

Research Paper

# Problematic Smartphone Use in Adolescents with Attention-Deficit/Hyperactivity Disorder: The Roles of Domestic Violence, Parenting Styles, and Peer Bullying Victimization

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## Abstract

**Background:** Problematic smartphone use (PSU) was associated with the increased risk of mental health problems in adolescents. Studies have identified several individual factors related to PSU in adolescents with ADHD; however, environmental factors related to PSU in adolescents with ADHD have not been examined. This cross-sectional questionnaire-survey study examined the associations of domestic violence, parenting styles, and peer bullying victimization with the severity of PSU in adolescents with attention-deficit/hyperactivity disorder (ADHD).

**Methods:** In total, 247 adolescents with ADHD and their parents participated in the study. The severity of PSU was assessed using the Smartphone Addiction Inventory. Domestic violence was assessed using the Parent-to-Child Violence Questionnaire and Violence among Adult Family Members Questionnaire. Parenting styles were assessed using the Parental Bonding Instrument. Peer bullying victimization was assessed using the School Bullying Experience Questionnaire.

**Results:** Violence among adult family members ( $p = .049$ ) and being a victim of social and verbal bullying ( $p = .049$ ) significantly correlated with higher PSU. Authoritarian and controlling parenting significantly correlated with PSU in bivariable but not multivariable regression analysis ( $p > .05$ ).

**Conclusion:** Environmental factors significantly correlated with PSU in adolescents with ADHD. Health professionals should incorporate these factors into the intervention programs for PSU among adolescents with ADHD.

Keywords: attention-deficit/hyperactivity disorder; problematic smartphone use; domestic violence; parenting styles; peer bullying victimization

## 1. Introduction

Smartphones have become one of the important devices for adolescents in modern life. Adolescents use smartphones to connect with others, get messages, have fun, and learn; adolescents can explore a wide range of values and develop an

independent and liberated self-identity [1]. However, smartphones can provide quick fun and close social interaction, which may lead to an increasing dependence on smartphones. Adolescents who have problematic smartphone use (PSU) experience

compulsive smartphone use, tolerance to smartphone use, withdrawal symptoms if smartphones are unavailable, and functional impairment due to PSU [2]. A meta-analysis found that the median prevalence of PSU amongst children and adolescents was 23.3% [3]; PSU was associated with the increased risk of depression, anxiety, perceived stress, and poorer sleep quality [3]. The results of studies indicate that PSU in adolescents is an important health issue and warrants further study.

Studies have demonstrated the significant associations of PSU with the diagnosis of ADHD and ADHD symptoms. A study in South Korean adolescents found that adolescents with ADHD have a higher risk of PSU than did those without ADHD (odds ratio = 6.43) [4]. PSU was also significantly associated with ADHD symptoms in children [5] and university students [6]. PSU can increase psychological distress and then compromise quality of life in individuals with ADHD [7]. Several individual factors such as low emotional intelligence [8], difficulty in stress management [8], high boredom proneness [9], aversion for delayed reward [10], high fun seeking [11], low frustration tolerance [11], comorbid oppositional defiant disorder (ODD) and conduct problems [12], comorbid depression and anxiety [13], and low self-esteem [13] have been proposed to explain the association between PSU and ADHD. However, according to Bronfenbrenner's ecological system theory [14], both personal and environmental factors contribute to the development of online compulsive shopping behaviors in adolescents. The environmental factors related to PSU in adolescents with ADHD have not been examined yet.

Domestic violence, parenting styles, and peer bullying victimization are environmental factors that have profound influences on adolescents' mental health and behaviors. According to Bronfenbrenner's ecological system theory [14], these three factors exist in microsystem that has direct contacts with adolescents. The interactions the adolescents have with their family members and peers directly impact adolescents' development. Studies have confirmed that children and adolescents with ADHD have higher exposure of domestic violence compared with children without ADHD [15, 16]; ADHD and exposure to domestic violence to have an additive effect on adolescents' aggression and suicide attempts [16]. It is possible that domestic violence reduces parents' communication with children and monitoring children's smartphone use. Domestic violence may also cause adolescents to turn to smartphone use for stress relief and interpersonal support. However, the association between domestic

violence and PSU in adolescents with ADHD remain unclear. It is hypothesized that:

**Hypothesis (H) 1: Domestic violence is positively and significantly associated with PSU in adolescents with ADHD.**

Parenting style is a key adolescent-parent interaction factor that substantially affects adolescent behavior. Adolescents with ADHD experience unique parenting styles [17]. A meta-analysis revealed that positive parenting styles were significantly negatively associated with problematic internet use among adolescents [18]. Furthermore, a review demonstrated that adolescents from authoritative households consistently exhibited more protective behaviors and engaged in fewer risk behaviors compared with those from nonauthoritative households [19], whereas permissive and authoritarian parenting styles were positively correlated with internet addiction level of adolescents [20, 21]. Despite these findings, the specific associations between different parenting styles, such as caring or affectionate parenting, authoritative parenting, and parenting and PSU among adolescents with ADHD warrants further investigation. It is hypothesized that:

**H2a: Caring/affectionate parenting are negatively and significantly associated with PSU in adolescents with ADHD.**

**H2b: Authoritative and overprotective parenting is positively and significantly associated with PSU in adolescents with ADHD.**

Studies have found that a high proportion of adolescents with ADHD experience peer bullying victimization [22-24]. Bullying victimization causes emotional problems, compromise quality of life, and increase the risk of suicidal ideation in adolescents with ADHD [25, 26]. The victimized adolescents may seek interpersonal support and entertainment from smartphones to reduce distress. However, the association between bullying victimization and PSU in adolescents with ADHD has not been examined. It is hypothesized that:

**H3: Bullying victimization is positively and significantly associated with PSU in adolescents with ADHD.**

This cross-sectional questionnaire-survey study examined the associations of domestic violence, parenting styles, and peer bullying victimization with the severity of PSU in adolescents with ADHD. The hypotheses of this study were described above.

## 2. Methods

### 2.1. Participants and procedures

This was a cross-sectional questionnaire survey study. The study participants were adolescents with ADHD and their parents who mainly took care of

adolescents. This study enrolled adolescents with ADHD from six child psychiatry outpatient clinics of two hospitals in Taiwan. The inclusion criteria for adolescents with ADHD were as follows: (1) age 11–18 years and (2) having received a diagnosis of ADHD by a certified child psychiatrist in accordance with the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [27]. Adolescents and parents who had comorbid intellectual disability, severe autism spectrum disorder, bipolar disorder, schizophrenia, or any other cognitive deficit that could impede their understanding of the study purposes and completion of the research questionnaire were excluded.

Three child psychiatrists reviewed the medical records of adolescents with ADHD who visited the outpatient clinics between August 2023 and July 2024. Subsequently, at the outpatient clinics, we consecutively approached 259 adolescents with ADHD and their parents who met the inclusion criteria. The child psychiatrists interviewed the adolescents and their parents and excluded 12 adolescents with ADHD because they had comorbid autism spectrum disorder ( $n = 6$ ) and intellectual disability ( $n = 6$ ). The child psychiatrists explained the study purposes and procedures to the remaining adolescents and their parents and invited them to participate in the study. They were assured that their responses would remain confidential, and that their participation or nonparticipation would not influence their right to receive medical services. In total, 247 adolescents (41 girls and 206 boys, mean age [SD] = 13.2 [2.0] years) with ADHD and their parents (182 females and 65 males, mean age [SD] = 46.4 [6.4] years) agreed to participate in the study.

## 2.2. Ethics statement

This study was approved by the Institutional Review Boards of two university affiliated hospitals. Informed consents were obtained from all adolescents and their parents involved in the study. This questionnaire-survey study did not apply any experiments on humans or the use of human tissue samples. This paper conforms to the Declaration of Helsinki and Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals.

## 2.3. Measures

### 2.3.1. Smartphone addiction inventory

The 26-item Smartphone Addiction Inventory (SPAI) was used to assess the participants' self-reported severity of PSU in the one year prior to the assessments [2]. The participants rated each item

on a 4-point scale ranging from 1 (totally disagree) to 4 (totally agree), with a total score ranging from 26 to 104. A higher total score indicated a higher level of PSU. The SPAI has acceptable reliability and validity in the original study [2]. The Cronbach's  $\alpha$  coefficient of the SPAI in the present study was .92.

### 2.3.2. Rosenberg self-esteem scale

This study used the 10-item Rosenberg Self-Esteem Scale (RSES) to evaluate adolescents' self-reported self-esteem [28]. Each item was rated on a four-point scale response scale ranging from 1 (strongly disagree) to 4 (strongly agree). The scale yields a single overall score of self-esteem, with high scores indicating high levels of self-esteem. This scale has been previously used to evaluate the level of self-esteem in Taiwanese adolescents [29]. Cronbach's  $\alpha$  in the present study was .860.

### 2.3.3. Child behavior checklist for ages 6–18

The 112-item parent-reported Chinese version of the Child Behavior Checklist for Ages 6–18 (CBCL/6–18) was used to measure adolescents' behavior problems [30, 31]. We used the recommended T-score transformations of raw behavior scores, which were adjusted for age and sex differences in behavior found in normative samples. We used the domains of ADHD problems, internalizing problems (which includes scales for anxiety/depression, withdrawal/depression, and somatic complaint syndrome) and externalizing problems (which includes scales for oppositional defiant disorder and conduct symptoms) for analysis. The internal consistency (Cronbach  $\alpha$ ) ranges from .55 to .90, one-month test-retest reliability (Pearson  $r$ ) ranges from .51 to .74, and construct validity (eight-factor structure) have been demonstrated [32, 33].

### 2.3.4. Parental bonding instrument

The 25-item Chinese version of the Parental Bonding Instrument (PBI)-parent version was used to evaluate the parents' perceptions of three parenting styles: caring or affectionate parenting, authoritative parenting, and overprotective parenting [34]. Each item is rated on a 4-point Likert scale. A high score on the care/affection subscale reflects parents' perceptions of parental warmth and affection, whereas a low score indicates perceptions of rejection or indifference. The overprotection subscale measures overprotective parenting behaviors and denial of adolescents' psychological autonomy. The authoritarianism subscale evaluates the degree of authoritative control that parents exert over adolescents' behavior [35]. The reliability and validity

of the Chinese version of the PBI were established in a previous study [36]. In this study, the Cronbach's  $\alpha$  values were .78 for caring or affectionate parenting, .70 for overprotective parenting, and .68 for authoritative parenting, indicating acceptable internal consistency.

### 2.3.5. Domestic violence

This study assessed two forms of domestic violence, including parent-to-child violence and violence among adult family members. This study adopted seven items from the Child-to-parent Violence Questionnaire [37] to develop the child-reported Parent-to-Child Violence Questionnaire (PCV-Q) and parent-reported Violence among Adult Family Members Questionnaire (VAFM-Q). The PCV-Q assessed parents' verbal (four items) and physical violence (3 items) to adolescents in the preceding year. The VAFM-Q assessed verbal and physical violence among adult family members in the preceding year. The items in both questionnaires were rated on a five-point scale same as the CDPV-Q. Internal consistency (McDonald's  $\omega$ ) of the PCV-Q and CDPV-Q was .76 to .72, respectively. The answers other than 0 to the items of the PCV-Q and CDPV-Q indicate having parent-to-child violence and violence among adult family members.

### 2.2.6. Chinese version of the school bullying experience questionnaire

The self-reported Chinese version of the School Bullying Experience Questionnaire (C-SBEQ) was used to evaluate participants' experiences of peer bullying victimization at schools and cram schools in the previous year. Eight items assessing the experiences of victimization of social and verbal bullying (four items) and physical bullying (four items) were answered on a 4-point Likert scale [38, 39]. The C-SBEQ has acceptable reliability and validity [39]. In this study, the Cronbach's  $\alpha$  values were .81 for victimization of social and verbal bullying and 0.67 for victimization of physical bullying. Participants who answered 2 or 3 on any item among items 1 to 4 and items 5 to 8 were identified as self-reported victims of social and verbal bullying and physical bullying, respectively.

### 2.3.7. Demographic characteristics

Adolescents' gender and age and parents' gender, age, and education level were collected.

## 2.4. Data analysis

Statistical analyses were performed using IBM SPSS Statistics version 24.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics (presented

as means and frequencies) were used to summarize the characteristics of the study sample. Associations of individual factors (adolescent demographics, self-esteem, parent's education level, ADHD problems, internalizing problems, and externalizing problems), family factors (parenting styles and domestic violence), and peer factor (peer bullying victimization) with PSU were firstly examined using bivariable linear regression analysis. The associations of parenting styles, domestic violence, and peer bullying victimization with PSU were examined using multivariable linear regression analysis in separate models. A  $p$  value  $< .05$  was considered to indicate statistical significance.

## 3. Results

Participants' demographics, adolescents' behavioral problems, self-esteem, parents' parenting styles, domestic violence, peer bullying victimization, and PSU are shown in Table 1. The mean score of the SPAI was 42.6 (SD = 16.0). All values of skewness and kurtosis of continuous variables ranged between -1 and 1, indicating that these continuous variables were normally distributed.

**Table 1.** Demographic, Behavioral Problems, Self-esteem, Parenting Styles, Domestic Violence, and Peer Bullying Victimization (N = 247)

|   | n (%)       | Mean (SD)   | Range |
|---|-------------|-------------|-------|
| Adolescent gender                       |             |             |       |
| Girls                                   | 41 (16.6)   |             |       |
| Boys                                    | 206 (83.4)  |             |       |
| Adolescent age (years)                  |             | 13.2 (2.0)  | 11-18 |
| Parent gender                           |             |             |       |
| Females                                 | 182 (73.7)  |             |       |
| Males                                   | 65 (26.3)   |             |       |
| Parent age (years)                      |             | 46.4 (6.4)  | 27-76 |
| Parent education level                  |             |             |       |
| High school or below                    | 80 (32.4)   |             |       |
| College or above                        | 167 (67.6)  |             |       |
| Behavioral problems on the CBCL/6-18    |             |             |       |
| ADHD problems                           |             | 61.9 (7.7)  | 50-80 |
| Internalizing behavior problems         |             | 56.8 (10.2) | 33-85 |
| Externalizing behavior problems         |             | 55.7 (10.3) | 33-78 |
| Self-esteem on the RSES                 |             | 19.2 (6.0)  | 3-30  |
| Parenting styles on the PBI             |             |             |       |
| Affectionate parenting                  |             | 38.9 (4.8)  | 23-48 |
| Overprotective parenting                |             | 12.4 (3.0)  | 7-20  |
| Authoritarian and controlling parenting |             | 11.7 (2.9)  | 6-20  |
| Parent-to-child violence                | 96 (38.9)   |             |       |
| Violence among adult family members     | 102 (41.3)  |             |       |
| Social and verbal bullying victims      | 61 (24.7)   |             |       |
| Physical bullying victims               | 19 (7.7)    |             |       |
| Problematic smartphone use on the SPAI  | 42.6 (16.0) | 26-96       |       |

ADHD: attention-deficit/hyperactivity disorder; CBCL/6-18: Child Behavior Checklist for Ages 6-18; PBI: Parental Bonding Instrument; RSES: Rosenberg Self-Esteem Scale; SPAI: Smartphone Addiction Inventory

The results of examining the factors correlated with PSU using bivariable linear regression analysis are shown in Table 2. Older age ( $p < .001$ ) and being a victim of social and verbal bullying ( $p = .035$ ) were significantly associated with higher PSU. High self-esteem ( $p < .001$ ), higher authoritarian and controlling parenting ( $p = .049$ ), and violence among adult family members ( $p = .024$ ) were significantly associated with lower PSU. Adolescent gender, ADHD problems, parent's education level, internalizing and externalizing behavioral problems, affectionate and overprotective parenting, parent-to-child violence and being a victim of physical bullying were not significantly associated with PSU (all  $p > .05$ ).

The results of examining the associations of parenting styles, domestic violence, and peer bullying victimization with PSU are shown in Table 3. The results of Model I demonstrated that older age ( $p < .001$ ) and lower self-esteem ( $p < .001$ ) significantly correlated with PSU. The results of Model II demonstrated that after adjusting the effects of individual factors, parenting styles did not significantly correlate with PSU (all  $p > .05$ ). The results of Model II demonstrated that after adjusting the effects of individual factors, parenting styles did not significantly correlate with PSU (all  $p > .05$ ). The results of Model III demonstrated that violence

among adult family members significantly correlated with PSU ( $p = .049$ ), whereas parent-to-child violence did not significantly correlate with PSU ( $p > .05$ ). The results of Model IV demonstrated that being a victim of social and verbal bullying significantly correlated with PSU ( $p = .049$ ), whereas being a victim of physical bullying did not significantly correlate with PSU ( $p > .05$ ).

**Table 2.** Factors Correlated With Problematic Smartphone Use: Bivariable Linear Regression Analysis

|   | Unadjusted B (se) | 95% CI of B    |
|---|-------------------|----------------|
| Adolescent gender <sup>a</sup>                            | -2.528 (2.739)    | -7.922, 2.867  |
| Adolescent age  | 2.352 (0.482)***  | 1.403, 3.300   |
| Parent's education level at college or above <sup>b</sup> | -1.444 (2.179)    | -5.737, 2.849  |
| ADHD problems   | 0.110 (0.132)     | -0.150, 0.370  |
| Internalizing behavioral problems                         | 0.150 (0.100)     | -0.047, 0.347  |
| Externalizing behavioral problems                         | 0.032 (0.099)     | -0.163, 0.227  |
| Self-esteem   | -0.756 (0.165)*** | -1.081, -0.432 |
| Affectionate parenting                                    | 0.233 (0.214)     | -0.188, 0.655  |
| Overprotective parenting                                  | -0.013 (0.345)    | -0.692, 0.666  |
| Authoritarian and controlling parenting                   | -0.701 (0.355)*   | -1.400, -0.001 |
| Parent-to-child violence                                  | 2.916 (2.086)     | -1.192, 7.025  |
| Violence among adult family members                       | -4.669 (2.052)*   | -8.711, -0.628 |
| Social and verbal bullying victims                        | 4.985 (2.346)*    | 0.365, 9.605   |
| Physical bullying victims                                 | 1.491 (3.830)     | -6.052, 9.034  |

<sup>a</sup>: Girls as the reference; <sup>b</sup>: High school or below as the reference

ADHD: attention-deficit/hyperactivity disorder; CI: confidence interval; se: standard error

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

**Table 3.** Factors Correlated With Problematic Smartphone Use: Multivariable Linear Regression Analysis

|   | Model I           |                | Model II          |                | Model III        |                | Model IV         |                |
|---|-------------------|----------------|-------------------|----------------|------------------|----------------|------------------|----------------|
|   | Adjusted B (se)   | 95% CI of B    | Adjusted B (se)   | 95% CI of B    | Adjusted B (se)  | 95% CI of B    | Adjusted B (se)  | 95% CI of B    |
| Adolescent gender <sup>a</sup>                            | 0.424 (2.652)     | -4.801, 5.649  | 0.250 (2.644)     | -4.958, 5.459  | 0.480 (2.662)    | -4.764, 5.725  | 1.261 (2.686)    | -4.030, 6.552  |
| Adolescent age  | 2.163 (0.495)***  | 1.188, 3.138   | 2.183 (0.495)***  | 1.208, 3.158   | 2.079 (0.495)*** | 1.105, 3.054   | 2.317 (0.499)*** | 1.334, 3.301   |
| Parent's education level at college or above <sup>b</sup> | -1.490 (2.053)    | -5.535, 2.554  | -1.218 (2.070)    | -5.296, 2.860  | -1.277 (2.050)   | -5.315, 2.761  | -1.597 (2.047)   | -5.629, 2.435  |
| ADHD problems   | 0.218 (0.184)     | -0.144, 0.580  | 0.222 (0.187)     | -0.147, 0.591  | 0.227 (0.184)    | -0.136, 0.589  | 0.203 (0.185)    | -0.160, 0.567  |
| Internalizing behavioral problems                         | 0.024 (0.125)     | -0.222, 0.269  | 0.026 (0.127)     | -0.223, 0.276  | 0.041 (0.124)    | -0.204, 0.285  | 0.034 (0.124)    | -0.211, 0.279  |
| Externalizing behavioral problems                         | -0.046 (0.156)    | -0.353, 0.260  | -0.002 (0.157)    | -0.310, 0.307  | -0.015 (0.156)   | -0.324, 0.293  | -0.053 (0.155)   | -0.359, 0.252  |
| Self-esteem   | -0.624 (0.169)*** | -0.957, -0.290 | -0.639 (0.171)*** | -0.976, -0.301 | -0.567 (0.174)** | -0.910, -0.225 | -0.561 (0.174)** | -0.902, -0.219 |
| Affectionate parenting                                    |                   | 0.385 (0.215)  |                   | -0.038, 0.808  |                  |                |                  |                |
| Overprotective parenting                                  |                   | 0.215 (0.336)  |                   | -0.446, 0.876  |                  |                |                  |                |
| Authoritarian and controlling parenting                   |                   | -0.343 (0.368) |                   | -1.068, 0.381  |                  |                |                  |                |
| Parent-to-child violence                                  |                   |                |                   |                | 1.325 (2.106)    |                | -2.824, 5.474    |                |
| Violence among adult family members                       |                   |                |                   |                | -4.120 (2.080)*  |                | -8.218, -0.022   |                |
| Social and verbal bullying victims                        |                   |                |                   |                |                  |                | 4.573 (2.359)*   | 0.002, 9.220   |
| Physical bullying victims                                 |                   |                |                   |                |                  |                | -2.715 (3.722)   | -10.048, 4.617 |
| Adjusted R <sup>2</sup>                                   | 0.130             |                | 0.138             |                | 0.137            |                | 0.137            |                |

<sup>a</sup>: Girls as the reference; <sup>b</sup>: High school or below as the reference

se: standard error

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$

#### 4. Discussion

The present study found that several environmental factors in microsystem significantly correlated with PSU in adolescents with PSU. Being a victim of social and verbal bullying and violence among adult family members were significantly associated with higher PSU. Authoritarian and controlling parenting significantly correlated with PSU in bivariable but not multivariable regression analysis.

Victimization of social and verbal bullying is a distressing experience for adolescents. For adolescent bullying victims, there is a strong association between bullying victimization and psychological symptoms (e.g., depression, difficulties in getting to sleep, and loneliness, helplessness) [25-27, 40]. The victimized adolescents may use their smartphones for entertainment such as listening to music, watching videos, and playing games to improve their mood. A meta-analysis found a significant association between internet gaming disorder and bullying victimization in adolescents [41]. The victimized adolescents may seek interpersonal interactions via smartphones to compensate for interpersonal difficulties caused by real-life bullying. However, PSU may increase the risk of cyberbullying victimization in adolescent [42]. Studies have also found that adolescents with ADHD are more likely to suffer from both victimization in cyberbullying and traditional bullying [43, 44]. Victimization of social and verbal bullying and PSU may form a vicious cycle that leads to exacerbating each other's severity. This study did not find a significant association between being a physical bullying victim and PSU in adolescents with ADHD. Only 7.7% of the participants were physical bullying victims in this study; the small number of physical bullying victims might limit the inference of the relationship between being a physical bullying victim and PSU.

The present study found a negative association between authoritarian and controlling parenting and PSU in adolescents with ADHD. Authoritative-authoritarian parenting typologies proposed by Baumrind [45] are important to understand parenting behavior in Western cultures.

However, several studies have found that Authoritative-authoritarian parenting typologies are also applicable to modern Chinese parenting behaviors [46, 47]. Authoritarian and controlling parenting reflects the degree of authoritarian-quality parental control over their adolescents' behaviors [35]. Parents who adopt an authoritarian attitude expect their children to completely fulfill their orders. It is hypothesized that parents of adolescent with electric

device addiction may have an authoritarian parenting to control their child's electric device use [20, 21]. Studies have found that authoritarian parenting styles were positively correlated with internet addiction level of adolescents [20, 21]. However, the result of this study was different from those of previous studies. It is hypothesized that authoritative-authoritarian parenting typologies may not be the same concept in both Western and Chinese cultures. For example, under the cultivation of individualism, Western societies emphasize the positive development of children's personalities, thus aiming to cultivate independence, creativity and diversity; whereas traditional Chinese societies emphasize familism, and the main focus of the parenting philosophy is to raise children who meet the expectations of society, and to make the child a person who can honor the family and shine [48]. In this way, the authoritarian and controlling parenting of parents in traditional Chinese societies may be consistent with the discipline of children's smartphone use for the sake of children's academic achievement and then reduce the severity of PUS. Further, studies have found the specific aspects of parenting in Chinese parents, such as "*guan*" [49, 50]. *Guan* taps into the sense of responsibility endorsed by Chinese parents in their childrearing. Central to this responsibility is that parents govern and train children through providing close monitoring, firm directives, and high demands to help children develop into well-funding members of society [49]. Intriguingly, the concepts of *guan* are positively related to both authoritative and authoritarian parenting [51, 52]. From the above findings, investigating both Authoritative-authoritarian parenting typologies and Chinese-specific parenting (e.g., "*guan*") simultaneously will help to understand the relationship between parenting behaviors and PSU among adolescents in contemporary Chinese-cultural societies.

Violence among adult family members significantly correlated with PSU after adjusting the effects of individual factors. Violence among adult family members will result in parents having no time to care for their children and control their behaviors and increase the risk of adolescents' PSU [53]. Domestic violence may also compromise adolescents' self-control and friendship quality and then increase PSU [54]. Domestic violence may also increase the risk of electric device addiction through emotional and sleep problems [55, 56]. However, the association between violence among adult family members and PSU became insignificant in multivariable regression analysis. Given that exposure to domestic violence was significantly associated with lower self-identity development [57], the association between violence

among adult family members and PSU might be confounded by self-esteem.

The present study did not find the significant association between parent's education level and PSU in adolescents with ADHD. However, we did not examine the roles of other socioeconomic factors and community environment such as the families', schools' and communities' attitudes toward adolescent smartphone use for PSU. These factors existing in microsystem, mesosystem, and exosystem may influence adolescents' smartphone use. The correlations of these factors with PSU in adolescents with ADHD warrant study in future. Further qualitative studies such as interviews or focus groups with adolescents and parents also help to provide insights into the experiences and perceptions surrounding PSU. The present study has several limitations. First, adolescents with ADHD were recruited from outpatient clinics, where they were actively receiving pharmacological or psychological therapy. Future studies should investigate whether the study findings can be extrapolated to adolescents with ADHD who are not receiving medical treatment and TD adolescents recruited through alternative methods. Including a more diverse sample population across different cultural and socioeconomic backgrounds could provide a broader understanding of PSU in adolescents with ADHD. Second, given the cross-sectional design of the present study, the temporal associations between PSU and other variables could not be determined. Third, this study did not assess smartphone usage types (e.g., educational vs. recreational). Research found that social network service and music/videos positively correlated with PSU, whereas study negatively correlated with PSU [58].

## 5. Conclusion

The present study found that being a victim of social and verbal bullying was significantly associated with higher PSU in adolescents with ADHD. It is necessary to survey the existence of PSU among adolescents with the experience of bullying victimization. Health professionals should understand the relationship between bullying experiences and PSU in adolescents and help develop strategies to control smartphone use. Authoritarian and controlling parenting and violence among adult family members significantly correlated with PSU in bivariable regression analysis. Although the correlations became nonsignificant in multivariable regression analysis, parenting styles and domestic violence are environmental factors that warrants survey in managing PSU among adolescents with ADHD. Several intervention programs such as

cognitive-behavioral therapy, enhancing family support and supervision, changing lifestyle, use of assistive technology, exercise, mindfulness, and meditation have been proposed for PSU [59]. Health professionals should help adolescents and parents based on these intervention models and integrate the interventions of parenting styles, domestic violence, and bullying into the models.

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### Availability of data and materials

The data will be available upon reasonable request to the corresponding authors.

### Competing Interests

The authors have declared that no competing interest exists.

### References

1. Gemelli RJ. Normal child and adolescent development. Washington, DC: American Psychiatric Press; 1996.
2. Lin YH, Chang LR, Lee YH, Tseng HW, Kuo TB, Chen SH. Development and validation of the Smartphone Addiction Inventory (SPAI). *PLoS One*. 2014; 9: e98312.
3. Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: a systematic review, meta-analysis and GRADE of the evidence. *BMC Psychiatry*. 2019; 19: 356.
4. Kim SG, Park J, Kim HT, Pan Z, Lee Y, McIntyre RS. The relationship between smartphone addiction and symptoms of depression, anxiety, and attention-deficit/hyperactivity in South Korean adolescents. *Ann Gen Psychiatry*. 2019; 18: 1.
5. Huang BY, Chen YM, Hsiao RC, Yen CF. Smartphone and internet overuse and worsened psychopathologies in children with attention-deficit/hyperactivity disorder during the COVID-19 pandemic. *Kaohsiung J Med Sci*. 2022; 38: 719-20.
6. Kwon SJ, Kim Y, Kwak Y. Influence of smartphone addiction and poor sleep quality on attention-deficit hyperactivity disorder symptoms in university students: a cross-sectional study. *J Am Coll Health*. 2022; 70: 209-15.
7. Chen CY, Lee KY, Fung XCC, Chen JK, Lai YC, Potenza MN, et al. Problematic Use of Internet Associates with Poor Quality of Life via Psychological Distress in Individuals with ADHD. *Psychol Res Behav Manag*. 2024; 17: 443-55.
8. Kaypakti GY, Metin O, Varmis DA, Ray PC, Celik GG, Karcı CK, et al. Technological addictions in attention deficit hyperactivity disorder: Are they associated with emotional intelligence? *Indian J Psychiatry*. 2020; 62: 670-7.
9. Chou WJ, Chang YP, Yen CF. Boredom proneness and its correlation with Internet addiction and Internet activities in adolescents with attention-deficit/hyperactivity disorder. *Kaohsiung J Med Sci*. 2018; 34: 467-74.
10. Ko C-H, Yen J-Y, Yen C-F, Chen C-S, Chen C-C. The association between Internet addiction and psychiatric disorder: a review of the literature. *European Psychiatry*. 2012; 27: 1-8.
11. Lu WH, Chou WJ, Hsiao RC, Hu HF, Yen CF. Correlations of Internet Addiction Severity With Reinforcement Sensitivity and Frustration Intolerance in Adolescents With Attention-Deficit/Hyperactivity Disorder: The Moderating Effect of Medications. *Front Psychiatry*. 2019; 10: 268.
12. Gunes H, Tanidir C, Adaletli H, Kilicoglu AG, Mutlu C, Bahali MK, et al. Oppositional defiant disorder/conduct disorder co-occurrence increases the

risk of Internet addiction in adolescents with attention-deficit hyperactivity disorder. *J Behav Addict.* 2018; 7: 284-91.

13. Wacks Y, Weinstein AM. Excessive Smartphone Use Is Associated With Health Problems in Adolescents and Young Adults. *Front Psychiatry.* 2021; 12: 669042.
14. Bronfenbrenner U. The Ecology of Human Development Experiments by Nature and Design: Harvard University Press; 1979.
15. Brown NM, Brown SN, Briggs RD, Germán M, Belamarich PF, Oyeku SO. Associations between adverse childhood experiences and ADHD diagnosis and severity. *Academic pediatrics.* 2017; 17: 349-55.
16. Craig SG, Bondi BC, O'Donnell KA, Pepler DJ, Weiss MD. ADHD and Exposure to Maltreatment in Children and Youth: a Systematic Review of the Past 10 Years. *Curr Psychiatry Rep.* 2020; 22: 79.
17. Bhide S, Sciberras E, Anderson V, Hazell P, Nicholson JM. Association Between Parenting Style and Socio-Emotional and Academic Functioning in Children With and Without ADHD: A Community-Based Study. *J Atten Disord.* 2019; 23: 463-74.
18. Niu X, Li JY, King DL, Rost DH, Wang HZ, Wang JL. The relationship between parenting styles and adolescent problematic Internet use: A three-level meta-analysis. *J Behav Addict.* 2023; 12: 652-69.
19. Newman K, Harrison L, Dashiff C, Davies S. Relationships between parenting styles and risk behaviors in adolescent health: an integrative literature review. *Revista latino-americana de enfermagem.* 2008; 16: 142-50.
20. Bilge M, Ucan G, Baydur H. Investigating the Association Between Adolescent Internet Addiction and Parental Attitudes. *Int J Public Health.* 2022; 67: 1605065.
21. Setiawati Y, Hartanti DT, Husada D, Irwanto I, Ardani I, Nazmuddin M. Relationship between Paternal and Maternal Parenting Style with Internet Addiction Level of Adolescents. *Iran J Psychiatry.* 2021; 16: 438-43.
22. Chou W-J, Liu T-L, Yang P, Yen C-F, Hu H-F. Bullying victimization and perpetration and their correlates in adolescents clinically diagnosed with ADHD. *Journal of attention disorders.* 2018; 22: 25-34.
23. Hellstrom L. A Systematic Review of Polyvictimization among Children with Attention Deficit Hyperactivity or Autism Spectrum Disorder. *Int J Environ Res Public Health.* 2019; 16.
24. Hu HF, Yen CN, Wu YY, Hsiao RC, Yen CF, Cheng CP. Child-Mother Agreement on Experiences of School Bullying Involvement in Children With ADHD. *J Atten Disord.* 2021; 25: 44-52.
25. Chen YL, Ho HY, Hsiao RC, Lu WH, Yen CF. Correlations between Quality of Life, School Bullying, and Suicide in Adolescents with Attention-Deficit Hyperactivity Disorder. *Int J Environ Res Public Health.* 2020; 17.
26. Lin CW, Lee KH, Hsiao RC, Chou WJ, Yen CF. Relationship between Bullying Victimization and Quality of Life in Adolescents with Attention-Deficit/Hyperactivity Disorder (ADHD) in Taiwan: Mediation of the Effects of Emotional Problems and ADHD and Oppositional Defiant Symptoms. *Int J Environ Res Public Health.* 2021; 18.
27. American Psychiatric A. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR (TM)). Washington, D.C: American Psychiatric Association Publishing; 2022.
28. Rosenberg M. Society and the Adolescent Self-Image: Princeton University Press; 1965.
29. Yen CF, Liu TL, Yang P, Hu HF. Risk and Protective Factors of Suicidal Ideation and Attempt among Adolescents with Different Types of School Bullying Involvement. *Arch Suicide Res.* 2015; 19: 435-52.
30. Achenbach TM, Edelbrock CS. Psychopathology of childhood. *Annual review of psychology.* 1984; 35: 227-56.
31. Chen YC, Huang HL, Chao CC. Achenbach system of empirically based assessment. Taipei: Psychological Publishing; 2009.
32. Wu YT, Chen WJ, Hsieh WS, Chen PC, Liao HF, Su YN, et al. Maternal-reported behavioral and emotional problems in Taiwanese preschool children. *Res Dev Disabil.* 2012; 33: 866-73.
33. Yang HJ, Soong WT, Chiang CN, Chen WJ. Competence and behavioral/emotional problems among Taiwanese adolescents as reported by parents and teachers. *J Am Acad Child Adolesc Psychiatry.* 2000; 39: 232-9.
34. Parker G. The Parental Bonding Instrument: A decade of research. *Soc Psychiatry Psychiatr Epidemiol.* 1990; 25: 281-2.
35. Cox BJ, Enns MW, Clara IP. The Parental Bonding Instrument: confirmatory evidence for a three-factor model in a psychiatric clinical sample and in the National Comorbidity Survey. *Soc Psychiatry Psychiatr Epidemiol.* 2000; 35: 353-7.
36. Gau SS, Shen H-Y, Chou M-C, Tang C-S, Chiu Y-N, Gau C-S. Determinants of adherence to methylphenidate and the impact of poor adherence on maternal and family measures. *Journal of Child & Adolescent Psychopharmacology.* 2006; 16: 286-97.
37. Contreras L, Bustos-Navarrete C, Cano-Lozano MC. Child-to-parent Violence Questionnaire (CPV-Q): Validation among Spanish adolescents. *Int J Clin Health Psychol.* 2019; 19: 67-74.
38. Kim Y, Koh YJ, Noh J. Development of Korean-Peer Nomination Inventory (K-PNI): An inventory to evaluate school bullying. *J Korean Neuropsychiatry Assoc.* 2001; 40: 867-75.
39. Yen CF, Kim YS, Tang TC, Wu YY, Cheng CP. Factor structure, reliability, and validity of the Chinese version of the School Bullying Experience Questionnaire. *Kaohsiung J Med Sci.* 2012; 28: 500-5.
40. Due P, Holstein BE, Lynch J, Diderichsen F, Gabhain SN, Scheidt P, et al. Bullying and symptoms among school-aged children: international comparative cross sectional study in 28 countries. *Eur J Public Health.* 2005; 15: 128-32.
41. Gao YX, Wang JY, Dong GH. The prevalence and possible risk factors of internet gaming disorder among adolescents and young adults: Systematic reviews and meta-analyses. *J Psychiatr Res.* 2022; 154: 35-43.
42. Topan A, Anol S, Tasdelen Y, Kurt A. Exploring the Relationship Between Cyberbullying and Technology Addiction in Adolescents. *Public Health Nurs.* 2025; 42: 33-43.
43. Liu TL, Hsiao RC, Chou WJ, Yen CF. Perpetration of and Victimization in Cyberbullying and Traditional Bullying in Adolescents with Attention-Deficit/Hyperactivity Disorder: Roles of Impulsivity, Frustration Intolerance, and Hostility. *Int J Environ Res Public Health.* 2021; 18: 6782.
44. Yen CF, Yang P, Wang PW, Lin HC, Liu TL, Wu YY, et al. Association between school bullying levels/types and mental health problems among Taiwanese adolescents. *Compr Psychiatry.* 2014; 55: 405-13.
45. Baumrind D. Current patterns of parental authority. *Developmental Psychology.* 1971; 4: 1-103.
46. Chang L, McBride-Chang C, Stewart SM, Au E. Life satisfaction, self-concept, and family relations in Chinese adolescents and children. *International Journal of Behavioral Development.* 2003; 27: 182-9.
47. Wu P, Robinson CC, Yang C, Hart CH, Olsen SF, Porter CL, et al. Similarities and differences in mothers' parenting of preschoolers in China and the United States. *International Journal of Behavioral Development.* 2002; 26: 481-91.
48. Wu M. Parenting dilemma : sociological analysis of parenting teenagers in Taiwan. 初版 ed. Taipei: Wu-Nan Book Inc.; 2016.
49. Chao RK. Beyond Parental Control and Authoritarian Parenting Style: Understanding Chinese Parenting Through the Cultural Notion of Training. *Child Development.* 1994; 65: 1111-9.
50. Jose PE, Huntsinger CS, Huntsinger PR, Liaw F-R. Parental Values and Practices Relevant to Young Children's Social Development in Taiwan and the United States. *Journal of Cross-Cultural Psychology.* 2000; 31: 677-702.
51. Chen F-M, Luster T. Factors related to parenting practices in Taiwan. *Early child development and care.* 2002; 172: 413-30.
52. Pearson E, Rao N. Socialization goals, parenting practices, and peer competence in Chinese and English preschoolers. *Early Child Development and Care.* 2003; 173: 131-46.
53. Kwak JY, Kim JY, Yoon YW. Effect of parental neglect on smartphone addiction in adolescents in South Korea. *Child abuse & neglect.* 2018; 77: 75-84.
54. Kim HJ, Min JY, Min KB, Lee TJ, Yoo S. Relationship among family environment, self-control, friendship quality, and adolescents' smartphone addiction in South Korea: Findings from nationwide data. *PLoS One.* 2018; 13: e0190896.
55. Guo N, Weng X, Zhao SZ, Zhang J, Wang MP, Li L, et al. Adverse childhood experiences on internet gaming disorder mediated through insomnia in Chinese young people. *Front Public Health.* 2023; 11: 1283106.
56. Zhang Q, Zhang Q, Ran G, Liu Y. The Association Between Child Abuse and Internet Addiction: A Three-Level Meta-Analysis. *Trauma Violence Abuse.* 2024; 25: 2234-48.
57. Makhubela MS. Exposure to domestic violence and identity development among adolescent university students in South Africa. *Psychological reports.* 2012; 110: 791-800.
58. Hong YP, Yeom YO, Lim MH. Relationships between Smartphone Addiction and Smartphone Usage Types, Depression, ADHD, Stress, Interpersonal Problems, and Parenting Attitude with Middle School Students. *J Korean Med Sci.* 2021; 36: e129.
59. Wu YY, Chou WH. A Bibliometric Analysis to Identify Research Trends in Intervention Programs for Smartphone Addiction. *Int J Environ Res Public Health.* 2023; 20: 3840.