Research in Developmental Disabilities 35 (2014) 3543–3553

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Cyberbullying among male adolescents with attention-deficit/hyperactivity disorder: Prevalence, correlates, and association with poor mental health status

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ARTICLE INFO

Article history:
Received 15 May 2014
Received in revised form 24 August 2014
Accepted 28 August 2014
Available online

Keywords:
Adolescent
Attention-deficit/hyperactivity disorder (ADHD)
Cyberbullying
Family
Peer
Bullying

ABSTRACT

The aims of this study were to examine the prevalence rates and multilevel correlates of cyberbullying victims and perpetrators among male adolescents diagnosed with attention-deficit/hyperactivity disorder (ADHD) in Taiwan. The relationships between cyberbullying involvement and depression, anxiety, and suicidality were also examined. The experiences of cyberbullying victimization and perpetration in 251 male adolescents with ADHD were assessed. Logistic regression analysis was used to examine the correlates of cyberbullying victims and perpetrators. The relationships between cyberbullying involvement and depression, anxiety, and suicidality were examined using multiple regression analysis. A total of 48 (19.1%) and 36 (14.3%) participants reported that they were cyberbullying victims or perpetrators, respectively. Those who had increased age and a higher parental occupational socioeconomic status, and reported more severe traditional passive bullying victimization were more likely to be cyberbullying victims. Those who had increased age and combined-type ADHD, and reported lower BAS reward responsiveness, more severe Internet addiction and more severe traditional passive bullying perpetration were more likely to be cyberbullying perpetrators. Cyberbullying victims reported more severe depression and suicidality than those who were not cyberbullying victims. A high proportion of male adolescents with ADHD are involved in cyberbullying. Clinicians, educational professionals, and parents of adolescents should monitor the possibility of cyberbullying involvement among male adolescents with ADHD who exhibit the cyberbullying correlates identified in this study.

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http://dx.doi.org/10.1016/j.ridd.2014.08.035
0891-4222/

1. Introduction

Cyberbullying is a new mode of bullying that has emerged in the digital age (Kowalski, Limber, & Agatston, 2012). Cyberbullying involves bullying through the use of electronic venues, such as social networking sites, e-mail, chat rooms, instant messaging, Web sites, online games, and text messaging (Kowalski & Limber, 2013). Research has revealed that both adolescent victims and perpetrators of cyberbullying are more likely to have psychological problems, including depression (Yang et al., 2013), anxiety (Kowalski & Limber, 2013; Yang et al., 2013), suicidality (Kowalski & Limber, 2013; van Geel, Vedder, & Tanilon, 2014), substance abuse (Sourander et al., 2010; Ybarra, Espelage, & Mitchell, 2007), and adjustment problems in school (Kowalski & Limber, 2013), than those who are not involved in cyberbullying. Therefore, cyberbullying among adolescents is a serious health problem that warrants further investigation by mental health and education professionals.

The prevalence and correlates of cyberbullying in adolescents clinically diagnosed with attention-deficit/hyperactivity disorder (ADHD) have not been thoroughly investigated. Two findings support the importance of investigating cyberbullying in adolescents clinically diagnosed with ADHD. First, both cross-sectional and prospective studies have identified children and adolescents with ADHD as a high-risk group of traditional bullying victimization and perpetration (Holmberg & Hjern, 2008; Yang et al., 2013). Furthermore, traditional bullying co-occurs frequently with cyberbullying (Hinduja & Patchin, 2008). Second, a 2-year prospective study reported that ADHD can predict the occurrence of Internet addiction in adolescents (Ko, Yen, Chen, Yeh, & Yen, 2009), indicating that adolescents with ADHD may spend more time on the Internet than do adolescents without ADHD. Thus, the risk of cyberbullying involvement may be increased for adolescents with ADHD. Examining the prevalence and correlates of cyberbullying involvement and its association with mental health problems in adolescents clinically diagnosed with ADHD is clinically crucial.

Previous studies have examined the associations of several individual, family, and peer factors with cyberbullying involvement in children and adolescents. Regarding individual factors, although low self-esteem was determined to be associated with cyberbullying perpetration and victimization (Yang et al., 2013), the results of previous studies on gender (Hinduja & Patchin, 2008; Wang, Iannotti, & Nansel, 2010) and age difference (Hinduja & Patchin, 2008; Schneider, O'Donnell, Stueve, & Coulter, 2012) in the context of cyberbullying involvement are mixed. Regarding family factors, living in a family that does not comprise two biological parents (Sourander et al., 2010) and poor relationships with parents (Berab & Li, 2007) were observed to be associated with cyberbullying victimization. Regarding peer factors, whereas certain studies have presented mixed results on the association between cyberbullying and poor peer relationships (Calvete, Orue, Estévez, Villardoń, & Padilla, 2010; Williams & Guerra, 2007), most of them have indicated that involvement in physical, verbal, and relational bullying are significantly associated with cyberbullying involvement (Hinduja & Patchin, 2008; Salmivalli, Sainio, & Hodges, 2013). Individual, family, and peer correlates of cyberbullying involvement have not been thoroughly examined in adolescents clinically diagnosed with ADHD.

Previous studies have indicated that severe ADHD symptoms (Kawabata, Tseng, & Gau, 2012), comorbid oppositional defiant disorder (ODD) and conduct disorder (Holmberg & Hjern, 2008), and autism spectrum disorders (ASDs) (Montes & Halterman, 2007) were significantly associated with the traditional bullying involvement of children and adolescents with ADHD. Studies have also reported the significant associations existing between hyperactivity symptoms and cyberbullying perpetration (Sourander et al., 2010), as well as those between excessive Internet use and cyberbullying perpetration and victimization among children and adolescents in a community (Floros, Siomos, Fisoun, Dafouli, & Geroukalis, 2013; Smith et al., 2008). However, the association of ADHD-related characteristics and psychiatric comorbidities with cyberbullying involvement in adolescents clinically diagnosed with ADHD has not been examined.

The association of cyberbullying involvement with ADHD-related behavioral temperamental traits, such as the behavioral inhibition system (BIS) and behavioral approach system (BAS), also requires further study. According to Gray's reinforcement sensitivity theory (Gray & McNaughton, 2003), the BIS represents sensitivity to punishment and reflects anxiety, whereas the BAS represents sensitivity to reward. Compared with the general population, people with ADHD have low BIS inhibition (Hart, Radua, Nakao, Mataix-Cols, & Rubia, 2013), low BAS drive (Castellanos & Tannock, 2002) and high BAS fun seeking (Franken & Muris, 2006). The relationships between behavioral temperamental traits in the BIS and BAS and cyberbullying involvement in adolescents with ADHD are not well characterized.

The aims of this study were to examine the prevalence rates of cyberbullying victimization and perpetration, and their associations with individual (demographic characteristics, behavioral temperamental traits, and self-esteem), ADHD-related (ADHD subtypes and symptoms, and receiving medication for ADHD), psychiatric comorbidity (ODD or conduct disorder, ASD, tic disorder, and Internet addiction), family (parental marriage and occupational socioeconomic status [SES] and satisfaction with family relationships), and peer factors (satisfaction with peer relationships and four types of traditional bullying involvement) in a group of male adolescents clinically diagnosed with ADHD in Taiwan. Research has found gender differences in ADHD (Biederman, Faraone, & Monuteaux, 2002), Internet use behaviors (Ko, Yen, & Yen, 2005) and traditional bullying involvement (Veenstra et al., 2005), and thus we focused on male adolescents with ADHD in this study.

2. Methods

2.1. Participants

The participants were recruited from the child and adolescent psychiatric outpatient clinics of two medical centers in Kaohsiung, Taiwan. Male adolescents aged between 11 and 18 years, diagnosed with ADHD according to the diagnostic criteria in the Diagnostic and Statistical Manual of Mental Disorders-IV Text Revision (DSM-IV-TR; American Psychiatric Association, 2000) were consecutively invited to participate in this study between November 2012 and November 2013. ADHD was diagnosed by applying multiple data collection methods, including (a) an interview with the participant performed by a child psychiatrist; (b) clinical observations of participant behavior; and (c) an examination of the medical history provided by the parents. Adolescents who exhibited intellectual disability, schizophrenia, bipolar disorder, autistic disorder with difficulty in communicating, or any cognitive deficits that prevented them from understanding the study purpose or completing the questionnaires were excluded. A total of 280 adolescents diagnosed with ADHD were invited to participate in this study. Among them, 251 (89.6%) agreed to participate and were interviewed by the research assistants based on the research questionnaire. Of the 29 adolescents who refused to join this study, 15 and 14 refused based on their parents' opinion and their personal opinion, respectively. The Institutional Review Board of Kaohsiung Medical University and Chang Gung Memorial Hospital, Kaohsiung Medical Center, approved this study.

2.2. Measures

2.2.1. Cyberbullying involvement

We used the Cyberbullying Experiences Questionnaire (CEQ) to assess participant experiences with cyberbullying involvement in the previous year, with six items answered using a 4-point Likert scale ranging from 0 (*never*) to 3 (*all the time*). This scale was composed of two 3-item subscales for evaluating experiences with cyberbullying perpetration and victimization through e-mails, blogs, social media (Facebook/Twitter/Plurk), and pictures or video clips. The first three items addressed the experiences of posting mean or hurtful comments; posting pictures, photos, or videos that upset someone; and spreading rumors online. The final three items addressed experiences with the types of victimization that were mentioned in the first three cyberbullying items. The Cronbach's α of the two subscales was 0.64 and 0.70, respectively. For analyses, the responses to the cyberbullying items were dichotomized as *yes* or *no*. Participants who did not give a score of 0 on any item among Items 1–3 and Items 4–6 were identified as self-reported cyberbullying perpetrators and victims, respectively.

2.2.2. Individual factors

In addition to collecting information on participant gender and age, we examined participant reinforcement sensitivity and self-esteem. The levels of reinforcement sensitivity were assessed using the BIS/BAS scales. The BIS/BAS scales contain 20 items ranked on a 4-point Likert scale that assess the sensitivity of the two motivational systems according to reinforcement sensitivity theory (Corr, 2004; Gray & McNaughton, 2003). The BIS measures the degree to which respondents expect to feel anxious when confronted with punishment cues. The BAS comprises subscales of reward responsiveness, drive, and fun seeking, which measure the degree to which rewards lead to positive emotions, a person's tendency to actively pursue appetitive goals, and the tendency to seek and impulsively engage in potentially rewarding activities. A high total score on the subscale indicates a high level of reinforcement sensitivity. The Cronbach's α of the four subscales ranged from 0.68 to 0.83. The level of self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965; Yen, Yen, Liu, Huang, & Ko, 2009). The RSES contains ten 4-point items that assess current self-esteem. A high total score indicates a high level of self-esteem. The Cronbach's α in this study was 0.86.

2.2.3. ADHD-related characteristics

We examined the subtypes of ADHD exhibited by the participants, whether they were receiving medication for ADHD, and the severity of ADHD symptoms in the month preceding the study. The subtypes of ADHD exhibited by the participants, including combined, inattention, and hyperactivity/impulsivity, were determined by child psychiatrists according to the diagnostic criteria in the DSM-IV-TR (American Psychiatric Association, 2000). The child psychiatrists also recorded whether the participants were currently receiving ADHD medication. ADHD symptoms were assessed using the short version of the Swanson, Nolan, and Pelham Version IV Scale-Chinese version (SNAP-IV; Gau et al., 2008; Swanson et al., 2001), which contains 26 items comprising the core DSM-IV-derived ADHD subscales of inattention, hyperactivity/impulsivity, and oppositional symptoms (Gau et al., 2008; Swanson et al., 2001). Each item is rated on a 4-point Likert scale from 0 (*not at all*) to 3 (*very much*). In this study, the total scores of the inattention and hyperactivity/impulsivity subscales were analyzed. The Cronbach's α values of these two subscales in this study were 0.86 and 0.88, respectively.

2.2.4. Psychiatric comorbidity

We assessed the existence of three categories of psychiatric comorbidities, including ODD/conduct disorder, ASDs, and tic disorders, based on clinical interviews and chart reviews. People who had been diagnosed with any ASD and exhibited low intelligence (the full-scale intelligence quotient was determined using the Wechsler Intelligence Scale for Children-4th

Edition-Chinese version; a score below 70 indicated low intelligence) or difficulties in communicating were excluded in this study. We also used the Chen Internet Addiction Scale (CIAS) to assess the participants' severity of Internet addiction in the month preceding the study. The CIAS contains 26 items ranked on a 4-point Likert scale, with the scaled score ranging from 26 to 104 (Chen, Weng, Su, Wu, & Yang, 2003). A high total score indicates a more severe level of Internet addiction. The internal reliability (Cronbach's α) of the CIAS in this study was 0.94.

2.2.5. Family factors

We examined the participants' parental marriage status (married and living together vs. divorced or separated), parental occupational SES, and adolescents' satisfaction with their family relationship. The levels of parental occupational SES were assessed using the Close-Ended Questionnaire of the Occupational Survey (CEQ-OS), which classifies paternal and maternal occupational SES into five levels (Hwang, 2005). A high level indicates a high occupational SES. The CEQ-OS has been proven to have high reliability and validity, and has been frequently used in studies on children and adolescents in Taiwan (Hwang, 2005). The level of adolescent satisfaction with their family relationship was assessed based on the family domain of the Taiwanese Quality of Life Questionnaire for Adolescents (TQOLQA; Fuh, Wang, Lu, & Juang, 2005). The family domain of the TQOLQA contains seven items ranked on a 5-point Likert scale that measure the levels of adolescent satisfaction with family relationships in the preceding month (Fuh et al., 2005). A high total score indicates that an adolescent reports a high level of satisfaction with family relationships. The Cronbach's α of the family domain of the TQOLQA in this study was 0.88.

2.2.6. Peer factor

We examined participant experiences with involvement in traditional bullying and their satisfaction with peer relationships. The self-reported Chinese version of the School Bullying Experience Questionnaire (C-SBEQ) was used to evaluate participant involvement in traditional school bullying in the previous year, with 16 items answered using a 4-point Likert scale ranging from 0 (*never*) to 3 (*all the time*; Kim, Koh, & Noh, 2001; Yen, Kim, Tang, Wu, & Cheng, 2012). This scale was composed of four 4-item subscales for evaluating experiences with passive and active traditional bullying victimization and perpetration. High total scores for Items 1 to 4, Items 5 to 8, Items 9–12, and Items 13–16 indicated severe passive victimization, active victimization, passive perpetration, and active perpetration, respectively. The results of a previous study in which the psychometrics of the C-SBEQ were examined indicated that the C-SBEQ has acceptable reliability and validity (Yen, Yen, et al., 2012). The peer domain of the TQOLQA contains five items ranked on a 5-point Likert scale that measure adolescent satisfaction with peer relationships in the preceding month (Fuh et al., 2005). A high total score indicates that an adolescent reports a high level of satisfaction with peer relationships. The Cronbach's α of the peer domain of the TQOLQA in this study was 0.79.

2.2.7. Depression

The severity of depression symptoms was assessed using the Mandarin Chinese version (Chien & Cheng, 1985) of the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The CES-D comprises 20 four-point items that assess the frequency of depressive symptoms in the preceding month on a 4-point Likert scale month. A high total score indicates more severe depression. The Cronbach's α for the scale in the present study was 0.86.

2.2.8. Anxiety

We used the Taiwanese version of the Multidimensional Anxiety Scale for Children (MASC-T, March, 1997; Yen, Yang, Wu, Hsu, & Cheng, 2010) to evaluate adolescent anxiety symptoms in the preceding month. The MASC-T evaluates the level of anxiety symptoms in children and adolescents, with 39 items answered using a 4-point Likert scale. A high total score indicates more severe anxiety symptoms. Research has proven that the psychometrics of the MASC-T have satisfactory reliability and validity (Yen et al., 2010). The Cronbach's α for the scale in this study was 0.84.

2.2.9. Suicidality

The five-item questionnaire from the epidemiological version of the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS-E) (Puig-Antich & Chambers, 1978) was used to assess the occurrence of suicide attempts and that of four forms of suicidal ideation in the preceding year (Tang et al., 2009). Each question elicited a "yes" or "no" answer. In a previous study, the Cohen's kappa coefficient of agreement (κ) between participants' self-reported suicide attempts and their parents' reports was 0.541 ($p < 0.001$; Tang et al., 2009). Those who answered "yes" to any of the five items were classified as engaging in suicidal ideation or attempts.

2.3. Procedure and statistical analysis

Research assistants conducted interviews by using the research questionnaires to collect data from the adolescents. The adolescents' parents completed the SNAP-IV and CEQ-OS according to the directions of the research assistants. Data analysis was performed using SPSS 17.0 statistical software (SPSS Inc., Chicago, IL, USA). The prevalence rate of being a cyberbullying victim or a perpetrator among adolescents with ADHD was calculated by percentage. We used five logistic regression models to examine the correlates of being a cyberbullying victim and a perpetrator, which were used in subsequent analyses. In the first model, the individual correlates of being a cyberbullying victim and perpetrator were examined. We subsequently

added ADHD-related, psychiatric comorbidity, family, and peer factors to the second, third, fourth, and fifth models, respectively. We also used multiple regression analysis models to examine the association of being a cyberbullying victim or a cyberbullying perpetrator with depression, anxiety, and suicidality. A two-tailed p value less than 0.05 was considered statistically significant.

3. Results

Table 1 shows the individual, ADHD-related, psychiatric comorbidity, family, and peer characteristics of male adolescents with ADHD. A total of 48 (19.1%) and 36 (14.3%) participants reported that they were cyberbullying victims or perpetrators, respectively. Table 2 shows the results of examining the correlates of being a cyberbullying victim by using logistic regression analysis models. The results of Model I indicated that older age increased the risk of being a cyberbullying victim. Models II and III did not reveal a significant association between being a cyberbullying victim and ADHD-related factors and psychiatric comorbidities. Model IV revealed that a high paternal occupational SES increased the risk of being a cyberbullying victim. Model V indicated that severe traditional passive bullying victimization increased the risk of being a cyberbullying victim.

Table 3 shows the results of examining the correlates of being a cyberbullying perpetrator by using logistic regression analysis models. The results of Model I indicated that older age and higher BAS reward responsiveness increased the risk of being a cyberbullying perpetrator. Model II revealed that adolescents with combined-type ADHD were more likely to be a cyberbullying perpetrator than those with inattention-type ADHD. Model III indicated that severe Internet addiction increased the risk of being a cyberbullying perpetrator. Model IV did not reveal a significant association between being a

Table 1
Individual, ADHD, psychiatric comorbidity, family, and peer characteristics ($N = 251$).

	n (%)	Mean (SD)
Individual factors		
Age (years)		13.1 (2.0)
BIS		19.1 (3.9)
BAS reward responsiveness		16.6 (2.8)
BAS drive		12.0 (2.6)
BAS fun seeking		10.8 (2.7)
Self-esteem		20.2 (5.5)
ADHD factors		
ADHD subtypes		
Combined	200 (79.7)	
Inattention	49 (19.5)	
Hyperactivity/impulsivity	2 (0.8)	
Medication for ADHD		
No	39 (15.5)	
Yes	212 (84.5)	
ADHD symptoms on the SNAP-IV		
Inattention		5.9 (3.9)
Hyperactivity/impulsivity		3.2 (2.3)
Psychiatric comorbidity		
Psychiatric comorbidity		
ODD/conduct disorder	33 (13.1)	
ASD	36 (14.3)	
Tic disorders	25 (10.0)	
Internet addiction on the CIAS	57 (22.7)	
Family factors		
Parental marriage status		
Married and live together	194 (77.3)	
Divorced or separated	57 (22.7)	
Paternal occupational socioeconomic status		2.4 (1.2)
Maternal occupational socioeconomic status		2.1 (1.2)
Satisfaction to family relationship		26.1 (5.4)
Peer factors		
Satisfaction to peer relationship		17.8 (3.9)
Passive bullying victimization		2.0 (2.6)
Active bullying victimization		0.5 (1.0)
Passive bullying perpetration		1.3 (1.9)
Active bullying perpetration		0.3 (0.7)

ADHD: attention-deficit/hyperactivity disorder; ASD: Autism spectrum disorders; BAS: Behavior Approach System; BIS: Behavior Inhibition System; CIAS: Chen Internet Addiction Scale; ODD: oppositional defiant disorder; SNAP-IV: Swanson, Nolan, and Pelham, Version IV Scale; SD: standard deviation.

Table 2
Correlates of cyberbullying victims: logistic regression analysis.

	Model I (Individual factors)			Model II (+ADHD characteristics)			Model III (+Psychiatric comorbidity)			Model IV (+Family factors)			Model V (+ Peer factors)		
	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR
Age	6.756**	1.223	1.051–1.423	6.045*	1.219	1.041–1.427	6.151*	1.224	1.043–1.435	6.563*	1.241	1.052–1.464	10.091**	1.340	1.118–1.604
BIS	0.766	1.047	0.944–1.161	0.649	1.044	0.940–1.160	0.830	1.051	0.945–1.168	0.357	1.034	0.927–1.152	0.006	1.005	0.895–1.127
BAS reward responsiveness	0.221	0.962	0.817–1.132	0.145	0.969	0.821–1.142	0.242	0.959	0.810–1.134	0.100	0.972	0.817–1.158	0.329	0.946	0.783–1.144
BAS drive	0.054	0.981	0.832–1.156	0.092	0.975	0.825–1.151	0.050	0.981	0.828–1.162	0.074	0.976	0.820–1.162	0.161	0.962	0.796–1.162
BAS fun seeking	0.466	1.048	0.917–1.198	0.358	1.043	0.909–1.196	0.323	1.042	0.904–1.201	0.364	1.047	0.902–1.214	0.953	1.085	0.921–1.278
Self-esteem	1.024	0.967	0.907–1.032	1.373	0.961	0.898–1.027	0.899	0.967	0.902–1.037	0.068	0.990	0.917–1.068	0.046	0.991	0.915–1.074
ADHD combined type[a]				2.165	2.082	0.784–5.532	2.366	2.178	0.808–5.870	3.099	2.511	0.901–6.997	3.185	2.624	0.910–7.571
Medication for ADHD				0.006	1.038	0.410–2.628	0.069	1.139	0.431–3.014	0.062	1.135	0.416–3.099	0.184	1.272	0.424–3.815
ADHD Inattention				0.004	1.002	0.933–1.077	0.001	1.001	0.931–1.077	0.088	0.988	0.914–1.068	0.049	0.991	0.912–1.076
ADHD Hyperactivity/impulsivity				0.094	0.989	0.924–1.060	0.038	0.993	0.925–1.066	0.128	1.014	0.940–1.093	0.089	0.988	0.911–1.071
ODD/conduct disorder							0.745	0.625	0.215–1.816	0.220	0.771	0.260–2.287	0.049	0.878	0.276–2.792
ASD							1.049	1.623	0.642–4.103	0.795	1.551	0.591–4.073	0.242	1.302	0.455–3.727
Tic disorder							0.003	1.031	0.308–3.455	0.001	0.985	0.287–3.379	0.001	1.020	0.268–3.886
Internet addiction							0.202	1.006	0.981–1.031	0.961	1.013	0.987–1.041	0.851	1.014	0.985–1.043
Parental divorce or separation										0.029	0.921	0.356–2.379	0.000	0.993	0.364–2.710
Paternal occupational SES										5.317*	1.540	1.067–2.224	4.327*	1.533	1.025–2.293
Maternal occupational SES										0.264	0.918	0.663–1.271	0.208	0.917	0.631–1.331
Family relationship										0.021	1.005	0.937–1.078	0.737	1.033	0.959–1.113
Peer relationship													0.444	0.964	0.867–1.073
Passive bullying victimization													7.318**	1.244	1.062–1.457
Active bullying victimization													2.149	1.320	0.911–1.912
Passive bullying perpetration													0.027	1.019	0.817–1.270
Active bullying perpetration													0.233	1.123	0.702–1.797

ADHD: attention-deficit/hyperactivity disorder; ASD: Autism spectrum disorders; BAS: Behavior Approach System; BIS: Behavior Inhibition System; ODD: oppositional defiant disorder; OR: Odds ratio; SES: socioeconomic status; SES: socioeconomic status.

[a] Inattention type as the reference.

* $P < 0.05$.

** $P < 0.01$.

Table 3
Correlates of cyberbullying perpetrators: logistic regression analysis.

	Model VI (Individual factors)			Model VII (+ADHD characteristics)			Model VIII (+Psychiatric comorbidity)			Model IX (+Family factors)			Model X (+ Peer factors)		
	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR	Wald	OR	95% CI of OR
Age	14.817***	1.391	1.176–1.646	13.296***	1.393	1.166–1.666	9.907**	1.343	1.118–1.614	9.588**	1.347	1.116–1.627	11.259**	1.436	1.162–1.775
BIS	0.059	0.986	0.882–1.103	0.100	0.982	0.875–1.101	0.185	0.973	0.858–1.103	0.101	0.979	0.862–1.114	0.056	0.984	0.858–1.128
BAS reward responsiveness	3.888*	0.826	0.682–0.999	3.465	0.833	0.686–1.010	4.388*	0.805	0.657–0.986	3.361	0.824	0.669–1.013	1.539	0.870	0.697–1.084
BAS drive	1.751	1.148	0.936–1.407	1.579	1.141	0.929–1.402	2.867	1.208	0.971–1.503	2.694	1.205	0.964–1.506	0.833	1.121	0.877–1.432
BAS fun seeking	1.901	1.115	0.955–1.302	1.493	1.104	0.942–1.295	0.231	1.043	0.879–1.237	0.189	1.040	0.873–1.238	0.029	0.984	0.814–1.189
Self-esteem	0.467	1.028	0.949–1.115	0.419	1.028	0.945–1.119	1.739	1.066	0.969–1.172	2.617	1.088	0.982–1.206	2.628	1.094	0.981–1.220
ADHD combined type[a]				4.629*	4.710	1.064–13.526	4.344*	4.454	1.093–18.148	4.499*	4.771	1.126–20.213	5.856*	7.245	1.457–36.026
Medication for ADHD				0.113	0.837	0.297–2.361	0.070	0.855	0.269–2.721	0.102	0.827	0.259–2.643	0.239	0.736	0.215–2.518
ADHD Inattention				0.668	1.034	0.954–1.121	0.340	1.025	0.942-	0.147	1.017	0.932–1.110	0.463	1.033	0.941–1.135
ADHD Hyperactivity/impulsivity				0.521	0.971	0.897–1.051	0.311	0.976	0.897–1.062	0.120	0.985	0.902–1.074	0.533	0.965	0.878–1.061
ODD/conduct disorder							0.222	0.762	0.246–2.364	0.175	0.782	0.246–2.481	0.205	0.748	0.212–2.638
ASD							1.364	0.453	0.120–1.711	1.496	0.424	0.107–1.678	1.649	0.385	0.089–1.653
Tic disorder							0.606	0.517	0.098–2.726	0.745	0.476	0.089–2.564	0.610	0.492	0.083–2.922
Internet addiction							9.661**	1.050	1.018–1.083	9.561**	1.051	1.019–1.085	7.601**	1.049	1.014–1.085
Parental divorce or separation										0.001	0.997	0.338–2.937	0.155	1.255	0.404–3.903
Paternal occupational SES										0.279	1.133	0.713–1.803	0.167	1.110	0.672–1.835
Maternal occupational SES										0.024	1.032	0.697–1.528	0.006	0.982	0.621–1.551
Family relationship										0.602	0.969	0.894–1.050	0.028	0.993	0.909–1.084
Peer relationship													0.320	0.960	0.832–1.107
Passive bullying victimization													0.007	0.990	0.787–1.246
Active bullying victimization													0.467	1.165	0.752–1.803
Passive bullying perpetration													7.374**	1.382	1.094–1.745
Active bullying perpetration													2.845	1.592	0.927–2.733

ADHD: attention-deficit/hyperactivity disorder; ASD: Autism spectrum disorders; BAS: Behavior Approach System; BIS: Behavior Inhibition System; ODD: oppositional defiant disorder; OR: Odds ratio; SES: socioeconomic status; SES: socioeconomic status.

[a] Inattention type as the reference.

* $P < 0.05$.

** $P < 0.01$.

*** $P < 0.001$.

Table 4
Association of being a cyberbullying victim or perpetrator with depression, anxiety, and suicidality: multiple regression analysis.

	Depression			Anxiety			Suicidality		
	Beta	*t*	*p*	Beta	*t*	*p*	Beta	*t*	*p*
Bullying victim	0.221	3.222	0.001	0.116	1.663	0.098	0.226	3.286	0.001
Bullying perpetrator	−0.038	−0.545	0.586	0.038	0.531	0.596	0.021	0.304	0.761
Age	0.135	2.117	0.035	−0.147	−2.248	0.025	0.051	0.791	0.430

cyberbullying perpetrator and family factors. Model V demonstrated that engaging in severe traditional passive bullying perpetration increased the risk of being a cyberbullying perpetrator.

Table 4 shows the results of the multiple regression analysis models used to examine the association of being a cyberbullying victim or perpetrator with depression, anxiety, and suicidality. The results indicated that after controlling for the effects of gender and age, cyberbullying victims reported more severe depression and suicidality than did those who were not cyberbullying victims. However, no significant differences in depression, anxiety, and suicidality were observed between those who were and were not cyberbullying perpetrators.

4. Discussion

The present study found that 19.1% of the male adolescents clinically diagnosed with ADHD reported that they were cyberbullying victims. Consistent with the results of previous studies (Kowalski & Limber, 2013; van Geel et al., 2014; Yang et al., 2013), the present study found that cyberbullying victims with ADHD reported more severe depression and suicidality than did those who had ADHD, but were not cyberbullying victims. Furthermore, 14.3% of the male adolescents with ADHD reported that they were cyberbullying perpetrators. Although we did not identify significant differences in the severities of depression, anxiety, and suicidality between ADHD male adolescents who were and were not cyberbullying perpetrators, cyberbullying perpetration is a mental health problem that requires evaluation because it can directly lead to cyberbullying victimization. The prevention and intervention of cyberbullying perpetration is essential for reducing cyberbullying victimization. The results of this study indicated that both cyberbullying victimization and perpetration are prevalent among male adolescents with ADHD.

The present study found that among male adolescents with ADHD, severe passive bullying victimization increased the risk of being a cyberbullying victim, and severe passive bullying perpetration increased the risk of being a cyberbullying perpetrator. Previous studies have reported that in the general population of adolescents, cyberbullying perpetration is an extension of traditional bullying perpetration, particularly psychological, relational, and indirect forms of bullying in cyberspace (Patchin & Hinduja, 2006, 2011). Compared with traditional bullying perpetrators, cyberbullying perpetrators can remain virtually anonymous (Kowalski & Limber, 2007). Being cruel and malicious using digital harassment is also easier because of the physical distance separating the offender and the victim (Patchin & Hinduja, 2006). Furthermore, numerous adolescents use the Internet outside the purview of adults (Williams & Guerra, 2007). All of these cyber activity characteristics may extend bullying perpetration from face-to-face interactional situations to cyberspace. The results of this study are a reminder to mental health and education professionals of the necessity of evaluating involvement in traditional bullying when approaching cyberbullying involvement among adolescents with ADHD. Furthermore, because cyberbullying is less detectable by adults than traditional bullying is (Williams & Guerra, 2007) and because most cyberbullying victims do not report cyberbullying to an adult or use digital tools to prevent online incidents (Juvonen & Gross, 2008), involvement in traditional bullying may be used as an indicator for detecting the occurrence of cyberbullying involvement among adolescents with ADHD. Research has indicated that the victimization involved in bullying may produce feelings of anger, which further produces feelings of anger and frustration, causing victimized adolescents to be at an increased risk for cyberbullying perpetration (Patchin & Hinduja, 2011). However, we did not observe a significant difference in traditional bullying victimization between cyberbullying perpetrators and nonperpetrators.

We determined that older age increased the risk of being a cyberbullying victim and a cyberbullying perpetrator. Older adolescents may spend more time in cyberspace than younger adolescents do, which increases the risk of cyberbullying involvement. Furthermore, cyberbullying may be considered a form of psychological, relational, and indirect bullying (Patchin & Hinduja, 2006, 2011). Based on the developmental theory of aggression proposed by Björkqvist, Osterman, and Kaukiainen (1992), older adolescents may use indirect forms of aggression to a greater extent because their social skills are sufficiently developed to enable more subtle forms of aggression, such as frequent cyberbullying (Björkqvist et al., 1992). Perpetrators may consider cyberbullying as a form of aggression with a lower risk of detection compared with that of traditional face-to-face bullying.

Previous studies have reported various levels of self-esteem between those involved and uninvolved in traditional bullying (Olweus, 1992; O'Moore, 2000). However, we did not observe differences in self-esteem between ADHD adolescents involved and uninvolved in cyberbullying. Further study is required to examine whether the incongruence between the present and previous studies is derived from study sample differences (ADHD adolescents vs. general school students) or

types of bullying (cyberbullying vs. traditional bullying). Previous studies have observed the positive associations of Internet addiction with high BIS and high BAS in adolescents and young adults (Yen, Ko, Yen, Chen, & Chen, 2009; Yen, Kim, Tang, Wu, & Cheng, 2012; Yen, Yen, et al., 2012). Therefore, hypothesizing that high BIS and high BAS may increase the risk of cyberbullying involvement, mediated by Internet addiction, is reasonable. This study found that male adolescents with ADHD who reported lower BAS reward responsiveness were more likely to be cyberbullying perpetrators, whereas no difference in BIS was observed between ADHD adolescents involved and uninvolved in cyberbullying. Low BAS reward responsiveness. Adolescents with low BAS reward responsiveness are independent of punishment sensitivity, and thus they may ignore the possible punishment resulted from their behaviors and bully others online.

The present study found that male adolescents with combined-type ADHD were more likely to be a cyberbullying perpetrator than were those with inattention-type ADHD. Research has also revealed that peers rate children with combined-type ADHD as more likely to start fights (Hodgens, Cole, & Boldizar, 2000). We also observed no differences in ADHD inattention and hyperactivity/impulsivity symptoms between adolescents involved and uninvolved in cyberbullying. The result was inconsistent with that reported in a study on involvement in traditional bullying. Kawabata et al. (2012) reported that severe ADHD symptoms are the most frequently proposed risk factor for traditional bullying involvement among children and adolescents with ADHD (Kawabata et al., 2012). They hypothesized that inattention and hyperactivity/impulsivity symptoms may result in socially inappropriate behaviors during peer interactions (Kawabata et al., 2012). In the present study, parents rated adolescent ADHD inattention and hyperactivity/impulsivity symptoms in a virtual world; however, they might not have detected inattention and hyperactivity/impulsivity symptoms occurring during peer interactions and doing online activities in cyberspace.

The present study found that cyberbullying perpetrators reported more severe Internet addiction than nonperpetrators did. Internet addiction indicates that users may spend increasing amounts of time on the Internet. Interaction in cyberspace can be anonymous, which may cause adolescents with an Internet addiction to feel safe in perpetrating cyberbullying without worrying about being identified. Furthermore, because cyberbullying perpetration is an extension of traditional bullying perpetration (Patchin & Hinduja, 2006, 2011), and ODD/conduct disorder (Holmberg & Hjern, 2008) and ASD (Montes & Halterman, 2007) are significantly associated with traditional bullying involvement among adolescents with ADHD, comorbid ODD/conduct disorder and ASD might increase the risk of cyberbullying involvement in adolescents with ADHD. However, the present study did not produce such a significant association. Further study is required to examine whether the interaction patterns in cyberspace differ from those in the real world for adolescents with ADHD, comorbid ODD/conduct disorder, or ASD. In cyberspace, adolescent tics are not visible or audible, which may partially account for the lack of a significant association between cyberbullying involvement and comorbid tic disorders.

Studies have indicated that parental monitoring, and providing guidance and restrictions to Web sites are effective as protective mechanisms from cyberbullying victimization (Mesch, 2009). Parents with a high SES may have the ability to use effective techniques to prevent adolescents from cyberbullying victimization. However, we observed that a high paternal but not maternal occupational SES increased the risk of being a cyberbullying victim for male adolescents with ADHD. Further study is required to examine whether income inequality results in increased risk of cyberbullying victimization for adolescents with a high paternal occupational SES, or whether the reason for an increased risk of cyberbullying victimization is that adolescents with a high paternal occupational SES can access the Internet earlier and easier (e.g., accessing the Internet by using personal smartphones, compared with those with a low paternal occupational SES). Meanwhile, it also needs further study why maternal occupational SES is not associated with adolescents' cyberbullying involvement.

Several limitations of this investigation require attention. First, the cross-sectional research design of this study limited our ability to draw conclusions regarding causal relationships between cyberbullying involvement and certain correlates examined in this study. Second, the data were provided by adolescent participants. Thus, the possible problem of shared-method variance resulting from a sole data source requires careful consideration. Third, the study participants were a clinical sample of adolescents with ADHD and, as such, the results might not be generalized to adolescents with ADHD in the community who have never received treatment. Fourth, this study focused on male adolescents with ADHD. Further study is needed to examine the prevalence rates and correlates of cyberbullying among female adolescents with ADHD. Last, the relationships of several factors, for example, substance abuse, number of siblings, academic achievement, age of puberty onset, first sexual experience, and athletic ability with cyberbullying involvement in adolescents with ADHD have not been examined in this study.

5. Conclusion

The results of this study indicate that a high proportion of male adolescents with ADHD reported that they were cyberbullying victims or perpetrators. Cyberbullying victims reported more severe depression and suicidality than did those who were not cyberbullying victims. Traditional bullying victimization and perpetration are significantly associated with being cyberbullying victims and perpetrators, respectively. Older age is significantly associated with being cyberbullying victims and perpetrators. Low BAS reward responsiveness, Internet addiction and combined-type ADHD increase the risk of being bullying perpetrators, and a high paternal occupational SES increases the risk of being bullying victims. Clinicians, education professionals, and parents of adolescents should monitor the possibility of cyberbullying involvement among adolescents with ADHD who exhibit the cyberbullying correlates identified in this study.

Role of the funding source

The funding source had no involvement in the study design; the collection, analysis, and interpretation of data; the writing of the report; or the decision to submit the article for publication.

Acknowledgment

This study was supported by grants from the Chang Gung Memorial Hospital Medical Research Projects, CMRPG8B0851 and CMRPG8C0881, Taiwan.

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