doses and duration, about 20%–30% of patients do not respond sufficiently and continue to experience significant depressive symptoms.⁶ In contrast, psychotherapy offers greater flexibility and avoids the adverse effects and potential drug interactions associated with medications.⁷ Therefore, it is necessary to explore the psychological mechanisms underlying adolescent depression for developing targeted psychotherapeutic interventions.

Family function, as a key determinant of individual mental health, has attracted considerable research attention in recent years. Family systems theory posits that the family serves as a critical environment for adolescent psychological development, with its function encompassing multiple dimensions such as member support, communication quality, and intimacy.⁸ Research indicates that healthy family function can alleviate anxiety and depressive symptoms in adolescents and reduce the risk of self-harm.⁹ Recent large-scale studies further support this association. For example, Xie *et al.*¹⁰ demonstrated that family function was significantly associated with depression severity among adolescents even after controlling for neighborhood environment and screen time. However, the specific statistical associations linking family function to depression remain to be fully elucidated. The stress-buffering model suggests that social support serves a protective function in stressful situations.¹¹ As the fundamental unit of social structure, the family has been shown to strengthen adolescents' positive psychological resources through strong emotional bonds.¹² Meanwhile, in positive psychology, positive coping is viewed as both a stress-buffering mechanism and a strategy for enhancing resources.¹³ Therefore, our study incorporates resilience and positive coping as potential mediators in the relationship between family function and depression.

Resilience reflects an individual's capacity to mobilize resources and adapt to environmental demands under stress, influenced by factors such as family environment and social support.¹⁴ According to resilience models in adolescents, family environment shows cross-sectional statistical correlations with adolescents' resilience levels.¹⁵ Coping styles refer to the cognitive and behavioral strategies people adopt when facing stressors, whereby higher levels of positive coping are associated with lower severity of depression.^{13,16} A close relationship exists between resilience and coping styles. Specifically, higher levels of resilience are positively associated with positive coping

strategies and negatively associated with negative ones.¹⁷ Recent empirical studies have consistently supported this linkage. For instance, Guo *et al.*¹³ found that resilience served as a prerequisite for effective coping in clinical adolescent populations. Similarly, Wang *et al.*¹⁸ reported that resilience was significantly associated with positive coping behaviors, which in turn buffered the impact of family stress on depressive symptoms.

Based on established theoretical frameworks, this study tests a hypothesized serial mediation framework to describe the statistical associations among family function, resilience, and positive coping within cross-sectional data. The proposed framework is grounded in the resilience process theory, which posits that resilience constitutes a relatively stable internal trait-like resource that is cross-sectionally associated with both stress appraisal and coping strategy use,¹⁹ whereas coping style is regarded as a more dynamic, context-dependent strategy.²⁰ Recent evidence further supports this proposition: Zhou *et al.*¹⁹ reported that resilience levels were associated with individuals' dynamic coping strategy preferences under stress, providing empirical justification for the proposed statistical association. The proposed progression from a "relatively stable trait" to a "dynamic situational strategy" provides a theoretical framework for investigating the complex interrelations among these variables in the link between family function and depression. By testing this serial mediation pathway, the present study aims to offer a more nuanced understanding of the underlying mechanisms connecting these constructs.

2. Materials and methods

The present study adopted a cross-sectional design. Adolescents with depressive disorder were surveyed using self-report questionnaires to examine the potential chained statistical mediation of resilience and positive coping between family function and depression severity.

2.1. Participants

We performed a prior power analysis using G*Power 3.1 to determine the required sample size. Assuming a medium effect size ($f^2 = 0.15$), a significance level (α) of 0.05, statistical power ($1-\beta$) of 0.95, and five predictor variables, the minimum required sample size was estimated at 138. To account for potential attrition and invalid responses, a total of 200 participants were planned for recruitment. Consecutive sampling was employed at the Child and Adolescent Psychology Clinic of Tianjin Anding Hospital, where eligible outpatients who met the inclusion criteria and none of the exclusion criteria were invited to participate between June 2023 and December 2023.

The inclusion criteria were as follows: (i) Age between 11 and 18 years; and (ii) a diagnosis of major depressive disorder made independently by two attending psychiatrists according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), and confirmed using the Mini International Neuropsychiatric Interview.

The exclusion criteria were as follows: (i) severe somatic diseases (e.g., malignant tumors, severe cardiovascular or cerebrovascular diseases, autoimmune diseases, or other conditions that substantially impaired daily functioning); (ii) a history of brain injury; and (iii) a diagnosis of another primary psychiatric disorder, including but not limited to schizophrenia, bipolar disorder, or autism spectrum disorder, as assessed by the two attending psychiatrists based on the DSM-5 criteria.

The research protocol was approved by the Ethics Committee of Tianjin Anding Hospital (approval No. 2023-25). Written informed consent was obtained from all participants and their guardians before the investigation. Researchers informed all participants of data confidentiality and the exclusive use of data for academic research, in order to reduce social desirability bias and enhance the credibility of the results. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.2. Measures

2.2.1. Demographic characteristics

Demographic information included age, gender, only-child status, area of family residence, and average income per capita per month.

2.2.2. Family Adaptation, Partnership, Growth, Affection, and Resolve scale

Perceived family functioning was assessed using the Adaptation, Partnership, Growth, Affection, and Resolve (APGAR).²¹ The scale assesses five dimensions: adaptability, partnership, growth, affection, and resolve. It yields a total score ranging from 0 to 10, with higher scores indicating better family functioning. For example, the item “I am satisfied with the way my family talks over things with me” assesses perceived communication quality within the family. Scores of 7–10 indicate good family functioning, 4–6 indicate moderate family dysfunction, and 0–3 indicate severe family dysfunction. In the present study, the scale demonstrated good internal consistency (Cronbach’s $\alpha = 0.897$).

2.2.3. Resilience Scale for Chinese Adolescents

The Resilience Scale for Chinese Adolescents (RSCA),

developed by Hu and Gan,²² consists of 27 items comprising five dimensions: goal orientation, emotion regulation, positive cognition, family support, and interpersonal assistance. An example item is “Failure always discourages me,” which is a negatively worded item assessing resilience in response to setbacks. Items are rated on a 5-point Likert scale. Items are rated on a 5-point scale ranging from 1 (“totally inconsistent”) to 5 (“totally consistent”), with negatively worded items reverse-scored. Higher total scores indicate higher levels of resilience. In the present study, the RSCA demonstrated acceptable internal consistency (Cronbach’s $\alpha = 0.729$).

2.2.4. Simplified Coping Style Questionnaire (SCSQ)

The Simplified Coping Style Questionnaire (SCSQ) was developed by Xie²³ for use in the Chinese cultural context. It includes two dimensions: positive coping and negative coping. For instance, “I talk to others and share my inner troubles” reflects positive coping, whereas “I rely on others to solve my problems” reflects negative coping. The questionnaire has been widely used in Chinese populations over the past two decades due to its cultural applicability. In the present study, the SCSQ demonstrated good internal consistency (Cronbach’s $\alpha = 0.811$).

2.2.5. Beck Depression Inventory-II

Depressive symptom severity was assessed using the 21-item Beck Depression Inventory-II (BDI-II), which was developed by Beck.²⁴ Each item is rated from 0 to 3, yielding a total score ranging from 0 to 63. For the dimension of sadness, “I do not feel sad” is scored 0, while “I am so sad or unhappy that I can’t stand it” is scored 3. According to the conventional interpretative ranges, scores of 0–13 indicate minimal depressive symptoms, scores of 14–19 indicate moderate symptoms, scores of 20–28 indicate moderate symptoms, and scores of 29–63 indicate severe symptoms. In the present study, the BDI-II demonstrated acceptable internal consistency (Cronbach’s $\alpha = 0.746$).

2.3. Data analysis

Data were analyzed using SPSS 27.0 (IBM Corp., United States of America). Independent-samples *t*-tests and one-way analyses of variance (ANOVA) were used to compare depressive symptom scores across demographic groups. Harman’s single-factor test was applied to evaluate common method bias. We conducted exploratory factor analysis on all items of family function, resilience, coping style, and depression. The results showed that 15 factors had eigenvalues greater than 1, and the maximum variance explained by a single factor was 20.32%, lower than the critical value of 40%. This indicated that no obvious common method bias existed in this study. Pearson correlation

analysis was used to examine the correlations among all variables. The PROCESS module was adopted to test the mediation model, and bootstrap confidence intervals were used to evaluate the significance of mediating effects at the significance level of 0.05. For the limited missing data at the item level (<1%), the mean of the subscale method was applied. Questionnaires with excessive missing data were excluded as per the criteria mentioned above.

3. Results

3.1. Participant characteristics and questionnaire flow

A participant flow diagram is shown in **Figure 1**. A total of 200 questionnaires were distributed in this study, of which 189 were retrieved, corresponding to a questionnaire return rate of 94.5%. Questionnaires were excluded because of: (i) incomplete answers; (ii) patterned or straight-line responding; (iii) logical inconsistency. According to these criteria, 44 questionnaires were excluded (11 for incomplete content, 29 for patterned responding, and 4 for logical inconsistency), and 145 valid questionnaires were retained, with an inclusion rate of 76.7%. Among these, a small proportion of participants had missing items on the primary scales: family function ($n = 2$), resilience ($n = 3$), positive coping ($n = 1$), and depression ($n = 1$). These missing values were imputed as described in the Methods section. Detailed sociodemographic characteristics are presented in **Table 1**.

Independent-samples t -tests and ANOVA results revealed that female participants and participants with siblings reported significantly higher levels of depression compared to their counterparts (both $p < 0.01$). No significant differences in depression levels were observed across age, residence, or per capita monthly household income. Therefore, gender and only-child status were taken as control variables in the subsequent mediation model analysis.

3.2. Correlations between family function, resilience, coping styles, and depression

Pearson correlation analysis indicated significant associations among all study variables (**Table 2**). Family function was positively correlated with resilience and positive coping, and negatively correlated with depression. Resilience was positively associated with positive coping and negatively associated with depression. Positive coping was also negatively correlated with depression (all $p < 0.001$).

Table 1. Participant characteristics ($n = 145$)

Characteristics	Value	p
Age (years, $M \pm SD$)	15.05 $\pm$ 1.70	0.404
Gender (n [%])		
Male	55 (37.93)	0.006
Female	90 (62.07)	
Only child in family (n [%])		
Yes	73 (50.34)	0.006
No	72 (49.66)	
Area of family residence (n [%])		
Urban	86 (59.31)	0.169
Town	36 (24.83)	
Rural	23 (15.86)	
Average income per capita per month (Chinese yuan, n [%])		
<3,000	5 (3.45)	0.051
3,000–6,000	131 (90.34)	
>6,000	9 (6.21)	

3.3. The mediating effects of resilience and positive coping in the relationship between family function and depression

Model 6 from the PROCESS component of SPSS 27.0 was used to estimate the proposed chained statistical mediation model based on cross-sectional data. In this model, family function was specified as the independent variable, depression as the dependent variable, resilience and positive coping as mediators, and gender and only-child status as control variables, all of which were standardized. After entering the mediators, family function continued to exert a significant negative direct effect on depression, while resilience and positive coping were also significantly negatively associated with depression. Regarding the specific pathways, family function significantly predicted resilience. However, the direct path from family function to positive coping was not statistically significant. Resilience, in turn, significantly predicted positive coping (**Table 3**).

Bootstrap analysis with 5,000 resamples confirmed the significance of the chained mediation pathway. Although the direct link between family function and positive coping was not significant, the total indirect effect-mediated sequentially through resilience and positive coping-remained significant, accounting for over half of the total effect (**Table 4**; **Figure 2**). Unadjusted indirect-effect

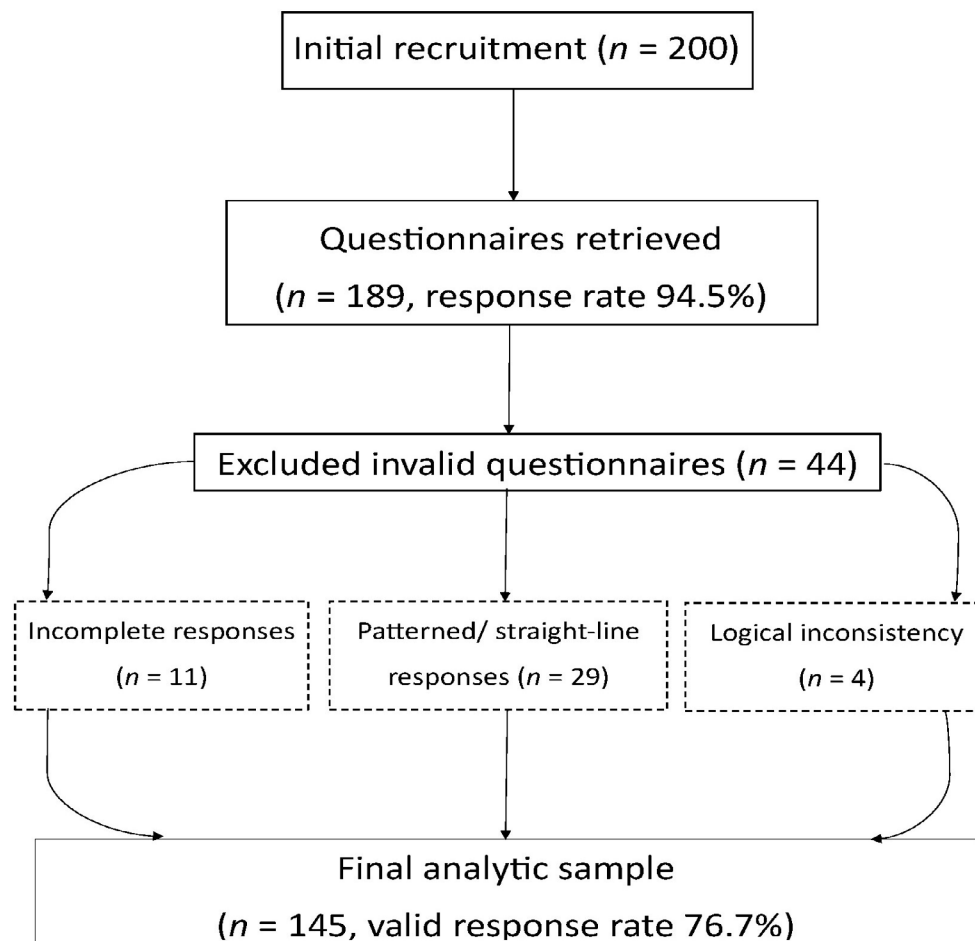


Figure 1. Flow diagram of participant recruitment and exclusion

Table 2. Descriptive statistics and Pearson correlations among the study variables ($n = 145$)

Variable	Mean $\pm$ SD	1	2	3	4
1. Family function	4.55 $\pm$ 2.77	–			
2. Resilience	68.52 $\pm$ 18.03	0.632***	–		
3. Positive coping	14.20 $\pm$ 7.23	0.461***	0.692***	–	
4. Depression	36.02 $\pm$ 14.02	–0.570***	–0.641***	–0.621***	–

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

estimates are presented in Table A1.

4. Discussion

Due to the cross-sectional design, all findings represent associations rather than causal relationships. The proposed serial mediation model should be considered a hypothetical

theoretical framework that requires longitudinal validation. Two statistical association pathways were identified: (i) resilience as an independent statistical mediator; and (ii) the sequential statistical mediation of resilience and positive coping.

The analysis revealed that family function, a crucial

Table 3. The results from mediation analysis using a bootstrapping method for depression

Regression equation		Integral fitting index			Significance of regression coefficient	
Outcome	Predictors	<i>R</i>	<i>R</i> ²	<i>F</i>	β	<i>t</i>
Depression	Family function	0.570	0.325	68.826***	−0.570	−8.296***
Resilience	Family function	0.632	0.399	95.131***	0.632	9.754***
Positive coping	Family function	0.693	0.480	65.518***	0.039	0.494
	Resilience				0.668	8.550***
	Family function				−0.261	−3.443**
Depression	Resilience	0.716	0.513	49.426***	−0.249	−2.665**
	Positive coping				−0.328	−4.027***

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4. Indirect effect of family function on depression via resilience and positive coping

Path	Coefficient	Relative effect (%)	95% confidence interval	
			Boot LLCI	Boot ULCI
1	−0.730	27.37	−1.441	−0.103
2	−0.055	2.06	−0.343	0.227
3	−0.607	22.76	−1.085	−0.225
Indirect effect	−1.392	52.19	−2.024	−0.833
Direct effect	−1.275	47.81	−2.033	−0.518
Total effect	−2.667	—	−3.357	−1.978

Notes: 1: Family function–resilience–depression; 2: Family function–positive coping–depression; 3: Family function–resilience–positive coping–depression. Abbreviations: LLCI: Lower limit of confidence interval; ULCI: Upper limit of confidence interval.

support system for adolescent psychological development,²⁵ was significantly associated with depressive symptom severity, which is consistent with previous findings. Adolescents from families with low intimacy and insufficient support often lack effective social communication patterns and coping skills, making them more vulnerable to negative emotions and maladaptation.^{26,27} Cross-sectional data also suggested a potential bidirectional association between family function and depression: adolescents' depressive symptoms were associated with poorer perceived family relationships,²⁸ while lower family support was further associated with higher stress and negative emotion levels among children and adolescents.²⁹

This study examined resilience and positive coping as mediating variables to explore the internal mechanism between family function and adolescent depression. Healthy family function helps enhance adolescents' resilience and alleviate depressive symptoms,³⁰ indicating that family function serves as a key protective factor for resilience. Resilience, an individual's psychological resource for coping with stress, is significantly negatively associated with depression.³¹ Poorer family function may be associated with increased depression risk partly through its association with lower resilience, whereas better family function can provide adolescents with a stronger sense of security, belonging, and guidance among adolescents.

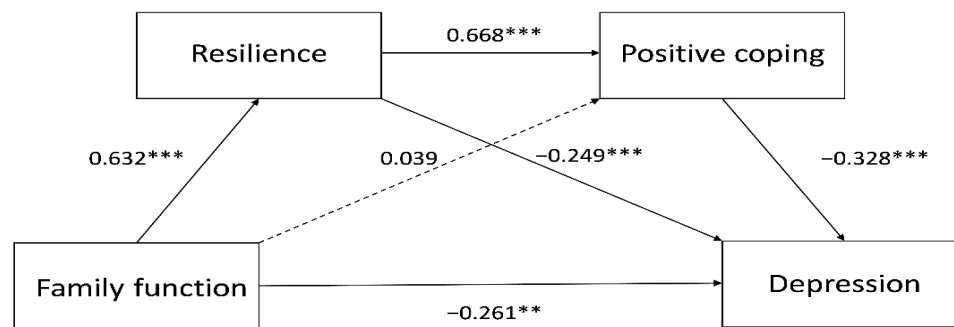


Figure 2. Path analysis for family function–resilience–positive coping–depression model

Notes: * $p < 0.01$; *** $p < 0.001$; values are shown as standardized coefficients.

and more harmonious parent–child relationships. On the other hand, it enhances positive self-perception, self-worth affirmation, and positive coping strategies when individuals face negative life events.³² According to the diathesis–stress model, coping styles are not inherently adaptive or maladaptive but are strategic choices shaped by environmental contexts;³³ individuals from families with stronger function are more inclined to adopt positive coping strategies, which helps them regulate their emotional states more effectively.¹⁸

Furthermore, this study identified a statistically significant serial association pattern of “resilience → positive coping” in the cross-sectional data. Consistent with prior literature, higher resilience levels were positively correlated with more frequent use of positive coping strategies in this sample. This pattern is compatible with the theoretical continuum from relatively stable psychological traits to situational coping strategies. Notably, the direct cross-sectional association between family function and positive coping was not statistically significant here, suggesting that for adolescents with depressive disorder, family environment was not directly correlated with coping strategy use in our sample. Instead, family function was associated with positive coping indirectly, via its correlation with internal psychological resources (i.e., resilience). These findings are consistent with the theoretical framing of resilience as a trait-like resource linked to state-like coping strategy selection, though no causal ordering can be inferred from the current design.

The cross-sectional findings of this study carry important hypothesis-generating implications for future prevention and intervention research. First, greater emphasis should be placed on the role of family-based interventions in the psychological treatment of depressed adolescents. Traditional individual-centered intervention models could be expanded to include systemic family interventions aimed at improving family communication

and enhancing emotional support, thereby strengthening the adolescents’ family support environment. Second, intervention programs should also incorporate resilience training to help adolescents develop emotional regulation and problem-solving skills. Furthermore, coping skills training should be included as a key component of interventions, supporting adolescents in learning and applying adaptive coping strategies.

Several limitations of this study need to be noted. First, as a cross-sectional study, all findings reflect statistical associations rather than causal relationships; the proposed serial mediation model remains a hypothetical framework requiring longitudinal validation. Future prospective studies are needed to confirm the temporal ordering of these associations. Second, the participants in this study were adolescents with depressive disorder recruited from a single medical institution, which limits the generalizability to adolescents with depression in other clinical and community settings. Therefore, future multi-center sampling is recommended to enhance representativeness. Third, the psychological indexes of patients were assessed using only self-report questionnaires. Consequently, future research should incorporate objective measures alongside self-report scales.

5. Conclusion

In conclusion, this cross-sectional study explored the psychological mechanisms underlying depression in adolescents, and the findings were as follows: (i) In this cross-sectional sample of adolescents with depressive disorder, family function, resilience, and positive coping were all significantly correlated with depressive symptom severity; (ii) The association between family function and depression was statistically explained both by a direct correlation and by the serial statistical mediation of resilience and positive coping.

By analyzing the status of family function, resilience, and coping styles among adolescents, this study clarified their statistical associations with depression and the proposed cross-sectional statistical framework describing how family function co-varies with depression. The research results provide theoretical support for the formulation of targeted intervention measures for adolescent depression.

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Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

Conceptualization: Tianhong Zhou, Ling Sun, Fuqiang Mao

Funding acquisition: Bin Zhang, Peiying Li

Investigation: Ling Sun

Project administration: Tianhong Zhou, Fuqiang Mao

Resources: Ling Sun

Supervision: Bin Zhang, Fuqiang Mao

Visualization: Yuwei Xia

Writing—original draft: Yuwei Xia

Writing—review & editing: Yuwei Xia, Bin Zhang, Peiying Li

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Tianjin Anding Hospital (Approval No. 2023-25). Written informed consent was obtained from all adolescent participants and their legal guardians. All research procedures complied with the ethical standards of the Declaration of Helsinki. We guaranteed participants' data confidentiality and informed them of the right to withdraw from the survey at any time.

Consent for publication

Written informed consent was obtained from all participants and their legal guardians prior to data collection. Participants were informed about the study objectives, procedures, potential risks, and their right to withdraw at any time without penalty. All data presented in this manuscript are anonymized, and no identifying

images, videos, or personal details are included.

Availability of data

The raw data supporting the conclusions of this study can be provided by the corresponding authors upon reasonable requests.

Further disclosure

The authors declare that no generative artificial intelligence tools were used at any stage in the conceptualization, data collection and analysis, interpretation, or writing and revision of this research manuscript. The entire content of this paper represents the authors' original and independent work.

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Appendix

Table A1. Unadjusted indirect effect of family function on depression via resilience and positive coping

Path	Coefficient	Relative effect (%)	95% confidence interval	
			Boot LLCI	Boot ULCI
1	−0.795	27.59	−1.571	−0.117
2	−0.064	2.22	−0.341	0.211
3	−0.701	24.32	−1.206	−0.288
Indirect effect	−1.560	54.13	−2.248	−0.942
Direct effect	−1.322	45.87	−2.081	−0.563
Total effect	−2.882	–	−3.569	−2.195

Notes: 1: Family function–resilience–depression; 2: Family function–positive coping–depression; 3: Family function–resilience–positive coping–depression.

Abbreviations: LLCI: Lower limit of confidence interval; ULCI: Upper limit of confidence interval.