

Family Structure, Childhood Maltreatment, and Anxiety Symptoms Among Chinese Adolescents: A Large-Scale Cross-Sectional Study

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Abstract

Background

Anxiety among adolescents has increasingly become a significant public health issue. Family structure is intertwined with caregiving resources, socioeconomic conditions, family relationships, and exposure to adversity. Yet, research systematically comparing anxiety prevalence across various family structures or exploring the mediating role of childhood maltreatment remains scarce. This study investigates the associations among family structure, childhood maltreatment, and anxiety symptoms in adolescents from China.

Methods

A large-scale, cross-sectional survey involving 29,405 middle-school students aged 11 to 18 was conducted between November 2019 and January 2020. Family structures were categorized into nuclear, extended, single-parent, and skip-generation households. Anxiety symptoms were evaluated using the Generalized Anxiety Disorder-7 (GAD-7), while childhood maltreatment was assessed via the Childhood Trauma Questionnaire (CTQ). Binary logistic regression and bootstrapped path analysis were applied to determine direct and indirect effects.

Results

Adolescents from skip-generation (45.5%) and single-parent households (47.4%) exhibited significantly higher anxiety symptom prevalence compared to peers from nuclear (34.9%) and extended households (34.8%). Emotional and sexual abuse consistently were positively associated with anxiety symptoms across all four family types. The path analysis identified statistically significant indirect associations through childhood maltreatment in both skip-generation and single-parent households. In skip-generation households, the indirect association was significant, whereas the remaining direct association was not, consistent with a statistical full-mediation pattern, whereas the indirect component accounted for 71.9% of the total statistical association in single-parent households. Furthermore, a suppression effect was identified in extended families, suggesting that their lower anxiety levels were associated with reduced childhood maltreatment. Additionally, emotional neglect was associated with lower odds of anxiety symptoms in nuclear and extended households, but this inverse association was not observed in skip-generation or single-parent households.

Conclusion

Family structure, childhood maltreatment, and anxiety symptoms were interrelated in this large cross-sectional sample. The higher prevalence of anxiety symptoms in skip-generation and single-parent households was partly reflected in statistical indirect associations through childhood maltreatment.

Reducing childhood maltreatment in both household types is key to easing anxiety and boosting mental health in teens. So, creating specific prevention programs for these situations is really important.

1. Introduction

Anxiety symptoms are the most common type of mental health issue in teens worldwide, hitting 6.5% at any given time (Rapee et al. 2023). Now, there's growing concern about anxious teens in China. In just ten years, the rate of anxiety among Chinese adolescents shot up from 10% to more than 20% (Xin, Niu and Chi 2012, Li et al. 2023), reaching 32.1% in 2023 (He et al. 2025). Teens who are anxious tend to have this constant worrying that won't go away. Usually, this also leads to trouble sleeping and feeling depressed. Plus, it can really hit their school performance and overall health, both physically and mentally, which isn't good (Rapee et al. 2023, Yao et al. 2025). Adolescent anxiety ups the chances of long-term mental health issues and even higher risks of mortality (Shao et al. 2020). Consequently, spotting factors that cause anxiety early on is key for stopping problems before they get bigger.

Family stuff really shapes how teens develop mentally. Family structure is not inherently harmful or protective. Rather, it may serve as a contextual indicator intertwined with socioeconomic resources, caregiver availability, parental migration, family conflict, parenting quality, and social support. Scientists say that dysfunctional families and not-so-great relationships among family members are big reasons why many teens suffer from anxiety (Kitt et al. 2022, Wang et al. 2021a, Zhang et al. 2021). Furthermore, more divorces mean there are now lots of single parents struggling to juggle everything, which complicates things for kids (Wang et al. 2021b). At the same time, tougher work conditions and the push for career development, especially for young moms, lead grandparents to pitch in way more often as the main carers (Zimmer and Treleaven 2020, Liang and Van Leeuwen 2025, Chen, Zhou and Bai 2024). In rural China, grandparents stepping in as the main caregivers has gotten really common (Xu and Huang 2023). There are basically two setups for this: first, kids live with both parents and grandparents; second, when grandparents are the only ones raising the kids.

Earlier studies have shown that teens from single-parent homes fare better mentally than those being raised solely by grandparents (Wu et al. 2019). It turns out that extra support from multiple generations, like in extended families, can be good for an adolescent's mental health (Viscogliosi et al. 2022). At the same time, moms and dads who actively raise their kids together and show lots of warmth create the best conditions for teen well-being (Wang et al. 2021a). Despite the need for it, thorough research comparing how different major family setups affect teenage anxiety isn't really out there. Specifically, we lack a big empirical study looking at anxiety symptoms in Chinese teens across various home types like nuclear, single-parent, skip-generation, and extended families.

To get a grip on teen mental health, we've got to look at key anxiety risk factors closely. Lots of studies point out that childhood maltreatment seriously amps up the odds of anxiety and depression in teens (Oram 2019, Grummitt et al. 2024). And guess who's at higher risk for this kind of maltreatment? Kids in single-parent homes, making them extra vulnerable to anxiety issues (Narayan et al. 2015). Additionally, adolescents in skip-generation families, where grandparents usually raise the kids, face special

challenges. These can include long-term parent absence, random caregiver involvement, and sometimes over-indulgence (Liang and Van Leeuwen 2025, Viscogliosi et al. 2022). In this context, studies have shown that resilience helps teens deal with these tough situations. It basically buffers against the negative effects and cuts down on anxiety (Wen et al. 2023).

Even with limited studies looking at how anxiety and childhood maltreatment link up differently in teens from various family setups, we think, based on earlier work, that family structure affects teen anxiety mostly through maltreatment. However, we lack solid proof for this idea. So, our study aims to clarify how family structure, maltreatment, and anxiety are connected in adolescents. This study tackles three main questions. First, what are the rates of anxiety symptoms in teens based on their family setup? Second, does family structure remain associated with anxiety symptoms after adjustment for measured demographic, family-relationship, resilience, and maltreatment variables? Third, does childhood maltreatment statistically mediate the association between family structure and anxiety symptoms? Given the cross-sectional design, the mediation findings were interpreted as statistical patterns rather than evidence of a temporal or causal pathway.

2. Methods

2.1. Study design and participants

This research took place from November 2019 to January 2020 in China and comprised a sample of 30,920 adolescents attending middle schools, ranging in age from 11 to 18 years. Participants were recruited using a two-stage cluster sampling technique, designed to ensure national representativeness. Initially, a stratified sampling procedure was employed based on China's administrative divisions to randomly select 15 cities. Then, one middle school from each chosen city was randomly identified using listings provided by the local education authorities. Guardians of all adolescents provided written informed consent before data collection.

Questionnaires were considered invalid if they met any of the following criteria: (1) less than 90% completion; (2) essential demographic data, including age or gender, missing; or (3) responses with logical inconsistencies.

Before accessing the questionnaire, all participants were presented with an information page describing the study purpose, the voluntary nature of participation, confidentiality, and data-protection procedures. Participants aged 16 years or older provided electronic informed consent directly by selecting “Yes, I agree to participate” before proceeding to the questionnaire. Participants who selected “No” were not allowed to complete the questionnaire and could submit a blank response. For participants younger than 16 years, written informed consent was obtained from a guardian before participation, in accordance with the consent procedure approved by the relevant ethics committee. The survey was anonymous and did not collect names, contact information, identification numbers, or other direct personal identifiers.

Ethical approval

for this study was granted by the Ethics Committee for Human Research of the Third Affiliated Hospital, Beijing University of Chinese Medicine (Approval No. BZYSY-2019KYKTPJ-21). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant national and institutional regulations. The survey procedures also adhered to the guidelines set forth by the American Association for Public Opinion Research (AAPOR).

2.2. Assessment and measures

The questionnaire collected information on: (1) demographic characteristics (age, gender, registered permanent residence, only-child status, and family structure); (2) quality of parental and parent-child relationships; (3) anxiety symptoms; (4) childhood maltreatment experiences; and (5) resilience.

Adolescents' family structures were categorized according to their living arrangements, resulting in four distinct groups: nuclear families, defined as living with both parents; single-parent families, residing with only one parent (Juteau et al. 2023); extended families, characterized by cohabitation with parents and grandparents (Hu et al. 2021); and skip-generation families, involving living exclusively with grandparents (Chen, Liu and Mair 2011).

Additionally, participants provided self-assessments of their relationships with parents, rating them as either "poor," "general," or "good."

Anxiety symptoms were evaluated using the Chinese version of the GAD-7 scale. Previous research has confirmed strong reliability of this instrument, reflected by Cronbach's alpha values ranging between 0.85 and 0.91 (Tiirikainen et al. 2019, Byrd-Bredbenner, Eck and Quick 2021). Adolescents scoring 5 points or higher were categorized as experiencing anxiety symptoms (Aktürk et al. 2025, Lai et al. 2020).

Childhood maltreatment was measured via the Chinese version of the Childhood Trauma Questionnaire (CTQ), a 27-item tool covering five domains: emotional abuse (EA), physical abuse (PA), sexual abuse (SA), emotional neglect (EN), and physical neglect (PN). Established cut-off points for maltreatment identification were as follows: $EA \geq 9$, $PA \geq 8$, $SA \geq 6$, $EN \geq 10$, and $PN \geq 8$ (Guo et al. 2018). The CTQ has demonstrated satisfactory validity and reliability among Chinese adolescent samples, yielding a Cronbach's alpha of 0.75 (Jiang et al. 2018).

Resilience levels were assessed using the Chinese adaptation of the Connor-Davidson Resilience Scale (CD-RISC), which contains 25 items, with higher total scores indicating greater resilience. Prior studies have verified robust psychometric properties of the CD-RISC among Chinese youth, reporting a Cronbach's alpha of 0.923 (Yu et al. 2011).

2.3. Data analysis

We used frequencies and percentages to summarize categorical data. Differences in adolescent mental health across various family structures were assessed with Pearson's chi-square test. For continuous variables, we checked normality using the Shapiro–Wilk test and Q–Q plots. Levene's test was employed

to examine the homogeneity of variance. Those that passed normality tests were reported as mean $\pm$ standard deviation (SD), while non-normally distributed ones were shown as medians with interquartile ranges.

Multivariate analysis of variance (MANOVA) was done to see how GAD-7 scores, resilience scores, and CTQ subscale scores differ across various family structures, adjusting for important covariates. Next, binary logistic regression helped us look at the links between anxiety symptoms, family structure, and other factors. To better understand what predicts anxiety, we split the sample into four groups based on family type - nuclear, extended, skip-generation, and single-parent. For each group, we ran separate binary logistic regression analyses. So, we could zero in on those specific predictors of anxiety.

Subsequently, path analysis examined whether, childhood maltreatment mediated the relationship between family structure and anxiety symptoms. Family structure was represented by three dummy variables. Childhood maltreatment was modeled as the observed CTQ total score, and anxiety was modeled as the continuous GAD-7 total score. Linear path models were used to estimate direct, indirect, and total associations. Indirect associations were tested using bias-corrected percentile bootstrap 95% confidence intervals based on 5,000 resamples. We reported non-standardized path coefficients. Given that the proposed exposure, mediator, and outcome were measured at the same survey occasion, the mediation analysis was used to characterize their cross-sectional statistical relationships.

All statistical analyses were conducted at an alpha significance level of 0.05, with non-standardized path coefficients reported alongside their corresponding 95% confidence intervals (Preacher and Hayes 2004). Analyses were performed using R statistical software.

3. Results

3.1 Demographic characteristics of participants

In this research, a total of 30,920 adolescents initially participated, among whom 29,405 provided valid questionnaires after screening for invalid responses, yielding a response rate of 95.1%. Participants were categorized into four family structure groups based on established criteria: nuclear families ($n = 18,476$), extended families ($n = 7,393$), skip-generation families ($n = 2,492$), and single-parent families ($n = 1,044$).

Notable demographic variations emerged across these groups regarding gender distribution, only-child status, household registration type, and marital status of parents (**Supplementary Table 1**).

Anxiety symptoms were significantly more prevalent among adolescents from skip-generation (45.5%) and single-parent (47.4%) households compared to their peers in nuclear (34.9%) and extended (34.8%) family contexts ($p < 0.001$).

There were big differences in mean GAD-7 scores for the four family setups, all super significant ($p < 0.001$). The least squares difference post hoc tests showed that teens from skip-generation and single-parent homes had much higher anxiety levels than those from traditional family structures ($p < 0.001$). At

the same time, kids living in extended families had way lower anxiety scores and didn't experience as much childhood maltreatment as their peers in other setups ($p < 0.001$; Fig. 1).

3.2 Factors Associated with Anxiety Symptoms

To figure out what predicts anxiety symptoms, we did some binary logistic regression analyses (Table 1). In the first model, we just looked at family structure and saw big differences in anxiety based on the type of family ($p < 0.001$). In Model 2, demographic variables, parental relationship quality, and parent-child relationship status were added alongside family structure, with family structure remaining significantly associated with anxiety ($p = 0.005$). In Model 3, psychological resilience (CD-RISC total score) and five childhood maltreatment subtypes (EA, PA, SA, EN, PN) were further incorporated. All variables, except marital status of parents, maintained significant associations with anxiety symptoms in this comprehensive model ($p < 0.05$), and family structure also remained significantly predictive ($p = 0.016$).

Table 1
Association between family residence structure, anxiety symptoms, and other factors.

Variable	Model 1	Model 2	Model 3
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Family residence structure (Nuclear families as reference)			
Extended families	0.999(0.944,1.058)	1.057(0.996,1.121)	1.107**(1.039,1.180)
Skip-generation family	1.553*** (1.427,1.691)	1.167** (1.062,1.283)	1.003(0.905,1.111)
Single-parent family	1.683*** (1.484,1.909)	0.994(0.849,1.165)	1.062(0.892,1.265)
Age		1.091*** (1.065,1.117)	1.076*** (1.049,1.104)
Gender (1 = boy)		1.500*** (1.426,1.577)	1.274*** (1.204,1.347)
Only-child status (1 = only children)		0.957(0.905,1.012)	0.845*** (0.795,0.898)
Rural (1 = rural)		1.014(0.963,1.068)	1.107*** (1.047,1.171)
Parental marital (1 = marriage)		1.101** (1.041,1.164)	1.002(0.942,1.066)
Parental relationship (1 = poor)		0.779*** (0.740,0.820)	0.924**0.873,0.978)
Parent-child relationship (1 = poor)		0.430*** (0.408,0.454)	0.792*** (0.744,0.844)
Resilience			0.977*** (0.975,0.978)
Childhood maltreatment			
Emotional abuse			1.286*** (1.271,1.302)
Physical abuse			1.006(0.990,1.023)
Sexual abuse			1.093*** (1.067,1.120)
Emotional neglect			0.986*** (0.979,0.994)
Note: *: p < 0.05, **: p < 0.01, ***: p < 0.001			

Variable	Model 1	Model 2	Model 3
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physical neglect			1.017**(1.005,1.030)
Note: *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$			

Model 1 showed that teens living in skip-generation and single-parent homes had much higher odds of feeling anxious than those from traditional nuclear families ($p < 0.001$). However, after accounting for various factors like demographics, parenting aspects, and psychology in Model 3, the direct link for skip-generation and single-parent setups wasn't significant anymore. On the flip side, kids in extended family structures still showed a significant link. This points towards possible mediating or suppressing roles, calling for more in-depth analyses, such as path analysis to look closer at what's happening here.

3.3 Family Structure-Specific Factors Associated with Anxiety Symptoms

Binary logistic regression was subsequently performed separately within each family structure category, utilizing significant predictors identified in Model 3 (Table 2). Among adolescents from nuclear families, older age (OR = 1.086, 95% CI: 1.051–1.122, $p < 0.001$), being female (OR = 1.280, 95% CI: 1.192–1.375, $p < 0.001$), urban household registration (OR = 1.136, 95% CI: 1.058–1.219, $p < 0.001$), EA (OR = 1.286, 95% CI: 1.266–1.306, $p < 0.001$), and SA (OR = 1.089, 95% CI: 1.054–1.126, $p < 0.001$) were significant risk factors for anxiety symptoms. Conversely, protective factors identified included having siblings (OR = 0.781, 95% CI: 0.723–0.844, $p < 0.001$), positive parent-child relationships (OR = 0.732, 95% CI: 0.673–0.797, $p < 0.001$), higher resilience (OR = 0.975, 95% CI: 0.973–0.978, $p < 0.001$), and EN (OR = 0.985, 95% CI: 0.976–0.994, $p < 0.05$) were associated with lower odds of anxiety symptoms..

Table 2

Binary logistic regression analysis of anxiety symptoms in different family residence structures

Variable	Nuclear families	Extended families	Skip-generation family	Single-parent family
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Age	1.086*** (1.051,1.122)	1.050(0.997,1.106)	1.093* (1.009,1.184)	1.035(0.906,1.183)
Gender (1 = girl)	1.280*** (1.192,1.375)	1.306(1.168,1.462)	1.175(0.979,1.410)	1.154(0.859,1.550)
Only-child status (1 = Non-only children)	0.781*** (0.723,0.844)	0.972(0.862,1.096)	0.925(0.750,1.140)	0.936(0.700,1.252)
Rural (1 = urban)	1.136*** (1.058,1.219)	1.037(0.929,1.159)	1.229* (1.015,1.488)	0.910(0.676,1.225)
Parental relationship (1 = poor)	0.929(0.861,1.003)	0.901(0.791,1.026)	0.896(0.782,1.025)	1.007(0.825,1.229)
Parent-child relationship (1 = poor)	0.745*** (0.687,0.809)	0.866* (0.754,0.995)	0.890(0.748,1.060)	0.857(0.645,1.139)
Resilience	0.975*** (0.973,0.978)	0.975*** (0.971,0.978)	0.988*** (0.982,0.993)	0.980*** (0.971,0.989)
Childhood maltreatment				
Emotional abuse	1.286*** (1.266,1.306)	1.294*** (1.262,1.327)	1.271*** (1.226,1.317)	1.277*** (1.204,1.356)
Physical abuse	1.014(0.992,1.036)	1.012(0.978,1.047)	0.962(0.919,1.008)	0.988(0.916,1.066)
Sexual abuse	1.089*** (1.054,1.126)	1.067** (1.017,1.120)	1.139*** (1.070,1.211)	1.169* (1.020,1.341)
Emotional neglect	0.985** (0.976,0.994)	0.982* (0.967,0.997)	1.001(0.979,1.025)	0.992(0.956,1.029)
Physical neglect	1.005(0.989,1.021)	1.033** (1.008,1.059)	1.031(0.992,1.071)	1.080* (1.016,1.148)
Note: *: p < 0.05, **: p < 0.01, ***: p < 0.001				

For adolescents in extended families, demographic variables such as age, gender, only-child status, and residential registration status were no longer significantly predictive, though PN emerged as a notable risk factor (OR = 1.033, 95% CI: 1.008–1.059, $p < 0.01$), whereas EN showed a small inverse association with anxiety symptoms (OR = 0.982, 95% CI: 0.967–0.997, $p < 0.05$). In contrast, variables including gender, only-child status, parental relationships, and parent-child interactions did not predict anxiety symptoms within skip-generation or single-parent families.

Notably, psychological resilience consistently acted as a protective factor across all family types, whereas EA and SA consistently posed significant risks.

3.4 Childhood maltreatment as a mediator between family structure and adolescent anxiety

Significant differences in childhood maltreatment experiences were identified across the four family structure groups, prompting further analysis to assess whether childhood maltreatment mediated the relationship between family structure and adolescent anxiety symptoms. Therefore, mediation analysis using a bootstrap method was conducted, controlling for sociodemographic variables, to evaluate direct, indirect, and overall effects (Fig. 2).

Overall, the total effects of skip-generation and single-parent family structures on adolescent anxiety were significantly different from those of nuclear families, but extended families did not significantly differ from nuclear families. Specifically, for single-parent households, the direct association with anxiety symptoms was statistically significant ($\beta = 0.131$, 95% CI: 0.040–0.222, $p < 0.05$), as was the indirect association through childhood maltreatment ($\beta = 0.336$, 95% CI: 0.283–0.392, $p < 0.001$). The indirect component accounted for 71.9% of the total statistical association, consistent with a statistical partial-mediation pattern. Conversely, skip-generation families exhibited no significant direct effect ($\beta = 0.031$, 95% CI: -0.065–0.126, $p > 0.05$), although a robust indirect effect mediated by childhood maltreatment was observed ($\beta = 0.431$, 95% CI: 0.381–0.482, $p < 0.001$). This result was consistent with a statistical full-mediation pattern.

In extended families, the overall effect on anxiety was nonsignificant ($\beta = -0.010$, 95% CI: -0.138–0.118, $p > 0.05$). However, a significant positive direct effect ($\beta = 0.201$, 95% CI: 0.084–0.317, $p < 0.01$) alongside a significant negative indirect effect via childhood maltreatment ($\beta = -0.211$, 95% CI: -0.263 to -0.158, $p < 0.001$) indicated a competitive mediation pattern.

4. Discussion

Several notable findings emerged from the current study. Firstly, adolescents residing in skip-generation and single-parent households exhibited increased anxiety symptom prevalence and elevated anxiety scores relative to their peers. Secondly, emotional and sexual abuse consistently emerged as significant predictors of anxiety across all examined family types. Emotional neglect showed a different pattern: higher emotional-neglect scores were associated with lower anxiety symptoms among adolescents from

nuclear and extended households, although this inverse association was not observed in skip-generation or single-parent households. Thirdly, mediation analyses identified significant indirect statistical associations through childhood maltreatment for skip-generation and single-parent families, whereas no significant indirect association was observed for extended families compared with nuclear families.

Specifically, anxiety symptom prevalence was notably higher in adolescents from skip-generation (45.5%) and single-parent families (47.4%), compared to their counterparts from nuclear (34.9%) and extended (34.8%) family structures. These findings are consistent with prior evidence highlighting the greater vulnerability of adolescents in non-intact family environments to adverse psychological outcomes (Park et al. 2026, Wang et al. 2024).

Prior studies have shown heightened anxiety symptoms among adolescents from single-parent households (Garnefski and Diekstra 1997, Lee and Kushner 2008). Adolescents in single-parent families are often exposed to family conflicts, interparental aggression, EA, and domestic violence, factors that significantly impair mental health (Avci et al. 2021). Furthermore, single-parent families frequently experience economic hardship, limited supervision, and reduced emotional support. Collectively, these stressors significantly contribute to psychological distress among adolescents (Cavanagh and Fomby 2019, Van Winkle and Leopold 2021).

Skip-generation families typically form under challenging circumstances, such as parental poverty, migration for employment, illness, divorce, or death, placing grandparents in prolonged caregiving roles (Dolbin-MacNab and Yancura 2018). Adolescents in these families often have histories of adverse childhood experiences prior to their grandparents assuming caregiving responsibilities, contributing to ongoing physical and psychological challenges (Chan et al. 2019). Our findings similarly demonstrated elevated rates of childhood maltreatment among adolescents from skip-generation families, highlighting structural vulnerabilities associated with increased maltreatment risks. Furthermore, these family arrangements are frequently characterized by intergenerational communication barriers and weak emotional bonds, limiting grandparents' abilities to provide consistent, warm, and attentive caregiving, factors that typically mitigate risks of abuse and neglect (Xu et al. 2022). Grandparents who serve as primary caregivers commonly experience high levels of psychological stress, which can undermine emotion regulation abilities and increase risks of neglectful or abusive behavior (Smith et al. 2008). Economic factors also play a critical role, as parental migration for work frequently results in grandparents becoming sole caregivers. Custodial grandparents often face significant barriers in accessing essential resources, including information, financial assistance, and protective services. Such resource deficits can exacerbate behavioral problems, emotional distress, and maltreatment experiences among their grandchildren, negatively affecting long-term psychological development (Fernandes et al. 2021, Xu et al. 2021).

After controlling for potential confounders, direct links between family structure (skip-generation and single-parent) and adolescent anxiety symptoms were no longer statistically significant. This suggests that childhood maltreatment played a fully or partially mediating role. Interestingly, despite extended family structure emerging as significant in regression analyses, adolescents from such households

exhibited the lowest absolute anxiety symptom rates. Several studies support the protective role of extended family structures against adolescent anxiety, primarily through improved family functioning (An et al. 2024). This protective effect can be explained by multiple mechanisms. First, co-residing grandparents typically provide consistent emotional support to both parents and grandchildren, reducing parental stress and buffering children from the negative emotional impacts associated with maternal adversity (Zhu et al. 2024). Additionally, grandparental involvement promotes higher-quality co-parenting and secure mother-infant attachment, both of which mitigate internalizing issues such as anxiety (Poblete and Gee 2018). Coleman's intergenerational closure model posits that cooperation among multiple generations within households fosters consistent supervision and stable rules for adolescents, thereby mitigating emotional distress (Zhu et al. 2024). These findings illustrate the nuanced and complex relationship between family structure and adolescent mental health. Nevertheless, adolescents who do not co-reside with both parents generally remain at heightened risk of experiencing anxiety.

Moreover, adolescents from skip-generation households reported the highest occurrence of childhood maltreatment across all assessed subtypes, closely followed by those in single-parent families. In contrast, adolescents from extended households demonstrated the lowest maltreatment scores. Previous research consistently underscores the interrelations among family structure, experiences of maltreatment, and psychological outcomes during adolescence. For instance, adolescents from single-parent households are notably more susceptible to maltreatment compared with those from nuclear families (Zerr et al. 2019, Tran et al. 2021, Wen et al. 2024). However, systematic comparisons of childhood maltreatment and adolescent anxiety across diverse family types within a unified framework remain scarce. To our knowledge, this research represents the first comprehensive analysis of anxiety and childhood maltreatment prevalence across multiple family structures.

Numerous studies have established a robust link between childhood maltreatment and anxiety symptoms (Lindert et al. 2014, Gardner, Thomas and Erskine 2019). Childhood maltreatment is commonly classified into five categories: SA, PA, EA, EN, and PN (Norman et al. 2012). We identified emotional and SA as significant risk factors for adolescent anxiety symptoms across all family structures. EA, in particular, emerged as a central factor connecting childhood maltreatment and adolescent anxiety. By triggering or exacerbating somatic symptoms such as sleep disturbances, headaches, and fatigue, EA reinforces and maintains anxiety networks (Zhao et al. 2025). Moreover, EA substantially undermines psychological resilience (Hunt, Slack and Berger 2017), thereby increasing adolescents' vulnerability to anxiety. Additionally, extensive evidence suggests that SA has especially severe long-term effects on anxiety symptoms in adolescents, with mechanisms likely involving neurobiological alterations and compromised psychosocial functioning (Maniglio 2013, Hailes et al. 2019). These traumatic experiences impair emotional regulation capacities, disrupt attachment formation, and heighten sensitivity to environmental threats (Zheng et al. 2025).

Contrary to expectations, this study found that EN served as a protective factor against anxiety among adolescents from nuclear and extended families. Although existing research has consistently associated childhood EN with adult anxiety (Salokangas et al. 2020), potentially mediated by impacts on brain

development (Pasion et al. 2025), its influence on adolescent mental health has not been uniformly established. This unexpected finding may relate to the role of emotional autonomy within family contexts (Gong and Wang 2023). Specifically, in well-functioning families, moderate EN might encourage adolescents to develop independent coping mechanisms, thereby reducing vulnerability to anxiety. However, this protective effect appears contingent upon supportive and intact family systems and does not apply to emotionally deficient family environments. Therefore, categorizing EN simply as a risk or protective factor overlooks its context-dependent complexities. Comprehensive assessments of family functioning are crucial to accurately interpret its effects and guide targeted interventions.

Path analyses provided additional insights, highlighting differential mediation by childhood maltreatment of the family structure-anxiety relationship. Childhood maltreatment may heighten adolescents' vulnerability to anxiety via various epigenetic pathways, including alterations in brain structure (Dannlowski et al. 2012), dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis (Marques-Feixa et al. 2023), and impaired psychological functioning (Jaffee 2017).

Specifically, in skip-generation families, childhood maltreatment fully mediated the relationship with anxiety symptoms. This means that family structure alone did not directly predict anxiety; instead, it increased the likelihood of maltreatment, which subsequently led to anxiety symptoms. Protective factors, such as stable emotional bonds and effective communication, often fail to fully develop in skip-generation or single-parent family environments. Although these family structures themselves were not directly associated with anxiety, the cumulative effects of family stress and childhood trauma significantly increased anxiety risk (Xu et al. 2022, Fernandes et al. 2021). Therefore, the heightened anxiety risk observed in adolescents from skip-generation families largely arises from poorer caregiving quality and reduced emotional support. If childhood maltreatment in these families can be effectively mitigated, disparities in anxiety between skip-generation and nuclear family adolescents might significantly decrease.

In single-parent families, childhood maltreatment also substantially mediated the relationship, accounting for 71.9% of the total statistical association. The mediation pathway in single-parent families can be explained by the uniquely stressful environments these families experience. Single parents commonly face multiple stressors, including economic strain, limited time, insufficient social support networks, and emotional trauma from divorce or bereavement (Breslau et al. 2011). Such stressors can lead to harsh or impatient parenting practices, increasing the risk of emotional and PA (Farrell et al. 2017, Nickel et al. 2004). Moreover, the pressures of earning a living frequently prevent single parents from spending adequate time with their children, resulting in implicit EN, characterized as "absence in presence."

Interestingly, the negative indirect effect of extended family structure on adolescent anxiety through childhood maltreatment indicated that adolescents in multigenerational households experienced significantly lower maltreatment levels. This reduction aligns with the increased monitoring and supervision typical in extended families. According to Coleman's model of intergenerational closure, the presence of multiple adult caregivers enhances oversight and reduces opportunities for unnoticed

neglect or abuse (Coleman 1988). Prior studies also report that grandparental involvement correlates with reduced rates of harsh parenting and maltreatment, as grandparents provide direct caregiving and emotional support that buffers parental stress (Silverstein and Ruiz 2006, Zhu et al. 2024). Thus, lower childhood maltreatment levels in extended families appear to represent a critical mechanism through which this family structure benefits adolescent mental health.

These findings show that stopping childhood abuse is super important. It could really help reduce anxiety in teens, especially those from skip-generation and single-parent homes. Luckily, a lot of child abuse prevention programs have already been set up in many places across the US, Europe, and parts of Asia (Gubbels et al. 2021). For skip-generation families, experts need to focus on spotting abuse early on, think emotional and physical neglect. This means doing more thorough care checks, connecting grandma and grandpa with more support, and giving them more parenting help and info on mental health. In single-parent setups, using layered interventions works well. First, teaching parents better ways to manage emotions and handle tough situations. Next, giving direct help like cash aid, more social backing, and therapy options. Overall, the key is to blend methods that fix family dynamics with other types of outside help. This combo does wonders for lessening trauma and boosting mental health in kids growing up in these unique family structures.

5. Limitations and strengths

This study has several limitations. Firstly, its cross-sectional design means we can't figure out causation between family structure, maltreatment, and anxiety in teens. Accordingly, the path analyses should be understood as describing cross-sectional statistical relationships rather than causal mediation. Secondly, the info on maltreatment and anxiety came from people looking back, which could be way off or biased due to what sounds good. Plus, they controlled for quite a few things like demographic, family-relationship, resilience, and maltreatment variables, but did not directly examine all of the broader circumstances surrounding different living arrangements. Family structure should therefore be viewed as a contextual marker rather than an inherently harmful or protective exposure. Residual confounding from unmeasured family or socioeconomic factors may remain. Fourth, although our classification of family structures provides useful insights, it may oversimplify the complexities and fluidity of contemporary family arrangements; for example, step-parent or co-parenting families were not examined.

Despite its limitations, the study still has some big strengths. It looked at a huge and varied group, with over 29,000 adolescents, allowing detailed comparisons across four different family setups. The researchers used path analysis with bootstrapping, which helped find unique mediation effects of childhood maltreatment. This gives us fresh views on the underlying reasons and shows promise for targeted interventions based on specific family structures.

6. Conclusion

In conclusion, this large-scale cross-sectional study suggests that the higher anxiety risks observed in adolescents from skip-generation and single-parent families may be partially attributable to greater exposure to childhood maltreatment. For all family types, emotional and sexual abuse stick out as major issues, but emotional neglect can actually be protective in certain settings – mainly those that are more stable. Importantly, Mediation analysis identified a statistical full-mediation pattern through childhood maltreatment for skip-generation households and a partial-mediation pattern for single-parent households. These findings highlight childhood maltreatment as an important correlate of adolescent anxiety. So, family structure seems to shape how mentally healthy or unhealthy teens are, largely due to these kinds of negative experiences. This really highlights the urgent need for focused interventions to cut down on maltreatment and help improve teen mental health.

Declarations

7. Ethics approval and consent to participate

This study was approved by the Ethics in Human Research Committee of the Third Affiliated Hospital of Beijing University of Chinese Medicine (No. BZYSY-2019KYKTPJ-21). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and relevant national and institutional regulations. The survey procedures also adhered to the guidelines set forth by the American Association for Public Opinion Research (AAPOR).

8. Consent for publication

Not applicable. This manuscript does not contain any individual person's data in any form that could identify participants.

9. Availability of data and materials

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

10. Declaration of competing interests

We declare that submitted manuscript does not contain previously published material, and is not under consideration for publication elsewhere. The manuscript is truthful original work without fabrication, fraud or plagiarism. Each author has made an important scientific contribution to the study and is thoroughly familiar with the primary data. All authors listed have read the complete manuscript and have approved submission of the paper. All authors declare that there is no conflict of interest.

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12. Authors' contributions

All authors contributed to the study conception and design. W.C.Z analyzed and interpreted the data and wrote the manuscript. Y.J.C made critical revisions of the manuscript and reviewed the final version. J.J.W and H.Q.D conducted the survey and collected data. M.Q and Y.D conceived and coordinated the design of the study, and wrote the manuscript. All authors read and approved the final manuscript.

13. Acknowledgement

We are grateful to all the participants in this study.

14. Declaration of generative AI use

AI was used as a research and editorial tool in drafting this article. The analysis, framing, and conclusions are based on the authors' professional expertise in the relevant field and represent their independent editorial position.

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Figures

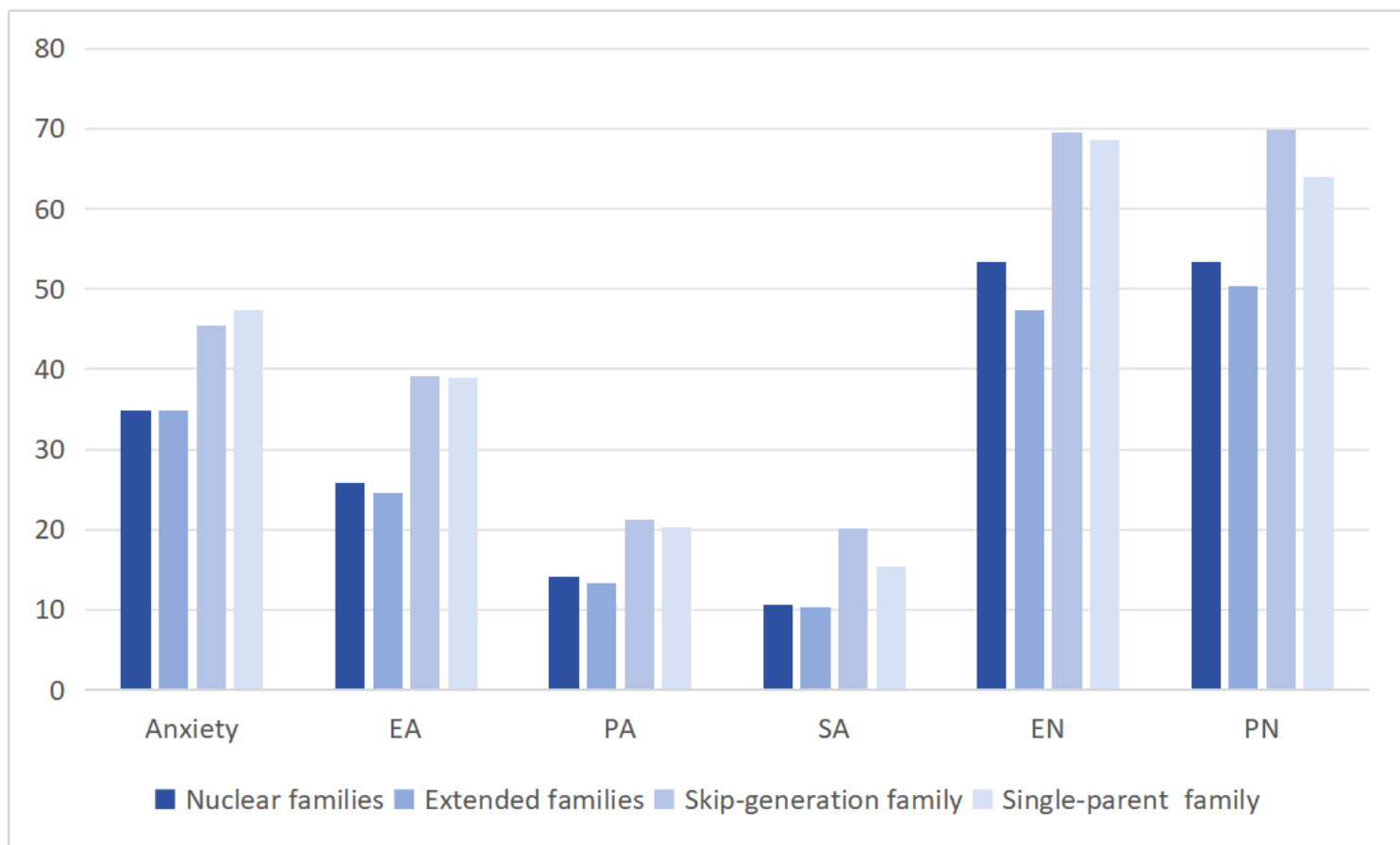


Figure 1

Prevalence of GAD-7 and five dimensions of childhood maltreatment under family residence structures

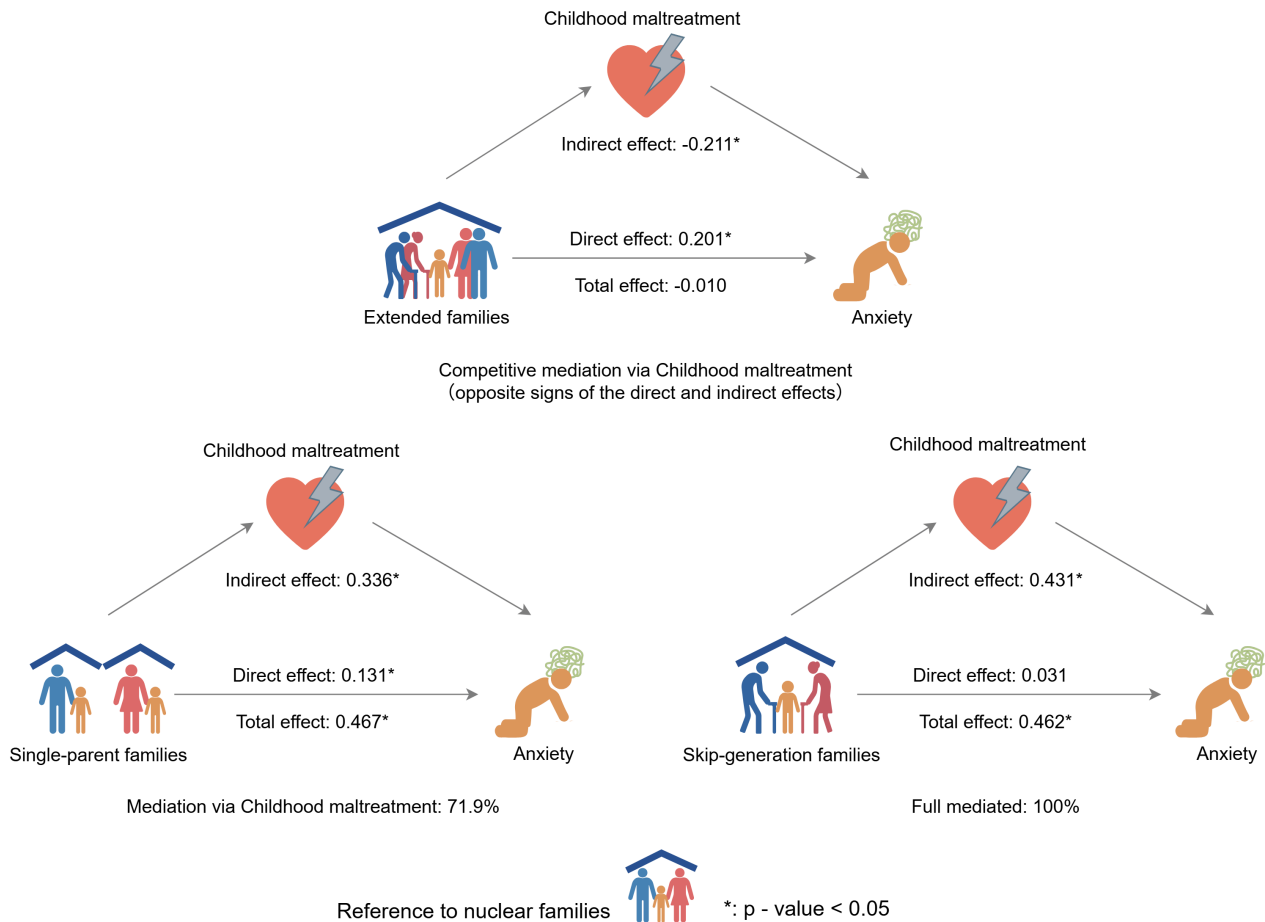


Figure 2

The hypothetical path model of family residence structure, childhood maltreatment and anxiety

Supplementary Files

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