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Title page

Association of harsh parenting and maltreatment with Internet addiction, and the mediating role of bullying and social support

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Abstract

Growing evidence has shown that exposure to harsh parenting and child maltreatment elevate the risk of Internet addiction in adolescence. Yet, limited research has examined the mechanisms underlying this association. The present study was a cross-sectional school survey of 1,204 adolescents (52.2% male and 47.8% female; mean age, 13.36 years) in Hong Kong. The adolescents completed a self-reported questionnaire about their exposure to bullying victimization, bullying perpetration, child maltreatment, Internet addiction, and social support. The findings showed that harsh parenting and maltreatment was significantly associated with Internet addiction. After controlling for a number of confounding factors, the results of the mediation analyses showed that family support and bullying perpetration, and family support and bullying victimization accounted for 36% and 25% of the effect of harsh discipline and maltreatment on Internet addiction, respectively. Effective prevention and intervention strategies for Internet addiction should target family and social vulnerabilities in adolescents.

Keywords: child maltreatment, parental harsh discipline, bullying, Internet addiction, social support, Chinese

Introduction

The use of the Internet and electronic devices for communication, social networking, and learning in children, especially among adolescents is increasing. There is a growing body of literature examining the potentially harmful effects of over-exposure to the Internet on adolescent health including physical inactivity and unhealthy eating habits (Busch et al., 2013). At the extreme end, children and adolescents can become dependent on the Internet and are prone to Internet addiction, which is characterized by preoccupation with the use of the Internet, failure to control the desire to access the Internet, and continuous use of the Internet despite varying levels of functional impairment (Kuss et al., 2014). A meta-analytic review showed a pooled prevalence of Internet addiction of 6% across 31 countries, and a slightly higher prevalence of 7.1% in Asian countries (Cheng & Li, 2014). In Hong Kong, a large-scale population-based survey ($N = 8286$) revealed an inflated rate of addictive Internet use of 16% among adolescents (Lau et al., 2017).

In light of the deleterious impacts of Internet addiction on children and adolescents' well-being including sleep disturbances, depression, and quality of life (Choi et al., 2009; Ferrara et al., 2017; Lam & Peng, 2010), previous studies have examined the risk factors of Internet addiction. In addition to individual factors such as impulsivity and neuroticism personality characteristics (Kuss et al., 2014), there is an increasing amount of research focusing on family influence on Internet addiction. In particular, it has been found that negative parenting practices, including hostility and harsh parenting increased adolescents' risk of Internet addiction (Wang & Qi, 2017; Yu et al., 2013). Furthermore, a growing number of studies have provided evidence supporting the notion that Internet addiction is associated with different types of child maltreatment, including physical abuse, neglect, sexual abuse, and emotional abuse (Hsieh et al., 2016b; Kim et al., 2017; Kwak et al., 2018). The finding on the

influence of harsh parenting and child maltreatment on Internet addiction is of professional concern as child maltreatment is also a prevalent issue, with global prevalence rates of 22.6% for physical abuse and 36.3% for emotional abuse (Stoltenborgh et al., 2015). Based on a representative sample of students aged 9 – 18 years, self-reported prevalence rates of child maltreatment were 32.2% for physical abuse and 48.6% for psychological abuse in Hong Kong (Chan, 2015). Moreover, harsh disciplinary method has found to be a widely practiced parenting strategy, such as in Asian countries (Fulu et al., 2017). This is evident by a study showing that 48.29% to 80.4% of the Chinese parents used some types of harsh parenting practices in the previous year (Wang & Liu, 2014).

In understanding the relationship of Internet addiction with harsh parenting and child maltreatment, evidence from some studies suggest that harsh parenting influences Internet addiction indirectly through a third variable (mediator variable). Specifically, studies have found that adolescents' psychological symptoms (Hsieh et al., 2016a; Kim et al., 2017), post-traumatic disorder (Hsieh et al., 2016b), lower self-esteem, (Kim et al., 2017), negative thoughts (Park et al., 2017), and relational maladjustment with teachers (Kwak et al., 2018) significantly mediated the effects of child maltreatment on Internet addiction. Although these studies provided important evidence supporting the notion that child maltreatment is indirectly associated with Internet addiction, the studies primarily focused on the mediating effects of adolescents' psychological factors, whether family and social resources play a role in explaining the association is unclear.

According to the deterioration model of social support (Barrera, 1986; Kaniasty & Norris, 1993; Wheaton, 1985), environmental and social stressors such as harsh parenting and maltreatment can cause diminished expectations for social support and interpersonal conflicts, which in turn may lead to maladjustment. In fact, social support, specifically functional support (e.g., perceived support and received support) has been consistently found to be related to child

maltreatment (Miller-Graff et al., 2017; Negriff et al., 2019; Sperry & Widom, 2013). Maltreated children growing up in a dysfunctional family environment or with impaired parental functioning are likely to perceive less support from the family and develop poor scripts for interpersonal relationships. This in turn leads them to perceive lower social acceptance among their peers and lower peer support (Alto et al., 2018; Pepin & Banyard, 2006). The resultant lower social support and poorer interpersonal relationships (Liu & Kuo, 2007; Wu et al., 2016) may, in turn, increase the adolescents' risk for Internet addiction.

The deterioration model also suggests that stressful life events can damage social relationships. Harsh in parental discipline and child maltreatment are seen as a fundamental failure in the parent-child relationship which may cause deficits in interpersonal skills in children and impede their ability to maintain or form healthy relationships in other contexts (Lim, 2020; Negriff et al., 2019). Hence, maltreated children may easily accept being bullied by peers or practice bullying behaviors on others. The literature has long shown that children exposed to maltreatment have increased risk of involvement in bullying either as perpetrator or victim (Duncan, 1999; Hong et al., 2012; Lereya et al., 2013; Shields & Cicchetti, 2001). In alignment with the findings of the literature, past studies also revealed that child maltreatment is positively associated with bullying victimization and perpetration in Chinese adolescents (Chan, Fong, Yan et al., 2011; Chan et al., 2017; Duong et al., 2009; Wang et al., 2017). Adolescents who are victims/bullies tend to have lower social bonds, spend more time on the Internet, and more easily establish online relationships than real life relationships to obtain a sense of belongingness, which may increase the risk for developing Internet addiction (Jia et al., 2018; Jung et al., 2014).

Building on the past literature, this study examined the potential mediators, namely social support, bullying perpetration, and bullying victimization, in linking child maltreatment and Internet addiction. It is hypothesized that adolescents' perceived social support and

involvement in bullying would mediate the relationship between child maltreatment and Internet addiction.

Materials and Methods

Study Participants

A cross-sectional survey was conducted in secondary schools in Hong Kong between October 2015 and March 2016. Invitation letters were sent to local secondary schools and six secondary schools were recruited. Invitation letters explaining the purpose of the study were distributed to parents of students attending Secondary 1 to 3 (equivalent to 7th to 9th grade) of the participating schools. Among the 1,792 students, written informed consent was received from the parents or guardians of 1,232 students, giving a response rate of 68.8%. The participating students completed the questionnaire during class time in a classroom setting or school hall setting. The students were informed that they can withdraw from the study at any time or refuse to answer any question items that they do not wish to answer. The questionnaire was carried out anonymously without collecting any personal identifiers and took approximately 20 minutes to complete. Research staff members collected the completed questionnaires and delivered back to the research office to ensure that the school personnel would not have access to the questionnaires. Of the 1,232 completed questionnaires, 28 questionnaires (2.3% of the sample) were discarded as they had more than 10% missing values, giving a final sample size of 1,204 participants.

Measurements

Demographic factors and Internet usage. Several demographic variables were collected, including students' age, sex, place of birth, family income, number of siblings, and parents' education level. Adolescents' usage of the Internet including daily Internet use (in hours) for non-academic purposes during school days and non-school days, and daily time

spent on online gaming and social networking were also collected.

Outcome measure

Internet addiction. The 20-item Young's Internet Addiction Test (IAT; Young, 1998) is a commonly used research measure that determines adolescents' risk for Internet addiction. The items assess an individual's Internet usage in terms of the extent of preoccupation, inability to control Internet use, hiding or lying about Internet use, and continued use despite negative consequences from Internet use. Each item is scored from 1 (representing *not at all*) to 5 (representing *always*) and the total scores range from 20 to 100, with higher score indicating higher levels of Internet addiction. The cut-off criteria suggested by Young (2007) were used: ≤30 for average Internet use, 31-49 for mild risk for Internet addiction, 50-79 for moderate risk, and ≥80 for high risk. The Chinese version of IAT has been validated in Hong Kong and has demonstrated strong internal consistency (α = .93). Satisfactory concurrent and convergent validity of IAT were found moderately correlated with the Revised Chen Internet Addiction Scale (*r* = .46) (Lai et al., 2013). In this study, internal reliability of IAT was α = .91.

Predictive variable

Harsh parenting and child maltreatment. Harsh parenting & maltreatment was measured using the two items on physical assault and verbal aggression from the Parent-Child Conflict Tactics Scale (CTSPC; Straus et al., 1998). Examples of physical assault and verbal aggression were provided to help adolescents to recall if such incidents had been perpetrated by parents/caregivers in their lifetime. Examples of physical assault included throwing things at a child, pushing or shoving, grabbing, slapping, twisting an arm, pulling the hair, hitting, choking, burning, scalding, use of knife or sharp weapon, and kicking. Examples of psychological aggression included insulting, shouting or yelling, spitting, destroying belongings, threatening, ignoring, calling the child dumb or lazy or a similar name, saying they would send the child away, kicking the child out of the house, and not providing meals. The

method of using a limited number of items from CTSPC has been employed in a previous study (Chan, 2015). The tool was previously translated into Chinese and used in various population-based surveys in Hong Kong, which have demonstrated its ability to identify child maltreatment (Chan, 2005; Chan, Brownridge, Yan et al., 2011). The internal reliability of the scale was .73 for this study. Furthermore, in this study, a dichotomous categorization ("yes" or "no") was created to indicate adolescents' exposure to harsh parenting & maltreatment. The adolescents were considered having exposed to harsh discipline and maltreatment if they indicated 'yes' among any of the items in the scale. This dichotomization method has been used in previous studies examining child maltreatment in Hong Kong.

Potential mediators

Perceived social support. The Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988) was used to measure adolescents' perceived social support from family and peers. The MSPSS consists of a 4-item family social support subscale and an 8-item peer social support subscale. The participants were asked to respond to each question on a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The Chinese version of MSPSS has been validated in a previous study and was shown to have excellent internal consistency (Chou, 2000). This study obtained an internal reliability of .95 for this scale.

Bullying victimization and perpetration. This study also examined the status of bullying victimization and perpetration. The 5-item peer and sibling module of the Chinese version of the 34-item Juvenile Victimization Questionnaire (JVQ; Finkelhor et al., 2005) was used to assess adolescents' exposure to bullying victimization in their lifetime. The 5-item module demonstrated satisfactory internal consistency and reliability (α = .768). The item on dating violence was not included as this is a very sensitive question. To provide a more comprehensive assessment of bullying, the Relational Aggression Scale (RAS; Crick &

Grotpeter, 1995) was used to assess relational bullying. The 5-item RAS included spreading rumors, keeping the victim from being in a group, telling friends to stop liking the victim, ignoring the victim, and threating the victim. The Chinese version of RAS has been used in a previous study demonstrating satisfactory internal consistency reliability (Cronbach's α = .836). The Chinese version of JVQ has been validated in a previous study, and showed good internal consistency with an α value exceeding .70 for all sub-scales and .89 for the whole scale (Chan, Fong, Yan et al., 2011). The adolescents were also asked to complete the same set of measures for their engagement in bullying perpetration. Internal reliability was .80 for JVQ and .75 for RAS in this study.

Ethics Approval

The study was approved by the Ethical Committee/ Institutional Review Board of The University of Hong Kong/ Hospital Authority Hong Kong West Cluster (Reference number: UW-14-128).

Data Analysis

Descriptive statistics and frequencies were calculated to analyze the study participants' demographic characteristics including age, sex, parents' education attainment, family income, Internet usage, and exposure to bullying, harsh parenting & maltreatment. There were 6.3% missing data in all the variables that were used in analysis. The variables with most missing data were family income (23.8%), paternal education (20.4%), and maternal education (16.5%). Internet addiction has 4.6% missing data. Path analyses were conducted to examine the potential mediating effects of perceived social support and bullying on the association between harsh parenting & maltreatment and Internet addiction. Confidence intervals and p-values were estimated using bootstrap and full information maximum likelihood (FIML). Bootstrapping

technique was used because it is more accurate than Sobel test (Zhang, 2014). FIML provides

more efficient unbiased estimates compared with listwise or pairwise deletion (Enders &

Bandalos, 2001). A number of confounding factors were adjusted for in the analyses including

age, sex, number of siblings, family income, place of birth, and school. These demographic

covariates were selected as they were associated with Internet addiction (Durkee et al., 2012;

Servidio, 2014). The path analyses were performed in R Statistical Software v3.4.3 using the

lavaan package (Rosseel, 2012). The statistical significance level was set at .05 in the two-

tailed tests.

Results

Characteristics of the Participants

The characteristics of the study participants are shown in Table 1. The adolescents

(52.2% male) were between the ages of 12 and 15 years ($M = 13.36$; $SD = 1.15$). The majority

of students were born in Hong Kong (84.5%), followed by Mainland China (14.2%) and other

countries including USA (0.8%). In regards to parental education level, 11.5% mothers and

9.5% fathers had a primary school or lower education, over half of parents (61.7% mothers and

58.3% fathers) had lower and upper secondary school education, and only 10.4% mothers and

11.8% fathers had a post-secondary education. In regards to socioeconomic status, 11.9% of

families had a family monthly income of less than USD1,282, 29.6% had a family monthly

income between USD1,282 and USD2,564, 17.3% had a family monthly income between

USD2,564 and USD3,846, and 17.5% had a family monthly income above USD3,846. The

median monthly household income in the Hong Kong population was USD3,205 in 2016

(Department, 2016). From adolescents' self-reports, verbal aggression (50.6%) was the most

common type of child maltreatment, followed by corporal punishment (49.7%), and physical

aggression (25.3%). In addition, 45.9% of the adolescents reported exposure to bullying victimization and 47.8% reported bullying perpetration in their lifetime.

Internet Usage Patterns of the Participants

Internet usage patterns of the study participants are shown in Table 2. Adolescents who were exposed to harsh parenting & maltreatment tended to spend more time on the Internet during weekdays ($t = 5.88$, $p = .02$) and on online gaming ($p = .001$). In regards to Internet addiction, adolescents who were exposed to harsh parenting & maltreatment were more likely to be classified as at risk for Internet addiction ($\chi^2 = 42.95$, $p < .001$). Specifically, 22.3% of the adolescents who reported history of parental harshness and maltreatment were classified as having moderate to high risk for Internet addiction compared to 12.2% in the non-maltreated group. Likewise, a significant difference was observed in the Internet Addiction Test scores between the victim ($M = 40.07$; $SD = 14.01$) and non-victim groups ($M = 34.70$; $SD = 12.35$) ($t = 46.84$, $p < .001$).

Mediation Analyses

Regression coefficients of the associations among key measurements examined in the mediation model including harsh parenting & child maltreatment, bullying perpetration, family support, peer support, and Internet addiction are presented in *Table 4a*. Harsh parenting & maltreatment was found to have significant associations with Internet addiction ($\beta = .27$, 95% CI = .12, .41; $p < .001$), bullying perpetration ($\beta = .27$, 95% CI = .20, .34; $p < .001$), and social support from family ($\beta = -.41$, 95% CI = -.54, -.28; $p < .0001$). Harsh parenting & maltreatment was not significantly associated with social support from peers ($\beta = -.08$, 95% CI = -.22, .06; $p = .271$). Social support from family ($\beta = -.12$, 95% CI = -.22, -.02; $p = .013$) and bullying perpetration ($\beta = .36$, 95% CI = .23, .49; $p < .0001$) were significantly associated with Internet

addiction. However, social support from peers (β = -.07, 95% CI = -.17, .02; p = .15) was not significantly associated with Internet addiction.

A summary of the mediation analysis for social support and bullying perpetration is shown in *Table 4b*. There was a significant indirect effect of harsh parenting & maltreatment on Internet addiction through family support (β = .05, 95% CI = .01, .10; p = .023, mediation proportion = 12%) and bullying perpetration (β = .10, 95% CI =.06, .14; p < .001, mediation proportion = 23%). Social support from peers was not a significant mediator (β = .01, 95% CI =-.01, .02; p = .447). The unmediated effect remained significant (β = .27, 95% CI = .12, .41, p < .0001) indicating that bullying perpetration and family support partially mediated the link between harsh parenting & maltreatment and Internet addiction. Together, family support and bullying perpetration accounted for 36% of the effect of harsh parenting & maltreatment on Internet addiction among adolescents, even after adjusting for a number of confounding factors (age, sex, number of siblings, family income, place of birth, and school).

Regression coefficients of the associations among key measurements examined in the mediation model including harsh parenting & maltreatment, bullying victimization, family support, peer support, and Internet addiction are presented in *Table 5a*. Harsh parenting & maltreatment was found to have significant associations with Internet addiction (β = .30, 95% CI = .15, .43; p < .0001), bullying victimization (β = .16, 95% CI = .10, .23; p < .0001), and social support from family (β = .41, 95% CI = -.54, -.28; p < .0001). Harsh parenting & maltreatment was not significantly associated with social support from peers (β = -.08, 95% CI = -.22, .06; p =.253). Social support from family (β = -.12, 95% CI = -.23, -.03; p < .0001) and bullying victimization (β = .27, 95% CI = .11, .42; p = .0004) were significantly associated with Internet addiction. However, social support from peers (β = -.07, 95% CI = -.16, .04; p =.194) was not significantly associated with Internet addiction.

A summary of the mediation analysis for social support and bullying victimization is shown in *Table 5b*. There was a significant indirect effect of harsh parenting & maltreatment on Internet addiction through family support (β = .05, 95% CI = .01, .10; p =.23, mediation proportion = 13%) and bullying victimization (β = .11, 95% CI = .04, .22; p = .006, mediation proportion = 11%). Social support from peers was not a significant mediator (β = .01, 95% CI = -.01, .02; p =.459). The unmediated effect remained significant (β = .30, 95% CI = .15, .43; $p < .0001$) indicating that bullying victimization and family support partially mediated the link between harsh parenting & maltreatment and Internet addiction. Together, family support and bullying victimization accounted for 25% of the effect of harsh parenting & maltreatment on Internet addiction among adolescents after adjusting for confounding variables as above.

Discussion

This study contributes to the research on the possible mechanisms underlying Internet addiction in adolescents, which is an underexplored area of research. The findings demonstrated that core social resource factors including bullying and perceived family support partially accounted for the association of parental harsh discipline and maltreatment with Internet addiction in adolescence.

In this study, we found that verbal aggression was the most common form of maltreatment, with 50.6% of adolescents reporting exposure to verbal aggression in their lifetime, followed by 49.7% of adolescents reporting ever exposure to corporal punishment, and 25.3% of adolescents reporting ever exposure to physical aggression. These figures are similar to the prevalence in a previous Chinese population-based study, which estimated 70.9% for psychological aggression, 39.5% for corporal punishment, and 27% for physical aggression (Chan, Brownridge, Yan et al., 2011). In terms of Internet usage, adolescents exposed to harsh discipline & maltreatment tended to spend more time on the Internet during weekdays

compared with the non-maltreated group. This finding is contrary to a previous study that showed more Internet usage at weekends than during weekdays in the general adolescent population (Mak et al., 2014), which suggests that maltreated adolescents may have different patterns of Internet use.

Consistent with the deterioration model of social support, this study revealed that harsh parenting & maltreatment had significant effects on Internet addiction through family social support and bullying perpetration, even after controlling for a number of confounding variables such as age, sex, family income, number of siblings, place of birth, and school. Family is an important source of security and support. However, when children or adolescents are exposed to maltreatment by caregivers, they are more likely to develop a sense of insecurity toward their caregivers, and view the world as unsafe and attend to hostile social cues, which can lead to problematic relationships (Crittenden & Ainsworth, 1989). With the internalized cognitive distortions of family relationship, maltreatment can affect the adolescents' perception of family support, and they in turn increase their usage of the Internet to escape from stressful family environments, thereby increasing their risk for Internet addiction. In response to inadequate family support and maltreatment, Internet addiction serves as a maladaptive form of avoidance coping strategy and a self-medicating behavior (Hsieh et al., 2016b). Owing to child maltreatment, adolescents fail to gain support from and establish trust with parents and other family members in the real world, which facilitate their temptation to cope with the adverse experiences by burying them in the Internet-based social network. Not only could they avoid or reduce the negative affect, they also become increasingly reliant on Internet addiction as a coping tool because of the lack of access to an effective support system at the family level.

Moreover, consistent with the study's hypothesis, this study found that harsh discipline and maltreatment in adolescents spilled over to problematic peer relationships, manifest as either bullying perpetration or bullying victimization, which was also associated with increased

risk for Internet addiction. Children and adolescents exposing to child maltreatment by caregivers may have acquired pro-violence attitudes, resulting in higher acceptance of violence in interpersonal relationships and higher risk of bullying (Chen et al., 2018). Dysfunctional peer relationships involving bullying perpetration and bullying victimization may increase adolescents' risk of turning to the Internet to establish relationships or to escape from stressful social environments. In particular, the anonymous nature of the Internet may provide an alternative safe space for maltreated adolescents to alter their identity and to meet their social needs. The cyber world may be perceived by adolescents as a safe environment that allows them to express their painful feelings. Playing and interacting with other people online helps the individual to develop a better sense of relatedness and competence. However, contrary to our hypothesis, adolescents' peer support did not mediate the association between harsh parenting & maltreatment and Internet addiction, indicating that in the face of violence, adolescents may not turn to their peers for support.

Study Implications

The mediating effects of bullying and family support on the association of harsh parenting & maltreatment with Internet addiction suggest that early identification and intervention for adolescents exposed to maltreatment and parental harshness may help prevent bullying and possibly reduce the risk of developing Internet addiction. For maltreated adolescents, interventions that focus on enhancing accessibility to a social network and expanding their social network outside of their family may be a promising strategy to prevent them from developing Internet addiction. Paradoxically, it is not easy to help adolescents extend their social network outside the family, because they may not have adequate social skills or the confidence to build meaningful relationships with their peers, particularly if they have relationship problems with their parents. It is therefore important for professionals to help adolescents identify safe and stable relationships, including informal social support from

relatives, grandparents, and teachers who can help them nurture their confidence and competence in social relationships, ultimately promoting their well-being. In particular, professionals can explore the potential benefits of grandparental support, as a large proportion of grandparents live with or are close to their grandchildren in the Asian context, including in Hong Kong (Leung et al., 2015; Mehta & Thang, 2011).

It has been suggested that restricting adolescents' time spent on the Internet may be an effective measure to prevent addictive Internet use in Hong Kong (Wang et al., 2014). However, in light of the study's finding showing that maltreatment and harsh discipline may be one of the contributing factor to Internet addiction, professionals working with adolescents with Internet addiction problems should assess their family functioning and screen for history of child maltreatment. Special care and targeted intervention, such as addressing underlying family dysfunction rather than reducing the Internet use per se, will likely be more effective to help adolescents cope with Internet addiction. Conversely, for professionals working with adolescents with a history of child maltreatment and bullying, they should assess these adolescents' online behaviors, as the Internet can be used by victims to obtain a sense of belonging, for emotional ventilation, and for psychological gratification. Over-reliance on the Internet to meet these psychological needs may increase adolescents' risk for Internet addiction.

In Hong Kong, excessive Internet use is matter of concern for health policy maker, calling for consortium of stakeholders in developing effective policy and program in response to the issue (Chung et al., 2018). In particular, parental involvement such as parental supervision was suggested to be one of the key components in preventing Internet addiction and other related disorders (Chung et al., 2018). While parental supervision may be useful in preventing Internet addiction in adolescents living in general and healthy families, negative parental control behaviors that involve excessive constraints is associated with increased risk of Internet addiction (Li et al., 2014). Parent-child conflicts over excessive Internet use, may in

turn trigger child maltreatment, creating a negative vicious cycle of abuse and Internet addiction. Preventive strategies targeting maltreating parents or dysfunctional families should be carefully developed.

Although the findings from this study suggest that harsh discipline & maltreatment negatively affects adolescents' perceived family support and impairs peer relationships (in the form of bullying perpetration and bullying victimization) that in turn may result in Internet addiction, it should be noted that the mediating effects were only partial. Future research is needed to examine the unexplained effects and to refine the explanation for the association. More studies are also needed to closely examine the role of peer social support in harsh parenting & maltreatment, as this study showed that peer social support did not significantly mediate the effect of parental harshness on Internet addiction. Furthermore, while this study focused on family and peer relationships that influence Internet addiction, teachers and other supportive networks that might buffer the effect of harsh parenting & maltreatment on Internet addiction are still worth considering.

Limitations

Caution is needed when interpreting the findings of this study. First, this study is limited by its cross-sectional study design, hence a causal relationship between harsh parenting & maltreatment and Internet addiction cannot be established and mediations were hypothesized. Future research may benefit from the use of a prospective, longitudinal design. In addition, as this study adopted a convenient sampling method, the adolescents included in the analysis might not represent the general adolescent population in Hong Kong, making it challenging to generalize the absolute risks and summary statistics, even though relative risk may be generalizable. The data is based on adolescents' self-reports, and therefore is subject to reporting bias due to social desirability, especially for some of the sensitive questions about their experience of bullying behaviors and exposure to child maltreatment. In addition, we

dichotomized the adolescents into maltreated group or not according to the adolescents' self-report of any exposure to harsh discipline or maltreatment perpetrated by their caregivers. This dichotomization approach has clear limitations, as we were unable to differentiate the two groups and determine the level of severity of each type of harsh discipline and maltreatment acts. Although this categorization is less stringent, it is important to note that harsh disciplinary acts can still be harmful to adolescents and that physical punishment is closely related to physical abuse (Straus, 2000). Another limitation is regard to potential reporting bias. As bullying often occurs in a school setting, students may not feel safe in reporting experiences of victimization, which may result in under-reporting. To minimize this limitation, we did not collect personal identifiers with the questionnaires. Participants were asked to fill in the questionnaire during class time and questionnaires were collected immediately after completion. Moreover, although growing attention has been paid to online gaming disorders, this study focused on Internet addiction without specifying the types of activities adolescents engaged in.

Conclusions

This study showed that harsh parenting and child maltreatment is indirectly associated with Internet addiction via bullying perpetration, bullying victimization, and social support from family. The findings provide additional evidence that social and family factors are crucial in understanding Internet addiction. Effective prevention and intervention strategies for Internet addiction should target family and social vulnerabilities in adolescents.

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Table 1

Characteristics of the study participants (N = 1204)

Variables	*N (%)*/ Mean (*SD*)
Age (years)	13.36 (1.15)
Sex	
Female	576 (47.84)
Male	628 (52.16)
Place of birth	
Hong Kong	1017 (84.5)
Mainland China	171 (14.2)
Other	10 (0.8)
Missing	6 (0.5)
No. of siblings	0.99 (0.82)
Maternal Education	
Primary or below	138 (11.5)
Lower secondary	264 (21.9)
Upper secondary	479 (39.8)
Post secondary	125 (10.4)
Missing	198 (16.4)
Paternal Education	
Primary or below	114 (9.5)
Lower secondary	252 (20.9)
Upper secondary	450 (37.4)
Post secondary	142 (11.8)
Missing	246 (20.4)
Family monthly income (USD)	
<$1,282	143 (11.9)
$1,282 - <$2,564	356 (29.6)
$2,564 - <$3,846	208 (17.3)
$3,846 or above	211 (17.5)
Missing	286 (23.8)
Harsh parenting and maltreatment	
Corporal punishment	598 (49.7)
Physical aggression	305 (25.3)
Verbal aggression	609 (50.6)
Bullying	
Victimization	553 (45.9)
Perpetration	575 (47.8)

Table 2

Internet usage patterns of adolescents exposed to harsh parenting & maltreatment

	Non-maltreated (Mean, *SD*)	Maltreated (Mean, *SD*)	χ^2 / t	p
Internet addiction test score	34.70 (12.35)	40.07 (14.01)	46.84	< .001
Internet addiction classifications			42.95	< .001
Average user (score 30 or less)	235 (43.9)	167 (27.2)		
Mild risk (31-49)	235 (43.9)	310 (50.5)		
Moderate risk (50-79)	62 (11.6)	126 (20.5)		
High risk (80 or more)	3 (0.6)	11 (1.8)		
Engagement in social networking			2.79	.59
Not at all	163 (29.1)	176 (27.5)		
< 0.5 hours	79 (14.1)	100 (15.6)		
0.5 - <1 hour	62 (11.1)	62 (9.7)		
1 - <2 hours	83 (14.8)	112 (17.5)		
>2 hours	173 (30.9)	189 (29.6)		
Engagement in online gaming			17.83	.001
Not at all	126 (22.5)	96 (15.0)		
< 0.5 hours	185 (33.0)	203 (31.7)		
0.5 - <1 hour	79 (14.1)	83 (13.0)		
1 - <2 hours	71 (12.7)	100 (15.6)		
>2 hours	100 (17.8)	158 (24.7)		
Time spent online during weekdays (hours)	2.71 (2.84)	3.17 (3.62)	5.88	.02
Time spent online during weekends (hours)	4.71 (4.08)	5.14 (3.94)	3.28	.07

Table 3

Correlation matrix of the study variables

	Variable	Mean (SD) / N (%)	Correlation					
			1	2	3	4	5	6
1	MSPSS friends	19.30 (5.99)	1.00***	.56***	-.23***	-.20***	-.10**	-.06
2	MSPSS family	41.47 (11.84)	.56***	1.00***	-.16***	-.02	-0.03	-.04
3	IAT	37.57 (13.53)	-.23***	-.16***	1.00***	.18***	.24***	.15***
4	CTS-PC	548 (45.5)	-.20***	-.02	.18***	1.00***	.25***	.21***
5	Bullying perpetration	527 (43.8)	-.10***	-.03	.24***	.25***	1.00***	.44***
6	Bullying victimization	487 (40.4)	-.06*	-.04	.15***	.21***	.44***	1.00***

Table 4

a. Coefficients of path analysis of the study variables

Outcome	Predictor	β (95% CI)	p	
Internet addiction score	Bullying perpetration	.36 (.23, .49)	< .0001	***
Internet addiction score	Social support (family)	-.12 (-.22, -.02)	.013	*
Internet addiction score	Social support (peers)	-.07 (-.17, .02)	.15	
Internet addiction score	Harsh parenting & maltreatment	.27 (.12, .41)	.0001	***
Bullying perpetration	Harsh parenting & maltreatment	.27 (.20, .34)	< .0001	***
Social support (family)	Harsh parenting & maltreatment	-.41 (-.54, -.28)	< .0001	***
Social support (peers)	Harsh parenting & maltreatment	-.08 (-.22, .06)	.271	

CI = Confidence interval; *p < .05; **p < .01; ***p < .001
Adjusted for age, sex, number of siblings, family income, place of birth, and school

b. Direct and indirect associations between harsh parenting & maltreatment and Internet

addiction in relation to bullying perpetration

	Coefficient estimates (95% CI)	Proportion of mediation (95% CI)	p	
Total effect	.42 (.28, .57)	1	< .0001	***
Unmediated effect	.27 (.12, .41)	.64 (.42, .78)	< .0001	***
Effect mediated through:				
Bullying perpetration	.10 (.06, .14)	.23 (.13, .37)	.0001	***
Social support (family)	.05 (.01, .10)	.12 (.02, .26)	.045	*
Social support (peers)	.01 (-.01, .02)	.01 (-.01, .06)	.447	

CI = Confidence interval; *p < .05; **p < .01; ***p < .001

Adjusted for age, sex, number of siblings, family income, place of birth, and school

Table 5

a. Coefficients of path analysis of the study variables

Outcome	Predictor	β (95% CI)	p	
Internet addiction score	Bullying victimization	.27 (.11, .42)	.0004	***
Internet addiction score	Social support (family)	-.12 (-.23, -.03)	.015	*
Internet addiction score	Social support (peers)	-.07 (-.16, .04)	.194	
Internet addiction score	Harsh parenting & maltreatment	.30 (.15, .43)	< .0001	***
Bullying victimization	Harsh parenting & maltreatment	.16 (.10, .23)	< .0001	***
Social support (family)	Harsh parenting & maltreatment	-.41 (-.54, -.28)	< .0001	***
Social support (peers)	Harsh parenting & maltreatment	-.08 (-.22, .06)	.253	

CI = Confidence interval; *p < .05; **p < .01; ***p < .001
Adjusted for age, sex, number of siblings, family income, place of birth, and school

b. Direct and indirect associations between harsh parenting & maltreatment and Internet addiction in relation to bullying victimization

	Coefficient estimates (95% CI)	Proportion of mediation (95% CI)	p	
Total effect	40 (.26, .52)	1	< .0001	***
Unmediated effect	.30 (.15, .43)	.75 (.53, .88)	< .0001	***
Effect mediated through:				
Bullying victimization	.04 (.01, .08)	.11 (.04, .22)	.006	***
Social support (family)	.05 (.01, .10)	.13 (.03, .29)	.023	*
Social support (peers)	.01 (-.01, .02)	.01 (-.2, .6)	.459	

CI = Confidence interval; *p < .05; **p < .01; ***p < .001

Adjusted for age, sex, number of siblings, family income, place of birth, and school

Figure 1

Path models of the study

```
                        ┌─────────────────────────┐
                        │ Bullying perpetration /  │
                        │      victimization       │
                        └─────────────────────────┘
                   b                                    a
┌──────────────────┐        d      ┌──────────────────┐      a      ┌──────────────────┐
│ Harsh parenting &│──────────────→│  Social support  │────────────→│ Internet addiction│
│ child maltreatment│               │     (family)     │             │      score        │
└──────────────────┘               └──────────────────┘             └──────────────────┘
                   d                                    a
                        ┌──────────────────┐
                        │  Social support  │
                        │     (peers)      │
                        └──────────────────┘
```
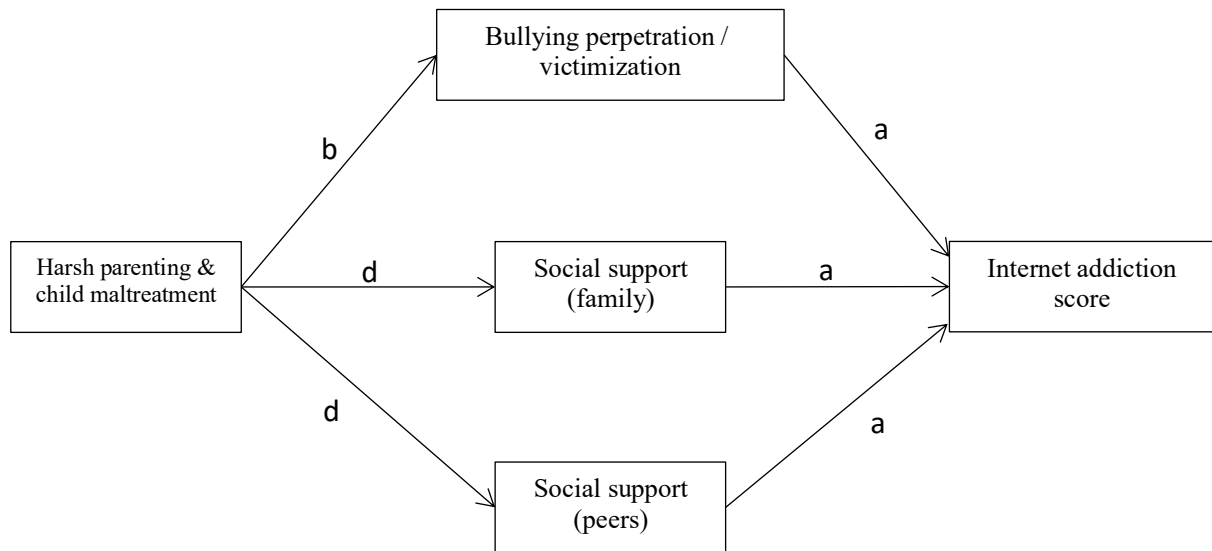
Each letter represents a regression model