A Novel Application of Multiple Regression Analysis Models to Internet Addiction

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Abstract – In this study we apply multiple regression analysis models to examine: i) associations between four types of family and peer victimization and child internet addiction, and ii) mediating effects of psychological symptoms on these associations. Data were collected from a national proportionately-stratified random sample of 6,233 fourth-grade primary school students in Taiwan in 2014. Bivariate correlations and sets of multiple regression analyses were conducted to examine the direct effects of multidimensional victimization on child internet addiction and the indirect effects through psychological symptoms. The results reveal that being male and experiencing victimization (psychological neglect, physical neglect, witnessing domestic violence, and bully victimization) are associated with an increased risk of developing psychological symptoms and internet addiction among children. Moreover, we found that psychological symptoms partially mediate the associations between multidimensional victimization and child internet addiction, with the exception of physical neglect. In conclusion, we demonstrate: i) the direct and indirect effects of multidimensional victimization on the psychological symptoms and child internet addiction, and ii) the importance of early family- and school-based prevention and intervention in addressing related public health concerns of multidimensional victimization and child internet addiction.

Keywords - bullying, child neglect, internet addiction, psychological symptoms, witnessing domestic violence

I. INTRODUCTION

Over the past thirty years, most people have been impacted significantly by technology. Currently, the internet is an important part of our daily lives. Access to the internet is available via computer, laptop, tablet, gaming console, or even smartphones, which are essentially powerful mini-computers that are readily available 24 hours a day at our uncensored and perhaps impulsive fingertips. So, the internet is now as close as our pocket or the palm of our hand. The internet can provide benefits in the realms of knowledge, education, entertainment, banking, communication, and more. However, most pressing and dark sides of internet use is internet addiction, which is the inability to control internet use an inability that can eventually lead to psychological, social, academic, and vocational problems and impairment (Davis, 2001; Young & Rogers, 1998). Compulsive usage and overdependence on the internet and smartphones are related to user stress and psychological traits, such as locus of control, social interaction anxiety, materialism, and the need for touch (Lee, Chang, Lin, & Cheng, 2014). In addition, “phubbing” (phone snubbing) can have a negative impact on relationship satisfaction and an indirect impact on depression and life dissatisfaction (Roberts & David, 2016). Children who are addicted to the internet may use the internet for extended hours and isolate themselves from other forms of social contact and broader life events. Prevalence rates for internet addiction in the United States and Europe ranged from 1.5% to 8.2% from 2000 to 2009 (Weinstein & Lejoeux, 2010). In Eastern Asia, the prevalence rate for having five or more symptoms of internet addiction among adolescents in Hong Kong in 2005 was 6.7% (Fu, Chan, Wong, & Yip, 2010) and 13.7% among college students in Taiwan in 1998 (Chou & Hsiao, 2000).

Most of the previous research on problematic internet use focused on adolescents and college students. However, the use of computer tablets, smartphones, and the internet can start as early as one year old when parents are trying to attract and hold their children’s attention, keep them calm, or provide educational stimulation. Among families with children aged eight and younger in the United States, a five-fold increase in the ownership of tablet devices such as iPads has occurred, from 8% of all families in 2011 to 40% in 2013 (Common Sense Media, 2013). The percentage of children with access to some type of smartphone or tablet has jumped from half (52%) to three-quarters (75%) of all children in just two years. Another study with a large national sample that covered children and adolescents from ages 8 to 18 in the United States found that young people have increased the amount of time they spend consuming media to over seven hours a day, which is almost the same amount of time that most adults spend at work each day, except that young people use these media seven days a week instead of five (Rideout, Foehr, & Roberts, 2010). Specifically, 8- to 10-year-olds spent five hours and twenty-nine minutes on media use in a typical day, and 11- to 14-year-olds spent eight hours and forty minutes. Although evidence has shown that accessibility to and the time spent on media among young children have increased over time, data about young children’s internet addiction are limited. One study screened for the presence of internet addiction among elementary school-aged children, and the results showed that 13.8% of 11-year-old Korean children tested positive for internet addiction (Ha, Yoo, Cho, Chin, Shin, & Kim, 2006). A government report in Taiwan found that 93.6% of students ages 10 to 18 have internet access at
home, most students started to use the internet as third or fourth graders (ages 9 to 10), and 65.7% of elementary students even have a Facebook account (Taiwan Ministry of Education, 2014). The Taiwanese government also found that, as of 2015, the prevalence rate of internet addiction among elementary students in Taiwan is 9.3%, 11.9% for online gaming addiction, and 10.6% for smartphone/tablet addiction (Taiwan Ministry of Education, 2015). Another study reported that the prevalence rate of internet addiction is 9.9% among 10- to 12-year-olds in Taiwan (Microsoft and the Child Welfare League Foundation, 2011). Therefore, it is important to examine the nature, patterns, and risk factors associated with internet addiction of young children and address the importance of prevention and intervention at early ages.

II. MULTIDIMENSIONAL VICTIMIZATION AND INTERNET ADDICTION

Research about internet addiction has documented prevalence rates across countries and has identified individual-level risk factors, including personality traits (Sariyska et al., 2014), certain online activities such as online gaming and social applications (Kuss, van Rooij, Shorter, Griffiths, & van de Mheen, 2013), and mental health problems such as depression (Chang, Chiu, Lee, Chen, & Miao, 2014; Yen et al., 2008) among adolescents or college students. For family-level risk factors, higher levels of parent-adolescent conflict and lower levels of family functionality and monitoring have been linked to a greater likelihood of internet addiction among adolescents (Yen, Yen, Chen, Chen, & Ko, 2007). However, little is known about the associations between internet addiction and the multiple types of victimization in family and school contexts among school-aged children.

Child victimization is one of the most important predictors of internet addiction (Hsieh et al., 2016). Hsieh et al. (2016) found that child neglect, paternal physical violence, and sexual violence are associated with child internet addiction. However, it is unclear whether witnessing violence between parents has a different effect than being the direct victim of violence, and whether peer violence has a different effect than child maltreatment. Therefore, in addition to direct forms of parent-child violence, indirect forms of inter-parental violence and child-peer violence, and their relationships to internet addiction, must be examined. As an extension of previous research (Hsieh et al., 2016), this study identified child victimization in the contexts of direct (parent-child) and indirect (inter-parental) violence, as well as in the context of peer violence, and examined the associations of these different types of victimization with internet addiction.

A. Parent-Child Violence

In the context of parent-child violence, child neglect is the most common form of maltreatment. Research often has focused on physical and sexual violence, often to the exclusion of neglect (Stith et al., 2009). However, child psychological and physical neglect is more prevalent than physical and sexual violence, and can be extraordinarily harmful to child development (Shin, Miller, & Teicher, 2013). Neglect accounted for 78% of all victims of child maltreatment and contributed to over 68% of child maltreatment-related deaths in 2010 (U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, & Children’s Bureau, 2011). Neglect often is defined as the failure of parents or caregivers to meet their children’s basic needs and proper level of care (American Psychological Association, 1998). For example, psychological neglect refers to the failure of a parent to provide needed emotional and psychological nurturing, whereas physical neglect refers to the failure of a parent to provide adequate food, clothing, health care, supervision, and a safe living environment to the degree that the child’s health, safety, and well-being are threatened (Child Welfare Information Gateway, 2014). Research has shown that child neglect is associated significantly with internalizing and externalizing behaviours as well as adverse cognitive and academic outcomes (Mills et al., 2011, 2013). With regard to internet-related problems in the context of parent-child violence, a 2012 study suggested that overall child maltreatment is associated with problematic internet use among college students in their early adulthood (Yates, Gregor, & Haviland, 2012). However, for children, only one study (Hsieh et al., 2016) has examined the relationships between child maltreatment and internet addiction among fourth-grade children. The Hsieh et al. (2016) findings indicate that both physical neglect and psychological neglect are associated with internet addiction directly and indirectly through the pathway of post-traumatic stress disorder (PTSD).

B. Inter-Parental Violence

In the context of inter-parental violence, although children may not be targeted directly as the immediate victims of violence, children who witness and are exposed to domestic violence in the family context are more likely to suffer developmental difficulties, including internalizing behaviours (i.e., depression and anxiety), externalizing behaviours (i.e., aggression and conduct problems), poor cognitive and academic functioning, social incompetence, and poor physical health (Holt, Buckley, & Whelan, 2008; Kolbo, Blakely, & Engleman, 1996; Voisin & Hong, 2012; Wood & Sommers, 2011; Yount, DiGirolamo, & Ramakrishnan, 2011).

With regard to internet-related problems in the context of inter-parental violence, research using direct-effect models has shown that high levels of inter-parental conflict, adolescents’ exposure to marital violence, and having divorced parents are factors associated with problematic internet use among adolescents in Eastern Asia (Li, Garland, & Howard, 2014; Park, Kim, & Cho, 2008; Shek
& Yu, 2012; Yen, Ko, Yen, Chang, & Cheng, 2009). However, little is known about the relationship between witnessing domestic violence and internet addiction among school-aged children and the pathways that lead to internet addiction. At different stages, children face specific developmental challenges that can be disrupted by exposure to family violence. Therefore, the effects vary depending on children’s vulnerability at certain periods of development and the interactions between the developmental stage and exposure to different types of violence (Margolin & Gordis, 2000). Younger children may be more susceptible to the effects of family violence than older children, but problems that are manifest by some children may not necessarily carry over to adolescence (Sternberg, Lamb, Guterman, & Abbott, 2006).

C. School-Aged Children

For school-aged children, although their parents are the most important persons in their lives, peers also play a meaningful role in their behavioural and social development. In the context of child-peer violence, being bullied in school can lead to physical and psychological symptoms such as headaches, stomach-aches, loneliness, depression, social anxiety, having a bad temper, and sleep problems (Due et al., 2005; Farrington, Loeber, Stallings, Ttofi, 2011; Nishina, Juvonen, & Witkow, 2005) as well as social and behavioural problems, such as peer rejection, delinquency, violence, binge drinking, substance abuse, and suicide ideation (Farrington et al., 2011; Hemphill et al., 2011; Hodges & Perry, 1999; Radliff, Wheaton, Robinson, & Morris, 2012). Only a few studies have examined the relationships between bully victimization and internet-related problems. Kim et al. (2015) found that victims of bullying among elementary school children who attend child-welfare facilities in South Korea reported internet addiction. Another study conducted in Spain showed that cyber-bullying victimization at time 1 predicted problematic internet use at time 2 (6 months apart) among adolescents, but problematic internet use did not predict cyber-bullying (Gámez-Guadix, Orue, Smith, Calvete, 2013). However, little is known about the mechanisms and pathways between bully victimization and internet addiction among school-aged children.

Multidimensional Victimization and Psychological Symptoms depression, hostility, sleep disturbance, and interpersonal hypersensitivity. The burdens that result from these symptoms not only decrease an individual’s productivity, but also increase the risk of behavioural problems. Although child neglect, physical abuse, and sexual abuse all have been associated with externalizing problems, child neglect has its unique effect on internalizing problems, social withdrawal, and limited peer acceptance (Hildyard & Wolfe, 2002; Manly, Kim, Rogosch, & Cicchetti, 2001). Compared to non-maltreated and non-abused children, neglected pre-schoolers are more likely to feel hopeless and angry, confused about others’ emotional displays, unhappy, and have the lowest positive affection and self-representation, and problems with emotional regulation (Crittenden, 1992; Egeland, Sroufe, Erikson, 1983; Pollack, Cicchetti, Horning, & Reed, 2000; Toth, Cicchetti, Macfie, & Emde, 1997). Neglected school-age children tend to be more avoidant in social interactions with peers and have a negative mental representation of themselves and others (Kaufman & Cicchetti, 1989; McCrone, Egeland, Kalkoske, & Carlson, 1994). Physically neglected children exhibited the most severe socioemotional and internalizing problems from kindergarten to elementary school (Erickson, Egeland, Pianta, 1989). Even after controlling for physical and sexual abuse, child neglect was still significantly associated with personality disorders and symptoms of anxiety and depression during early adolescence (Johnson, Smailes, Cohen, Brown, & Bernstein, 2000).

D. Witnessing Domestic Violence

Witnessing domestic violence also negatively affected children’s psychological adjustment. Adolescents who have been exposed to inter-parental physical and psychological violence tend to feel hopeless and have low self-esteem and psychological adjustment problems, such as depression, anxiety, PTSD, and oppositional defiant disorder (Haj-Yahia, 2001). Similarly, young adults who have been exposed to inter-parental violence in childhood or adolescence are more likely to have mental health problems, anxiety, and depression (Fergusson & Horwood, 1998; Turner & Kopiec, 2006). Finally, bully victimization also has been associated with psychological symptoms. A large-scale international study across 28 countries revealed that adolescents who were bullied were more likely to have psychological symptoms (e.g., feeling nervous, low, left out, lonely, helpless, and have a bad temper, sleep problems, and morning tiredness) (Due et al., 2005) than adolescents who had not been bullied. Similarly, a twin study found that a monozygotic twin who had been bullied at ages 7 and 9 had more internalizing symptoms than his/her co-twin who had not been bullied (Arseneault et al., 2008). In sum, child neglect, witnessing domestic violence, and bully victimization are associated with negative psychological symptoms.

The current study extends previous research by examining the associations among multiple types of victimization (psychological and physical neglect, witnessing domestic violence, and bully victimization) and psychological symptoms and internet addiction in the contexts of family violence and peer violence. Our primary hypothesis is comprised of two parts: Victimization in terms of parent-child violence, inter-parental violence, and peer violence has a direct effect on children’s internet addiction. Multidimensional victimization has an indirect effect on children’s internet addiction through the pathway of psychological symptoms.
III. METHOD

This study is part of the Longitudinal Study of Children’s and Adolescents’ Family and Social Experiences (LSCAFSE). The Institutional Review Board of the National Taiwan University Hospital declared that the LSCAFSE was consistent with the protection of the rights and welfare of human subjects.

A. Participants

We conducted this study in the 2014 spring semester with fourth-grade students. We stratified the sample by geographical locations across Taiwan (19 counties or cities in total) and randomly selected districts to increase representation. Of the invited elementary schools, approximately 49% (school n = 314) agreed to participate, and the final sample of this study consisted of 6,233 fourth-grade students (50.3% boys) who had parental consent and whose data were valid.

B. Procedure

Before administering the questionnaires, trained research assistants explained the research purpose and procedures to the students and emphasized the voluntary and confidential nature of the research. The assistants also informed the students of their right to withdraw from participation at any time. Self-report questionnaires were distributed to consenting students in group sessions scheduled for a period during or outside regular class hours.

C. Measures

The questionnaire was first sent to a group of seven experts for content validity examination (4 child development scholars, 1 sociologist, 1 clinical social worker, 1 statistician) before the measures were administered to 726 pilot-study participants. The LSCAFSE research team modified some measures according to (1) suggestions from scholars and other experts and (2) the results of the pilot study’s internal consistency analysis and principal component analysis. Psychometrics of these measures were examined again after formal data were collected.

D. Internet Addiction

We adapted items from the Revised Chen Internet Addiction Scale (CIAS-R) (Chen, Weng, Su, Wu, & Yang, 2003) to measure internet addiction. The original scale contains 26 items covering two domains: core symptoms (14 items) and related problems (12 items). The core symptoms comprise compulsion symptoms, withdrawal symptoms, and tolerance, and the related problems comprise interpersonal/health problems and time-management problems. Items are rated on a 5-point scale anchored by 1 (very not true) to 5 (very true). Considering children’s attention spans and the length of the questionnaire, in this study we used a short version of the scale by selecting items that have high factor loadings (higher than 0.55 or 0.60). This subscale used in the current study contains 10 items, including core symptoms (6 items) and related problems (4 items). The reliability of the scale was calculated using a Cronbach’s alpha of 0.88, demonstrating strong internal consistency. Construct validity was examined via factor analysis that confirmed the proposed two-factor structure and explained 60% of the variance.

E. Psychological and Physical Neglect

We used the 6-item Neglect Subscale of the ISPCAN Child Abuse Screening Tool Children’s Version (ICAST-C Zolotor et al., 2009) to define psychological neglect and physical neglect in the past year, and added one more item that accounts for children being left alone at home. Participants used a 5-point scale (0 = never, 1 = seldom, 2 = sometimes, 3 = very often, and 4 = always) to rate the frequency of parental psychological neglect, and used a 5-point scale (0 = never, 1 = 1 ~ 2 times, 2 = 3 ~ 5 times, 3 = 6 ~ 10 times, and 4 = more than 10 times) to rate the frequency of physical neglect by their parents. Higher scores indicated more severe child neglect. The reliability of the overall neglect scale was calculated using a Cronbach’s α of .70, and .65 for the psychological neglect subscale, and .61 for physical neglect.

F. Witnessing Domestic Violence

Two items from the Childhood Experiences of Violence Questionnaire (CEVQ) (Walsh, MacMillan, Trocmé, Jamieson, & Boyle, 2008) were used to define a child’s exposure to inter-parental violence: (1) “How many times have you ever seen or heard any one of your parents say hurtful or mean things to each other or to another adult in your home?” and (2) “How many times have you ever seen or heard any one of your parents hit each other or another adult in your home?” Participants used a 5-point scale (from 1 = never to 5 = more than 10 times) to rate the frequency of exposure to domestic violence. Test-retest reliability of the stem items exceeded .81. The Kappa coefficient of agreement for the classification of domestic violence indicated excellent interrater reliability (Landis & Koch, 1977).

G. Bully Victimization

The bully victimization scale used in this study is composed of seven items to measure the respondent’s victimization experience: verbal insult, threats, extortion, property damage, physical violence, and relational aggression. The scale was drawn from multiple existing instruments with modifications, and previous studies have shown its adequate reliability (Chen & Astor, 2012; Furlong
et al., 2005; Wei, Williams, Chen, & Chang, 2010). The scores were internally consistent (α = .86).

H. Psychological Symptoms

The Brief Symptom Rating Scale (BSRS-5) is composed of five self-report items for participants to report their psychological symptoms in the past week. This scale is commonly used in Taiwan to screen for psychological disorders. It is derived from the 50-item BSRS that measures anxiety (feeling tense or high-strung), hostility (feeling easily annoyed or irritated), depression (feeling depressed or in a low mood), interpersonal sensitivity (feeling inferior to others), and additional symptoms (i.e., having trouble falling asleep in the past week). The score for each item ranges from 0 to 4 (0 = not at all; 1 = a little bit; 2 = moderately; 3 = quite a bit; and 4 = extremely). The scores were internally consistent (α = .84).

IV. RESULTS

Among the different types of child victimization examined in the current study, bully victimization was found to be the most prevalent (71%), followed by psychological neglect (69%), physical neglect (67%), and witnessing domestic violence (28%). Table 1 provides the bivariate correlations and means for the major variables used in this study. All correlations between the model variables are statistically significant and in the expected directions. To test for the mediating effects of the psychological symptoms on the associations between multidimensional victimization and child internet addiction.

<table>
<thead>
<tr>
<th>Variables</th>
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<th>4</th>
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<th>7</th>
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<tbody>
<tr>
<td>Psychological Neglect</td>
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<td>Physical Neglect</td>
<td>0.38**</td>
<td>–</td>
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<tr>
<td>Witness to Domestic Violence</td>
<td>0.21**</td>
<td>0.25**</td>
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<tr>
<td>Bully Victimization</td>
<td>0.29**</td>
<td>0.30**</td>
<td>0.30**</td>
<td>–</td>
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<tr>
<td>Psychological Symptoms</td>
<td>0.34**</td>
<td>0.24**</td>
<td>0.26**</td>
<td>0.37**</td>
<td>–</td>
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<tr>
<td>Internet Addiction</td>
<td>0.25**</td>
<td>0.23**</td>
<td>0.17**</td>
<td>0.22**</td>
<td>0.27**</td>
<td>–</td>
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<tr>
<td>Child Gender</td>
<td>0.02</td>
<td>0.10**</td>
<td>0.05**</td>
<td>0.07**</td>
<td>-0.02</td>
<td>0.16**</td>
<td>–</td>
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<tr>
<td>Mean</td>
<td>1.93</td>
<td>1.22</td>
<td>0.58</td>
<td>1.63</td>
<td>3.57</td>
<td>1.82</td>
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Source: this study. Note: Gender was dummy-coded such that 0=female and 1=male. Multidimensional victimization comprises psychological neglect, physical neglect, witnessing domestic violence, and bully victimization. **>0.01.

As shown in Table 2, boys were more likely than girls to have high levels of internet addiction (β = 0.14, p < 0.001). After controlling for gender, all types of victimization in the study indicated direct effects on internet addiction and psychological symptoms. Moreover, psychological symptoms partially mediated the associations between multidimensional victimization and internet addiction, except for physical neglect.

A. Psychological Neglect

Psychological neglect was shown to be associated positively with internet addiction (see Step 1; β = 0.16, p < 0.001) and with psychological symptom(s) (see Step 2; β = 0.22, p < 0.001). After psychological symptom(s) was added to the model, psychological neglect significantly predicted internet addiction with a reduction in the coefficient (see Step 3; β = 0.12, p < 0.001). The Sobel test supported our finding that psychological symptom partially mediated the effect of psychological neglect on internet addiction (Z = 10.33, p < 0.001).

B. Physical Neglect

Physical neglect was shown to be associated positively with internet addiction (P = 0.10, p < 0.001) and with psychological symptom(s) (P = 0.05, p < 0.001). After psychological symptom(s) was added to the model, physical neglect still significantly predicted internet addiction with no reduction in the coefficient (P = 0.10, p < 0.001). Therefore, psychological symptom did not mediate the association between physical neglect and internet addiction.

C. Witnessing Domestic Violence

Witnessing domestic violence was shown to be associated positively with internet addiction (P = 0.08, p < 0.001) and with psychological symptom(s) (P = 0.13, p < 0.001). After psychological symptom(s) was added to the model, witnessing domestic violence still significantly predicted internet addiction with a reduction in the coefficient (P = 0.05, p < 0.001). The Sobel test supported our finding that psychological symptom partially mediated the effect of witnessing domestic violence on internet addiction (Z = 8.07, p < 0.001).
Despite these limitations, an important strength of the present study is our decision to include multiple types of victimization in the contexts of family and peers as risk factors. Thus, we were able to examine their unique effects on internet addiction and to explore possible mechanisms that underlie the effects. Moreover, whereas much of the earlier research on internet addiction used college student samples, our sample consisted of school-aged children to investigate the early onset of internet addiction and the risk factors of family, peers, and mental health that underlie internet addiction. Finally, our use of a large sample size with a stratified random sampling design has honed our representation and generalization.

V. CONCLUSION

In summary, we conclude that multiple types of victimization in the contexts of family and peers constitute important factors in predicting psychological symptoms and internet addiction in middle childhood. Sets of regression models reflect the direct effects of multidimensional victimization on child internet addiction and the indirect effects through the pathway of psychological symptoms.

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