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Original Research

The Influence of Parental Phubbing on Adolescents' Cyber-Aggressive Behavior: The Mediating Role of Authenticity and the Moderating Role of Only-Child Status

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Abstract

Background: With the rapid proliferation of smartphones, parental phubbing, defined as parents focusing on their phones while interacting with their children, has emerged as a significant factor hindering adolescents' psychological and behavioral outcomes. This study examined the association between parental phubbing and adolescents' cyber-aggressive behavior, exploring the mediating role of authenticity and the moderating role of only-child status. **Methods:** A cross-sectional survey was conducted with 1502 Chinese adolescents. Data were analyzed using a moderated mediation model to test the hypothesized effects. **Results:** Parental phubbing positively predicted adolescents' cyber-aggressive behavior, and authenticity partially mediated this association. Additionally, only-child status moderated the mediating pathway, such that the indirect effect of parental phubbing on cyber-aggressive behavior via authenticity was stronger among only children than among children with siblings. **Conclusions:** By elucidating the psychological mechanisms and boundary conditions underlying the relationship between parental phubbing and adolescents' cyber-aggressive behavior, this study offers valuable insights for developing interventions aimed at curbing this behavior.

Keywords: adolescent; authenticity; cyber-aggressive behavior; only-child status; parental phubbing

1. Introduction

With the deep penetration of information and communication technologies, cyber-aggressive behavior, which refers to intentional harm inflicted on others through electronic means such as hostile insults, has become a pressing global issue in the field of adolescent development (Jin et al., 2018). A multinational epidemiological study conducted by the World Health Organization revealed that approximately 24.2% of adolescents worldwide have been victims of cyberbullying, and 19.7% have engaged in such behaviors (Badura et al., 2024). In other words, nearly one in five adolescents is involved in the cycle of perpetrating or suffering from cyber-aggressive behavior. These behaviors are not harmless conflicts confined to the virtual world; rather, they are closely associated with a range of negative outcomes, including a higher risk of depressive disorders and even suicidal behaviors. Therefore, exploring the factors that contribute to adolescent cyber-aggressive behavior is of great practical significance.

1.1 Parental Phubbing and Adolescent Cyber-Aggressive Behavior

Parental phubbing, defined as parents neglecting or ignoring their children during interactions due to excessive parental smartphone use (David and Roberts, 2017; Xie et al., 2019), has emerged as a new form of parent-child relational disruption and is considered a critical risk factor for the development of adolescent aggressive behavior (Kildare and Middlemiss, 2017). Family systems theory emphasizes that the family is a dynamic interactive system, and parental behaviors, as part of the family environment, collectively shape adolescents' psychological development and behavioral outcomes (Hochgraf et al., 2025; Huang, 2025).

As noted by Kokkinos et al. (2016), adolescent engagement in cyber-aggressive behavior is often rooted in poor family-relationship quality. Elsaesser and colleagues (2017) found that parental warmth and effective supervision are associated with lower levels of cyber-aggressive behavior, whereas emotional detachment and lack of parental attention are linked to increased risks of externalizing behaviors, including cyberbullying (Stockdale et al., 2018). Recent empirical studies, as summarized in a narrative review, have further confirmed that parental phubbing is significantly associated with higher levels of adolescent cyber-aggressive behavior (Field, 2024).

In addition, parental neglect may serve as a behavioral model for adolescents, leading them to exhibit similar indifference or aggressive tendencies in online interactions. Parental neglect may also directly promote excessive smartphone use among adolescents, and such dependence on mobile devices is itself a high-risk factor for cyber-aggressive behavior (Çimke and Cerit, 2021; Xie et al., 2019). Furthermore, frequent parental phubbing may undermine adolescents' sense of secure attachment (Bowlby, 1982; Hood

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et al., 2021; McDaniel, 2019), leading to feelings of neglect and rejection, which in turn may intensify aggressive behaviors (Wang et al., 2022a; Wang et al., 2022c). Some empirical studies have shown that parental phubbing positively predicts adolescents' cyber-aggressive behavior (Chu et al., 2025; Qu et al., 2022).

Accordingly, hypothesis 1 (H1) was proposed: Parental phubbing positively predicts adolescent cyber-aggressive behavior.

1.2 The Mediating Role of Authenticity

Authenticity is defined as an individual's subjective experience of congruence between their actions and their true self (Kokkoris et al., 2019; Sedikides et al., 2017). Authenticity is a psychological state in which people make choices and behave based on their inner values and beliefs, free from external pressures (Goldman and Kernis, 2002). According to self-determination theory (SDT; Deci and Ryan, 2000), the development of authenticity depends on the fulfillment of an individual's basic psychological needs, particularly relatedness, autonomy, and competence. For adolescents, the family is the primary context for need satisfaction, and parental phubbing systematically undermines these needs by weakening parent-child bonding, reducing parental responsiveness, and depriving adolescents of opportunities for autonomous expression (Field, 2024; Yan and Wang, 2024).

However, SDT alone does not fully explain how unmet psychological needs translate into diminished authenticity. Horney's personality theory provided a critical intermediate mechanism: "defensive inauthenticity", a state in which individuals suppress or disguise their true selves to avoid psychological harm from unmet needs and environmental conflict (Horney, 2013a; Wood et al., 2008). Specifically, when basic anxiety is chronically activated, individuals lose the capacity to express their true feelings, desires, or values. Instead, they prioritize external approval over internal authenticity by suppressing their real self and adopting rigid, socially acceptable masks (Horney, 2013b). This theoretical linkage, framing defensive inauthenticity as a coping response to basic anxiety, directly connects Horney's theory to the focus of SDT on unmet needs; unmet needs trigger basic anxiety, which in turn activates defensive inauthenticity as a maladaptive self-protection strategy. The integration of SDT and Horney's theory has revealed a clear chain: parental phubbing frustrates basic psychological needs, triggering defensive mechanisms that ultimately reduce authenticity.

Reduced authenticity further predicts cyber-aggressive behavior through a multi-stage mechanism: First, diminished authenticity constitutes a "threat to self-identity", causing persistent anxiety, frustration, and self-denial (Blomgren and Stråaht, 2019; Guo et al., 2025). Second, these negative emotions activate self-protective motives, but real-world expression of aggression is inhibited by social risks (e.g., fear of judgment, Yang et al., 2024). Third, the online context lowers behavioral costs via anonymity, low feedback delay, and moral disengagement (perceiving "online behavior as unrelated to the true self") (Wang et al., 2022b; Zhang, 2023). Finally, adolescents use cyber aggression as an instrumental strategy, gaining emotional release and virtual control to compensate for lost self-efficacy (Jiang et al., 2025; Singh and Mahapatra, 2024). Research has indicated that individuals who exhibit lower authenticity are more likely to engage in aggressive behaviors (Pinto et al., 2012; Zhou et al., 2024).

Accordingly, hypothesis 2 (H2) was proposed: Authenticity mediates the relationship between parental phubbing and adolescent cyber-aggressive behavior.

1.3 The Moderating Role of Only-Child Status

Although the mediating role of authenticity sheds light on how parental phubbing may influence adolescent cyber-aggressive behavior, the conditions under which this effect is most pronounced remain unclear. With the evolving changes in China's family planning policies, systematic differences have been observed between the only child and those with siblings in terms of psychological development, social behavior, and parent-child relationship experiences (Cao et al., 2021; Chen et al., 2024; Zeng et al., 2020).

From the perspective of family systems theory (Bowen, 1978; Minuchin, 1985), the moderating role of only-child status stems from three key systemic differences between only-child and multi-child families: First, in terms of triangulation structure, only-child families form a parent-child triangle with no sibling buffer, and parental attention serves as the sole emotional support; multi-child families, by contrast, form a parent-child-sibling ternary triangle where sibling interactions can substitute for partial parent-child support (Han et al., 2025; Xia et al., 2022). Second, regarding self-differentiation, the only child tends to develop high emotional dependence and low self-differentiation, relying heavily on parental feedback for self-validation, whereas multi-child adolescents gain boundary-setting skills through sibling interactions (Rogers et al., 2022). Third, in terms of emotional-regulation resources, the only child depends exclusively on its parents for emotional support, whereas multi-child adolescents can access additional resources through sibling companionship (e.g., worry-sharing; Manglani et al., 2025; Paley and Hajal, 2022; Xie et al., 2024).

These differences render the only child more vulnerable to parental phubbing: without sibling buffers, parental inattention creates an emotional vacuum that amplifies feelings of neglect and frustration of basic psychological needs (Kildare and Middlemiss, 2017). Notably, no significant difference in parental-phubbing frequency exists between only-child and multi-child parents (Gu and Zhao, 2025); the key difference lies in the child's sensitivity to parental attention rather than the absolute amount of attention re-

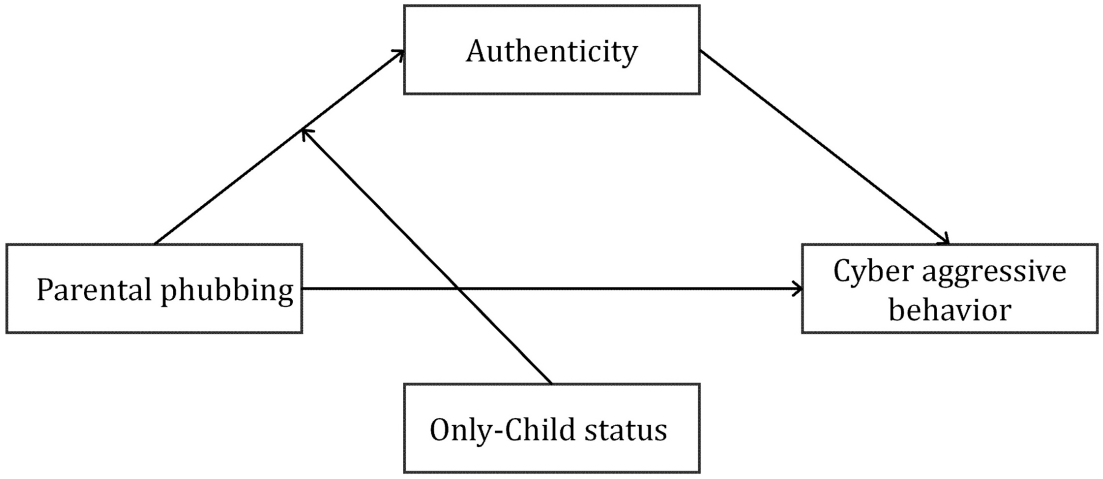


Fig. 1. A theoretical framework of moderated mediation.

ceived. Empirical evidence has confirmed that positive sibling relationships can buffer negative emotions (Buist et al., 2013) and mitigate externalizing behaviors (Lee et al., 2021; Wikle et al., 2019). In contrast, the only child lacks such protective buffers; this strengthens the indirect effect of parental phubbing on cyber-aggressive behavior through diminished authenticity (Zhang et al., 2023).

To verify these deductions, we propose:

H3: Only-child status moderates the effect of parental phubbing on authenticity, such that the negative impact is stronger for the only child.

H4: Only-child status moderates the indirect effect of parental phubbing on adolescent cyber-aggressive behavior via authenticity, such that the effect is stronger for the only child.

1.4 The Present Study

The present study contained a constructed moderated-mediation model to examine the mechanisms by which parental phubbing influences adolescent cyber-aggressive behavior (see Fig. 1). This model synthesized family systems theory, SDT, and Horney's personality theory: family systems theory served to account for the moderating role of only-child status; SDT delineated the link between parental phubbing and unmet psychological needs; and Horney's personality theory elaborated on the transition from unmet psychological needs to defensive inauthenticity.

Specifically:

(1) Main pathway: Parental phubbing results in unmet psychological needs among adolescents, which in turn triggers defensive inauthenticity, impairs individuals' perception of self-authenticity, and ultimately elevates the risk of engaging in cyber-aggressive behaviors.

(2) Moderating role: Differences in family structure (i.e., only child vs. non-only children) attenuate the adverse effects of parental phubbing on psychological needs, thereby mitigating the subsequent chain of effects.

The testing of these hypotheses empirically will advance our theoretical understanding of how the digital family environment shapes adolescent social behaviors and offer valuable insights for targeted parenting interventions in the digital age. Specifically, it highlights the need for parents to reduce phubbing, particularly for only children, and emphasizes fostering authenticity as a protective factor against cyber aggression.

2. Materials and Methods

2.1 Participants

Adolescents aged 12–18 years (n = 1550) were recruited from six schools located in Hunan Province, China, with schools selected via a convenience sampling method. The data-cleaning process excluded 48 responses for failing attention checks or providing patterned answers, yielding 1502 valid cases for analysis (M_{age} = 15.60 years, SD_{age} = 1.66 years; 55.00% female).

2.2 Procedure

Prior to the study, we obtained official authorization from school administrators to administer the questionnaire survey and secured written informed consent from the parents of all participating adolescents. The study strictly adhered to core ethical codes of good practice throughout data collection: participants' anonymity was strictly protected by omitting all personal identifiers (e.g., names, student IDs) from questionnaires and coding all data with anonymous serial numbers only. Additionally, all participants were explicitly informed of their right to withdraw from the study at any time without prejudice, with verbal and written explanations of this right provided by researchers before the survey commenced. Ethical oversight for the study was ensured by full compliance with the Declaration of Helsinki, and the research protocol was formally approved by the Institutional Review Board of the corresponding author's

affiliated institution. Upon completion of the anonymous questionnaire, each participant received a cash compensation of USD 0.42 as a token of appreciation for their participation.

2.3 Measures

2.3.1 Parental Phubbing

Parental phubbing behavior was measured using a revised version of the Parent Phubbing Scale originally developed by Roberts and David (2016) and adapted for use with Chinese adolescents by Ding et al. (2020). The scale consists of nine items that describe typical parental phone-related neglect during parent-child interaction (e.g., "My parent checks their phone intermittently while talking with me"). Respondents rated each item on a 5-point Likert scale ranging from 1 (Never) to 5 (Always). Mean scores across all items were calculated, with higher scores indicating greater perceived parental phubbing. In the current sample, the scale demonstrated good internal consistency, Cronbach's $\alpha = 0.90$.

2.3.2 Authenticity

Authenticity was measured using the Authenticity Questionnaire (Wood et al., 2008), which had been revised for Chinese adolescents by Song et al. (2020). The scale consists of 12 items assessing three dimensions: authentic living, self-alienation, and accepting external influence. An example item is: "I feel out of touch with the 'real me'." Participants rated each item on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Mean scores were calculated, with higher scores indicating a greater level of authenticity. In the present study, the scale demonstrated good internal consistency (Cronbach's $\alpha = 0.82$). We tested a higher-order model with three first-order factors (Authentic Living, Self-Alienation, Accepting External Influence) loading onto a second-order general Authenticity factor. The model demonstrated acceptable-to-good fit: $\chi^2/df = 3.21$, Comparative Fit Index (*CFI*) = 0.94, Tucker-Lewis Index (*TLI*) = 0.92, Root Mean Square Error of Approximation (*RMSEA*) = 0.07 (90% CI [0.06, 0.08]), *Standardized Root Mean Square Residual* (*SRMR*) = 0.05.

2.3.3 Adolescent Cyber-Aggressive Behavior

Adolescent cyber-aggressive behavior was assessed using the Adolescent Online Aggressive Behavior Scale developed by Zhao and Gao (2012). The scale consists of 15 items and includes two subscales: relational aggression and overt aggression. An example item is: "I have spread rumors about a person or an organization online." Participants rated each item on a 4-point Likert scale ranging from 1 (never) to 4 (always). Mean scores were calculated, with higher scores indicating higher levels of cyber-aggressive behavior. In the present study, the scale demonstrated good internal consistency (Cronbach's $\alpha = 0.84$). We tested a correlated two-factor model (Relational Aggression, Overt Aggression). The model fit was good: $\chi^2/df = 2.89$, *CFI* = 0.95, *TLI* = 0.94, *RMSEA* = 0.06 (90% CI [0.05, 0.07]), *SRMR* = 0.04.

2.3.4 Other Variables

We also collected data on participants' only-child status, sex, and age. For the only-child status, the only child was coded as 0 and a non-only child as 1. For sex, males were coded as 0 and females as 1. These variables were coded as dummy variables for all subsequent analyses.

2.4 Data Analysis

The research data were analyzed using IBM SPSS Statistics, version 23.0 (IBM Corp., Armonk, NY, USA). Initially, we conducted a test to assess common method bias. After this, we provided descriptive statistics and computed correlation coefficients for the primary variables. In the final phase of the analysis, we utilized model 4 and model 7 from the PROCESS macro, as introduced by Hayes (2012), to investigate the moderated mediation relationships.

3. Results

3.1 Common Method Bias Test

The Harman's single-factor test was conducted to assess the presence of common method bias. The analysis revealed that there were eight factors with eigenvalues exceeding 1, and the first unrotated factor accounted for only 19.45% of the variance, which is below the 40% threshold considered critical. Consequently, our study did not exhibit substantial common method bias.

3.2 Descriptive Statistics and Correlation Analysis

The key variables in this study exhibited the following means and standard deviations: parental phubbing ($M = 2.52$, $SD = 0.72$), authenticity ($M = 4.50$, $SD = 0.90$), and cyber-aggressive behavior ($M = 1.84$, $SD = 0.55$). Furthermore, non-only children accounted for 51.26% of the sample ($n = 770$).

Table 1 displays the findings from the correlation analyses. Overall, the bivariate correlations provided preliminary support for our hypothesized relationships. Notably, a positive correlation was observed between parental phubbing and cyber-aggressive behavior ($r = 0.21$, $p < 0.001$). Authenticity exhibited significant negative correlations with parental phubbing ($r = –0.20$, $p < 0.001$) and cyber-aggressive behavior ($r = –0.27$, $p < 0.001$). Furthermore, only-child status was found to be positively correlated with parental phubbing ($r = 0.28$, $p < 0.001$) and authenticity ($r = 0.06$, $p < 0.05$).

3.3 Mediating Analysis

To test the mediating hypothesis, we conducted a PROCESS model 4 analysis using SPSS 23.0, with age and

Table 1. Overview of correlational analysis of variables.

	1	2	3	4
1. Parental phubbing	-			
2. Authenticity	–0.20***	-		
3. Cyber-aggressive behavior	0.21***	–0.27***	-	
4. Only-child status	0.28***	0.06*	0.01	-

Notes: n = 1502. *p < 0.05, ***p < 0.001 (two-tailed).

sex as control variables. As shown in Table 2, parental phubbing was positively associated with adolescent cyber-aggressive behavior (β = 0.21, t = 8.16, p < 0.001, 95% CI = [0.14, 0.26]), supporting H1. Parental phubbing was negatively associated with authenticity (β = –0.20, t = –8.01, p < 0.001, 95% CI = [–0.27, –0.13]), and authenticity was negatively associated with cyber-aggressive behavior (β = –0.24, t = –9.48, p < 0.001, 95% CI = [–0.31, –0.17]). As shown in Table 3, further analyses revealed that authenticity significantly mediated the relationship between parental phubbing and adolescent cyber-aggressive behavior. The mediating effect was significant, as the 95% bias-corrected bootstrap confidence interval did not include zero (*Index* = 0.05, 95% CI = [0.03, 0.07]), and the ratio of indirect effect to total effect was 23.81%, thus supporting H2.

3.4 Moderated Mediating Model Analysis

We conducted a PROCESS model 7 analysis to test the moderated mediating model. As shown in Table 4, results showed that only-child status significantly moderated the first stage of the mediation path, namely the effect of parental phubbing on authenticity (interaction term: β = 0.26, t = 5.02, p < 0.001, 95% CI = [0.12, 0.41]). Simple slope analysis (see Fig. 2) revealed that for the only child (coded 0), parental phubbing had a strong negative effect on authenticity (β = –0.39, p < 0.001, 95% CI = [–0.50, –0.28]). For the non-only child (coded 1), this negative effect was significantly weaker (β = –0.13, p < 0.001, 95% CI = [–0.22, –0.03]), supporting H3.

Further analysis revealed that the index of moderated mediation was significant (*Index* = –0.06, 95% CI = [–0.09, –0.03]), suggesting that the positive indirect effect of parental phubbing on cyber-aggressive behavior via authenticity was weaker on the non-only child than on the only child, supporting H4. Specifically, for the only child, the indirect index was significant (*Index* = 0.09, 95% CI [0.07, 0.12]). For the non-only child, the indirect index was significant but weaker (*Index* = 0.03, 95% CI [0.01, 0.05]).

We should note that although statistically significant, the observed effect sizes were modest. This is consistent with research on complex social behaviors, which are typically influenced by a multitude of interacting individual, familial, and contextual factors.

Additionally, we conducted supplementary analyses to examine whether only-child status moderates (a) the second stage of the mediation pathway (authenticity → cyber-aggressive behavior) or (b) the direct path from parental phubbing to cyber-aggressive behavior. Specifically, we employed Model 59 of the SPSS PROCESS macro, which posits that only-child moderates all three pathways within the research model. The results revealed that the interaction terms for only-child at both stages were not statistically significant (Stage 2: β = –0.02, p = 0.69, 95% CI [–0.13, 0.08]; Direct Path: β = –0.04, p = 0.42, 95% CI [–0.14, 0.06]). In contrast, only-child moderates maintained a significant moderating effect exclusively on Stage 1 (parental phubbing → authenticity), β = 0.26, p < 0.001, 95% CI [0.16, 0.37]. These findings provide empirical support for the specificity of our proposed theoretical model.

4. Discussion

This study explored the relationship, along with its underlying psychological mechanisms, between parental phubbing and adolescent cyber-aggressive behavior in the context of smartphone ubiquity. The findings supported our hypothesized model: parental phubbing is significantly and positively associated with cyber-aggressive behavior. The higher the level of parental phubbing perceived by adolescents, the more likely they were to engage in cyber-aggressive behaviors. Furthermore, we found that parental phubbing is indirectly related to higher levels of adolescent cyber-aggressive behavior through a reduced sense of authenticity. This indirect effect was significantly stronger among only children than among those with siblings, suggesting a moderating effect of only-child status on the first half of the mediation pathway.

4.1 Parental Phubbing and Adolescent Cyber-Aggressive Behavior

The direct predictive effect of parental phubbing on cyber-aggressive behavior resonates with key concepts from Ecological Systems Theory, and aligns with previous empirical findings (Gao et al., 2023; Wang et al., 2022a; Wang et al., 2022c). Our results underscored the critical role of parental phubbing as a potential risk factor for adolescent externalizing behaviors in the digital age. Our findings highlighted that when parents are "physically present but psychologically absent", the emotional neglect experienced by adolescents can be as harmful as, or even more harmful than, overt family conflict. It is important to note that the quality of parent-child interaction depends not only on the duration of time spent together but more crucially on the depth of engagement and emotional responsiveness of the parent (Liu et al., 2025). Previous research demonstrated that emotional neglect can be even more detrimental to adolescents than physical abuse (Zhou and Zhen, 2022). Notably, results from a randomized controlled trial suggested that reducing attachment insecurity can significantly mitigate adolescent behavioral problems (Barone et al., 2021).

Table 2. Outcomes of the mediation analysis model.

Independent variables	Dependent variables					
	Model 1 Cyber-aggressive behavior		Model 2 Authenticity		Model 3 Cyber-aggressive behavior	
	β	t	β	t	β	t
Parental phubbing	0.21	8.16^{***}	-0.20	-8.01^{***}	0.16	6.30^{***}
Authenticity					-0.24	-9.48^{***}
Age	-0.06	-3.56^{**}	0.01	0.48	-0.05	-3.54^{**}
Sex	-0.10	-1.77^{*}	-0.08	-1.37	-0.12	-2.14^{*}
R^2	0.06		0.04		0.11	
F	29.17^{***}		21.67^{***}		46.08^{***}	

Notes: All variables within the model are standardized prior to their inclusion in the regression analysis. $n = 1502$.

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (two-tailed).

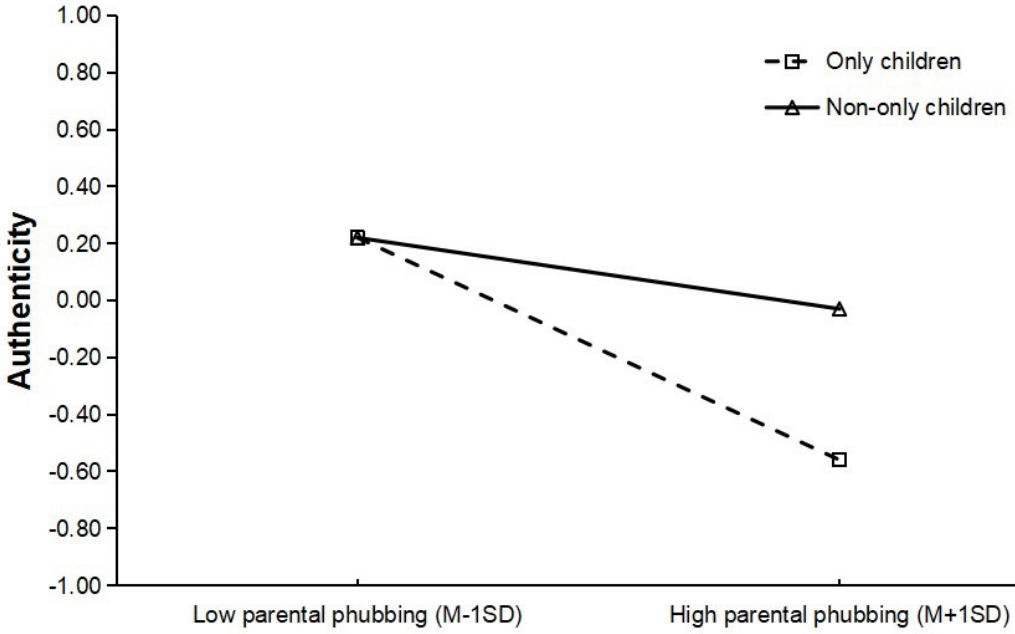


Fig. 2. Moderating analysis of only-child status.

Table 3. The indirect effect of authenticity.

	Index	95% CI	Proportion
Indirect effect (Authenticity)	0.05	[0.03, 0.07]	23.81%
Direct effect	0.16	[0.11, 0.21]	76.19%
Total effect	0.21	[0.16, 0.25]	-

4.2 The Mediating Role of Authenticity

The mediation analysis revealed that authenticity mediated the effect of parental phubbing on adolescent cyber-aggressive behavior. This finding may be explained by SDT, which posits that authenticity is rooted in the fulfillment of basic psychological needs, particularly relatedness and autonomy (Deci and Ryan, 2000). Frequent parental phone use during interactions can impair parental responsiveness and emotional engagement (Abels et al., 2018), leading adolescents to experience existential loneliness (Maftei and Măirean, 2023). Over time, this sense of emotional abandonment is associated with suppressed internal needs and self-expression (Liu et al., 2024), thereby undermining the adolescent's sense of authenticity. As noted by Wong et al. (2019), adverse experiences such as parental neglect are associated with impaired development of self-awareness and a stable sense of identity in adolescents. Meanwhile, adolescents with low authenticity often experience self-alienation and struggle to integrate internal emotions with external behavior. This may manifest in heightened defensiveness and hostility, particularly in online contexts where aggressive behaviors can serve as outlets for suppressed emotions, strategies to regain a sense of control, or tools for constructing a compensatory identity.

Table 4. Outcomes of the moderated mediation-analysis model.

Independent variables	Dependent variables			
	Model 1 Authenticity		Model 2 Cyber-aggressive behavior	
	β	t	β	t
Parental phubbing	–0.39	-9.76^{***}	0.16	6.30^{***}
Authenticity	-	-	–0.24	-9.48^{***}
Only-child status	0.27	5.15^{***}	-	-
Only-child status × Parental phubbing	0.26	5.02^{***}	-	-
Age	0.00	0.16	–0.05	-3.54^{**}
Sex	–0.04	–0.67	–0.12	-2.15^{*}
R^2	0.07		0.11	
F	23.15^{***}		46.09^{***}	

Notes: All variables within the model are standardized prior to their inclusion in the regression analysis. $n = 1502$. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$ (two-tailed).

4.3 The Moderating Role of the Only-Child Status

Further moderation analysis revealed that only-child status significantly moderated the relationship between parental phubbing and authenticity, specifically, the first stage of the mediation pathway. That is, the negative predictive effect of parental phubbing on authenticity was more pronounced on the only child than on the non-only child. This finding suggested that the only child is more susceptible to disruptions in their sense of authenticity when experiencing parental neglect, thereby being at a higher risk of engaging in cyber-aggressive behavior.

Consistent with family systems theory (Bowen, 1978; Minuchin, 1985) and studies in the literature (Paley and Hajal, 2022; Xia et al., 2022), the observed moderating effect can theoretically be attributed to the confluence of family systemic differences and cultural contextual factors.

First, from a systemic perspective, only-child families form a parent-child dyadic structure without sibling emotional buffering, leading the only child to rely solely on parents as their primary source of emotional support. In contrast, the non-only child can offset reduced parent-child engagement through sibling interactions. These structural differences amplify the only child's sensitivity to parental phubbing, as parental inattention is more likely to create a salient emotional gap, exacerbating the frustration of basic psychological needs (e.g., relatedness, autonomy) and eroding authenticity.

Second, within China's collectivist cultural context, the only child often serves as the family's "emotional pivot" (Wang et al., 2022a). Parental phubbing may thus be interpreted as relational abandonment, triggering self-worth doubts (e.g., "Am I not worth my parents' attention?") and further intensifying the psychological impact of parental inattention.

We acknowledge that our interpretation relied on theoretical deduction, as key process variables (e.g., perceived sibling buffering, attention sensitivity, emotional dependence, self-differentiation) were not directly operationalized or measured. Although alternative explanatory factors (e.g., family communication quality, parenting style heterogeneity) are plausible, they are more distal to our core theoretical framework—differences in family structure can affect the satisfaction of the individual's basic psychological needs, thereby shaping their sense of authenticity. However, we also recognized that the moderating effect of only-child status may be confounded by other family-level factors correlated with this status, which could independently or interactively affect the relationship between parental phubbing, authenticity, and cyber aggression. These unmeasured variables include: (1) parental anxiety, closely linked to only-child status in many cultures (Zhong et al., 2023), as parents of only children face greater parenting pressure due to concentrated hopes, which may lead to over-involvement, excessive sensitivity, or stricter control, thus eroding authenticity or increasing cyber aggression (Kochanska, 2002); (2) family economic resources, often correlated with only-child status (Benner and Kim, 2010), may buffer the negative effects of parental phubbing but also increase cyber exposure, complicating interpretation as a hidden third variable; and (3) differential parenting goals, where parents of the only child often hold higher expectations, leading to directive parenting that weakens authenticity and amplifies phubbing's impact, whereas multi-child families may adopt more egalitarian goals (Xu et al., 2024). We should emphasize that the current study focused on family structure as the core variable but could not disentangle its effects from these confounding factors due to the cross-sectional design. Future research should incorporate these variables (e.g., via propensity score matching or longitudinal designs) to strengthen the empirical rigor of the hypothesized mechanism.

4.4 Implications

The findings of the present study indicated that parental phubbing and authenticity play significant, albeit

modest, roles in adolescent cyber aggression. The modest effect sizes are to be expected in psychological research addressing multifaceted real-world behaviors, in which any single factor typically accounts for a limited portion of the variance. However, the theoretical and practical significance of these relationships should not be underestimated.

This present study advanced existing theoretical frameworks by introducing authenticity to the domain of digital-era parent-child relationships and adolescent behavioral problems, and enriching theoretical insights through the integration of SDT, Horney's personality theory, and family systems theory into a cohesive macro framework. This integrated model outlined a logical chain from family structure, through basic psychological need fulfillment and internal psychological processes, to behavioral outcomes, clarifying the hierarchical and sequential links between contextual factors, psychological mechanisms, and behavioral expressions. Specifically, family systems theory highlights the foundational role of family structure; self-determination theory explains how structural contexts shape need fulfillment; and Horney's personality theory details the psychological processes connecting unmet needs to behavioral tendencies. This logically coherent integration reflects the holistic nature of adolescent development and aligns with recent empirical advances in youth-development research. Furthermore, our study offered a novel explanatory mechanism for cyber-aggressive behavior, emphasizing how emotional neglect disrupts coherent self-concept development and precipitates externalizing behaviors via defensive self-protection processes. In doing so, it addressed growing societal concerns about family digital interference on youth psychological development and underscored the pivotal role of emotionally engaged interactions in adolescent socialization.

From a practical standpoint, the findings suggested that parents should enhance their situational awareness of digital-media use, avoiding psychological absence during interactions with their children. Beyond emotional responsiveness, parents should prioritize fulfilling adolescents' basic psychological needs (relatedness, autonomy, competence) by respecting their expressions, supporting independent choices, and affirming their efforts. By providing consistent emotional responsiveness and attention, parents can better fulfill adolescents' needs for relatedness and self-expression. For mental health professionals, interventions that promote authenticity, such as targeted programs addressing defensive inauthenticity and self-identity reconstruction, may help reduce cyber-aggressive behavior by addressing its emotional and psychological roots.

Additionally, the moderating role of only-child status underscores the importance of going beyond surface-level behavioral outcomes to explore the underlying psychological mechanisms shaped by family structure. Drawing on family systems theory, intervention for the only child should focus on mitigating the lack of sibling emotional buffers (e.g., fostering peer support or family communication training to enhance self-differentiation), whereas multi-child families can leverage positive sibling relationships to buffer parental phubbing's impact. Interventions should pay particular attention to the vulnerabilities of the only child, aiding them in developing a coherent and authentic sense of self. Strengthening emotional bonds within the family and promoting open, supportive communication can help these adolescents build stable self-identities, thereby reducing the likelihood of their engaging in cyber-aggressive behaviors.

4.5 Limitations and Future Directions

This study had several limitations that warrant consideration. First, the cross-sectional design limited the ability to infer causal relationships among the variables. Future research should employ longitudinal designs to track changes in parental phubbing, adolescents' authenticity, and cyber aggression over time, allowing for the examination of causal pathways and the control of stable confounding variables (e.g., parental anxiety, economic resources) that may persist across time, as well as experimental designs to better establish the directionality and causality of the observed associations. Beyond addressing causality, expanding the sampling frame to include adolescents from multiple provinces, urban and rural areas, and different school stages will enhance the geographic representativeness and generalizability of the findings.

Second, the sample was limited to Chinese adolescents, which may constrain the generalizability of the findings to other cultural contexts. Chinese culture places strong emphasis on parent-child attachment and family functioning, which may amplify the psychological impact of parental phubbing on adolescents.

Third, although our primary analyses utilized individual-level data to test the hypothesized model, we acknowledge that the sampling strategy (participants nested within classes and schools) may have introduced clustering effects. Future research would benefit from explicitly designing studies with a multilevel framework. This would allow for a more precise decomposition of variance at the individual, classroom, and school levels, and an examination of potential cross-level interactions.

Fourth, authenticity was examined as the sole mediating variable. Although it revealed a critical psychological mechanism, it likely did not account for all the pathways through which parental phubbing influences cyber-aggressive behavior. Other potential mediators, such as emotion regulation, self-esteem, and psychological loneliness, may also play important roles.

Fifth, the use of a binary classification for only-child status may oversimplify the complexity of family structure. Variables such as number of siblings, birth order, and sibling relationship quality may also influence adolescent development. Furthermore, optimizing measurement tools is

essential: developing scales that distinguish between maternal and paternal phubbing, splitting cyber aggression into relational and overt subtypes.

Finally, future studies should verify alternative moderation structures (e.g., moderating the second stage of the mediation pathway or dual-stage moderation) and explore boundary conditions by incorporating variables such as adolescent gender and age, as well as examining the interfering effects of family communication quality and parenting styles.

5. Conclusions

In the context of widespread smartphone use, this study systematically examined the impact of parental phubbing on adolescent cyber-aggressive behavior and its underlying psychological mechanisms. The findings revealed that frequent parental phone use during parent-child interactions not only directly predicted higher levels of cyber-aggressive behavior among adolescents but also indirectly increased such behavior by undermining adolescents' authenticity. Furthermore, only-child status moderated the mediating pathway such that the indirect effect of parental phubbing on cyber-aggressive behavior via authenticity was stronger among only children than non-only children.

Availability of Data and Materials

The data presented in this study are available on request from the corresponding author.

Author Contributions

Conceptualization, YQY and QX; methodology, YQY and QX; software, YQY and QX; formal analysis, YQY, JL and MJL; writing—original draft preparation, YQY and QX; writing—review and editing, JL and MJL; project administration, QX. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Hunan Police Academy (HPA-GLX 20240111). Informed consent was obtained from all subjects involved in the study.

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Conflicts of Interest

The authors declare no conflicts of interest.

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