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ORIGINAL ARTICLE

Online gaming and risks predict cyberbullying perpetration and victimization in adolescents

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Abstract
Objectives The present study examined factors associated with the emergence and cessation of youth cyberbullying and victimization in Taiwan.
Methods A total of 2,315 students from 26 high schools were assessed in the 10th grade, with follow-up performed in the 11th grade. Self-administered questionnaires were collected in 2010 and 2011. Multiple logistic regression was conducted to examine the factors.
Results Multivariate analysis results indicated that higher levels of risk factors (online game use, exposure to violence in media, internet risk behaviors, cyber/school bullying experiences) in the 10th grade coupled with an increase in risk factors from grades 10 to 11 could be used to predict the emergence of cyberbullying perpetration/victimization. In contrast, lower levels of risk factors in the 10th grade and higher levels of protective factors coupled with a decrease in risk factors predicted the cessation of cyberbullying perpetration/victimization.
Conclusion Online game use, exposure to violence in media, Internet risk behaviors, and cyber/school bullying experiences can be used to predict the emergence and cessation of youth cyberbullying perpetration and victimization.

Keywords Cyberbullying · Perpetration · Victimization

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Introduction

The amount of time that young people devote to the cyber world has increased. Ninety-three percent of teens in the United States have a computer, while 78 % have cell phones (Madden et al. 2013). The current household Internet access rate in Taiwan is 85 %, while 95 % of youths have used the Internet in the past 6 months (Taiwan Network Information Center 2013). The cyber world offers information and social networking opportunities, but also cyber risks including contact risks (e.g., cyberbullying, sexual solicitation, threats to privacy, offline contact), content risks (e.g., pornography, violence, gambling), commercial risks (e.g., alcohol, illegal sales), and health risks (e.g., Internet addiction) that can hurt and distort a child's development (Guan and Subrahmanyam 2009; Valcke et al. 2011). Among these risks, increases in the incidence and severity of cyberbullying have resulted in increases in the amount of attention being paid to it.

Cyberbullying has emerged as a new form of bullying and has become an emerging public health problem (David-Ferdon and Hertz 2007). Cyberbullying is defined as bullying or harassment through the Internet, cell phones, or other electronic devices (e.g., sending insulting messages, posting digitally altered photos, aggressive comments, sharing someone's embarrassing information, or sending messages that include threats of harm through e-mail, instant messaging, in a chat room, on a web site, or sent to a cell phone) (David-Ferdon and Hertz 2007; Kowalski and Limber 2007). Cyberbullying is made more devastating than face-to-face bullying due to its accessibility, its perpetrator anonymity, its widespread dissemination, and the indelible quality of its information. Cyberbullying victimization is known to be associated with psychological distress (Ybarra et al. 2006) and depression (Chang et al. 2013; Perren et al. 2010). The measurements of cyberbullying vary from study to study. Most studies have examined cyberbullying and online sexual solicitation separately. Thus, this study excluded online sexual solicitation from the operationalization of cyberbullying.

According to a 25-country survey in Europe, 15 % of 11–16-year-old youths received peer sexual messages, while 6 % of youths were sent nasty or hurtful messages online to others in 2010 (Livingstone et al. 2011). The US Youth Internet Safety Survey found 11 % of youth reported an online harassment experience in 2010, which was an increase from 9 % in 2005, and 6 % in 2000 (Jones et al. 2012). In the US, one-fifth of 11–18-year-old students have experienced cyberbullying victimization, while one-tenth of students were involved in both cyberbullying victimization and perpetration in 2010 (Hinduja and Patchin 2012).

Studies have found that the following factors can be associated with cyberbullying perpetration: being male (Huang and Chou 2010; Walrave and Heirman 2011; Wang et al. 2009), spending more time using Internet-based technologies to communicate with friends (Werner et al. 2010), giving passwords to friends (Mishna et al. 2012), offline perpetration and victimization (Hemphill et al. 2012; Ybarra et al. 2007b), and cyberbullying victimization experience (Werner et al. 2010). In addition, factors related to cyberbullying victimization include the following: being female (Walrave and Heirman 2011; Wang et al. 2009), computer use time, social network site use (Kwan and Skoric 2013; Staksrud et al. 2013; Ybarra et al. 2006), giving passwords to friends (Mishna et al. 2012), engaging in online risk behaviors (Walrave and Heirman 2011), school bullying victimization experience (Kwan and Skoric 2013), and cyberbullying perpetration involvement (Walrave and Heirman 2011; Ybarra et al. 2006).

According to social learning theory (Bandura 1978), youth might model aggressive behaviors from media. Bandura proposed that behaviors are socially learned through observation and vicarious reinforcement. Media violence and online games provide unlimited opportunities for youth to learn and develop aggressive behaviors. Studies have shown that exposure to media violence and violent video games can be associated with aggressive cognition and behaviors (Anderson et al. 2010; Huesmann 2007; Lam et al. 2013). Similar to western countries (Jones et al. 2012), cyberbullying is increasing among adolescents in Taiwan. The purpose of the present study was to assess the longitudinal predictors of the emergence and cessation of cyberbullying perpetration and victimization among senior high school students in Taiwan including online game use, exposure to media violence, Internet risk behaviors, cyberbullying perpetration/victimization experiences, school bullying perpetration/victimization experiences, and cyberbullying resistance efficacy.

Methods

Participants

In 2010, a total of 72,327 high school students were enrolled in the 10th grade of 122 high schools (including vocational high schools) in Taipei City and New Taipei City, Taiwan. Based on the sampling frame, which was a list of schools and their 10th grade student enrollments, a probability-to-size sampling method was used to systematically draw a random sample of schools stratified by high schools and vocational high schools. We randomly selected 3–4 classes from each sample school based on the size of the school. Approval was obtained from the Institutional Review Board (IRB) at Taipei Medical University.

Following class selection, consent forms were taken home by students to give to parents requesting their consent to allow the children to participate in the survey. After the parental consent forms were collected, researchers visited the schools to conduct the self–administered survey and address students' questions about it. Students were assured that the information would remain confidential. In 2010, a total of 2,992 students who were enrolled in the 10th grade from 102 classes in 26 sample schools completed the questionnaire. The response rate was 80 %.

In 2011, when the students were in the 11th grade, participating students were re-contacted to complete the same questionnaire. However, at the time of the follow-up surveys, some students had dropped out of school, some had transferred to other schools, and some refused to participate or were absent on that day. Thus, a total of 2,315 students completed the questionnaire in both the 2010 and 2011 surveys. Twenty-two percent of students dropped out of the follow-up survey. The baseline analysis showed that

with respect to the prevalence of cyberbullying perpetration and victimization, the differences between follow-up students (cyberbullying perpetration 14.3 %, victimization 15.3 %) and dropped-out students (cyberbullying perpetration 16.3 %, victimization 15.6 %) were not significant. The responses from the 2,315 students who completed both surveys were used to establish a pattern of change for cyberbullying perpetration/victimization, risks, and protective factors. The participating students included 1,181 (51.0 %) males and 1,134 (49.0 %) females. The mean age of the 10th grade students was 15 years. Of the participating schools, 54 % were public and 46 % were private. Most (88 %) of the schools were located in urban areas.

Instruments

A self–administered questionnaire was developed based on the instruments of online risky behaviors and online victimization/perpetration scales used in the US Youth Internet Safety Survey (Dowell et al. 2009; Ybarra and Mitchell 2007) and the instruments of violence behaviors scale used in the Youth Risk Behavior Surveillance System (Eaton et al. 2010). A group of ten experts were invited to assess the content validity of the questionnaire. The experts specialized in the following fields: school bullying, information science technology, digital literacy, health education, and computer education. The experts reviewed the draft questionnaire and gave comments and suggestions for improvements. In addition, the pilot survey was conducted at two schools that were different from the sample schools in order to examine the students' responses to the survey and to evaluate the reliability of the data yielded by the questionnaire. The pilot survey found that the data were reliable. The questionnaire was revised after the pilot survey.

The dependent variable in this study was the change pattern of cyberbullying perpetration and victimization behaviors from grades 10 to 11.

Cyberbullying perpetration

Cyberbullying perpetration was measured using 4 items. Participants were asked the following questions: How often have you ever (1) made rude comments to anyone online; (2) sent or posted others' embarrassing photos online; (3) spread rumors about someone online; and (4) made threatening comments to hurt someone online. Response options for each item included the following: "never," "happened a year ago," "a few times within a year," "a few times a month," and "a few times a week." If participants answered "a few times within a year" or more frequently for any of the cyberbullying items, they were coded as a cyberbullying perpetrator. Using students' self-reported cyberbullying perpetration in the 10th and 11th grades, respondents were categorized into one of four groups: (a) no cyberbullying perpetration: the student reported that he/she did not engage in cyberbullying perpetration in the 12 months prior to the two surveys in the 10th and 11th grades; (b) emergence of cyberbullying perpetration: the student reported that he/she did not engage in cyberbullying perpetration in the past 12 months in the 10th grade survey but reported involvement in cyberbullying perpetration in the 11th grade survey; (c) cessation of cyberbullying perpetration: the student reported that he/she engaged in cyberbullying perpetration in the past 12 months in the 10th grade survey but reported no involvement in cyberbullying perpetration in the 11th grade survey; or (d) persistent cyberbullying perpetration: the student reported involvement in cyberbullying perpetration in both the 10th and 11th grade surveys.

Cyberbullying victimization

Cyberbullying victimization was measured using four items. Participants were asked the following questions: How often has someone (1) made or posted rude comments to or about you online; (2) posted embarrassing or nude photos of you online; (3) spread rumors about you online; and (4) made threatening comments to hurt you online. Response options for each item included the following: "never," "happened a year ago," "a few times within a year," "a few times a month," and "a few times a week." If participants answered "a few times within a year" or more frequently for any of the cyberbully items, they were coded as a cyberbully victim. Using students' self-reported cyberbullying victimization in the 10th and 11th grades, respondents were categorized into one of four groups: (a) no cyberbullying victimization: the student reported that he/she had not been cyberbullied in the 12 months prior to the two surveys in the 10th and 11th grades; (b) emergence of cyberbullying victimization: the student reported that he/she had not been cyberbullied in the past 12 months in the 10th grade survey but had been cyberbullied in the 11th grade survey; (c) cessation of cyberbullying victimization: the student reported that he/she had been cyberbullied in the past 12 months in the 10th grade survey but had not been cyberbullied in the 11th grade survey; and (d) persistent cyberbullying victimization: the student reported that he/she had been cyberbullied in both the 10th and 11th grade surveys.

The independent variables in this study included weekly online game use days, exposure to media violence, Internet risk behaviors, cyberbullying perpetration/victimization experiences, school bullying perpetration/victimization experiences, and cyberbullying resistance efficacy.

Weekly online game use days

Participants were asked how many days during the past week they had played online games. The scores ranged between 0 and 7.

Exposure to media violence

Exposure to media violence was measured using 3 items. Participants were asked the following: During the past year, how often did you (1) see messages containing violence on television or in movies; (2) see messages containing violence in newspapers or magazines; and (3) see messages containing violence on the Internet or online games. Response options for each item included the following: "never" (scoring 1), "a few times yearly" (scoring 2), "a few times monthly" (scoring 3), "a few times weekly" (scoring 4), and "almost daily" (scoring 5). Cronbach's α for the violence media exposure scale was 0.82.

Internet risk behaviors

Internet risk behaviors were measured using 3 items. Participants were asked the following questions: How often have you ever (1) sent or posted personal information (e.g., name, telephone, age, school name, home address); (2) posted pictures online; and (3) used a webcam to chat with strangers. Response options for each item included the following: "never" (scoring 1), "a few times yearly" (scoring 2), "a few times monthly" (scoring 3), "a few times weekly" (scoring 4), and "almost daily" (scoring 5).

School bullying perpetration/victimization

School bullying and victimization were measured using eight items. School bullying was measured using three items. Participants were asked the following questions: How often have you ever (1) pushed, kicked, or hit classmates; (2) teased or said mean things to classmates; and (3) spread rumors or excluded classmates from your group? School bullying victimization was measured using five items. Participants were asked the following questions: How often has someone (1) hit you in school or outside school; (2) excluded you from their group because they were angry with you; (3) made threats to you; (4) threatened or injured you with a weapon in school or outside school; and (5) stole or damaged your property at school? If participants answered "a few times within a year" or more frequently for any item of school bullying items, they were coded as a school bully. Similarly, if participants answered "a few times within a year" or more frequently for any item of school bullying victimization items, they were coded as school bullying victims.

Cyberbullying resistance efficacy

Cyberbullying resistance efficacy was measured using three items. Participants were asked the following questions: How confident are you that (1) you would not cyberbully others; (2) you know how to prevent cyberbullying; and (3) you could comply with rules and laws related to the Internet. Response options were on a 5-point scale from "Not at all confident" to "Totally confident." Cronbach's α for the cyberbullying resistance scale was 0.81.

Adolescent characteristics

Adolescent characteristics obtained in the present study included adolescents' reports of gender (male vs. female), academic performance (average or above vs. below average), household poverty (yes vs. no), and parental education levels. The participating student was asked his/her household economic status. The response options included low-income household, low-middle income household, averaged income household, or wealthy household. If the student reported his/her household economic status was a low-income household or a low-middle income household, then they were classified as household poverty.

Data analysis

SAS software was used to perform the statistical analysis. Percentages and means were calculated for all variables. Multiple logistic regression was performed to examine factors in grade 10 and changes from grades 10 to 11 as they related to the emergence and cessation of youth cyberbullying perpetration and victimization in grade 11. The dependent variable in this study was the change pattern in cyberbullying perpetration and victimization behaviors from grades 10 to 11. Four models of the emergence and cessation of cyberbullying perpetration and victimization were tested. For example, for the cyberbullying perpetration emergence model, students who initiated cyberbullying perpetration by the 11th grade were compared with students who did not exhibit cyberbullying perpetration in the 10th and 11th grades.

Results

Demographic characteristics

Two-thirds of the students reported parents with a high school education level or lower, while one-third of students came from families with low or lower middle household

incomes. Males were more likely to be cyberbullying perpetrators (OR = 2.74, 95 % CI 1.93–3.89) and victims (OR = 3.72, 95 % CI 2.68–5.12), while females were more likely to cease cyberbullying perpetration (OR = 0.43, 95 % CI 0.25–0.74).

Cyberbullying perpetration and victimization types

Of the 1,972 students who reported no involvement in cyberbullying perpetration in the 10th grade, 159 students (8.1 %) were involved in cyberbullying perpetration by the 11th grade. Of the 328 students who reported involvement in cyberbullying perpetration in the 10th grade, 214 students (65.2 %) ceased cyberbullying perpetration in the 11th grade. The most prevalent cyberbullying perpetration type was "made rude comments to anyone online," followed by "spread rumors about someone online," "made threatening comments to hurt someone online," and "sent or posted others' embarrassing photos," respectively.

Of the 1,947 students who reported no cyberbullying victimization experience in the 10th grade, 206 (10.6 %) were involved in cyberbullying victimization by the 11th grade. Of the 351 students who reported being cyberbullying victims in the 10th grade, 226 (64.4 %) ceased being cyberbullying victims in the 11th grade. The most prevalent cyberbullying victimization type was "Made rude comments to you online" followed by "Spread rumors about you online," "Made threatening comments to hurt you online," then "Posted embarrassing photos of you online."

Factors by cyberbullying perpetration emergence and cessation

Table 1 presents risk factors and protective factors from grades 10 to 11 according to cyberbullying perpetration emergence and cessation status. This data show that the group with no involvement in cyberbullying perpetration had the lowest level of risk factors (e.g., weekly online game use days, violence media exposure, Internet risk behaviors, cyberbullying victimization, and school bullying perpetration/victimization) and the highest level of protective factors (e.g., cyberbullying resistance efficacy), while the group showing persistent cyberbullying perpetration exhibited the highest level of risk factors and the lowest level of protective factors. In addition, for the cyberbullying perpetration emergence group, most risk factors increased while protective factors decreased. For the cyberbullying perpetration cessation group, most risk factors decreased while protective factors increased. For example, the rate of involvement in school bullying perpetration during the past year among the cyberbullying perpetration emergence group increased from 20.1 % in the 10th grade to 31.4 % in the 11th grade ($p < 0.001$), while the rate among the cyberbullying perpetration cessation group decreased from 34.6 to 9.9 % ($p < 0.001$). In contrast, the mean score of cyberbullying resistance efficacy fell from 4.09 in grade 10 to 3.85 in grade 11 ($p = 0.024$) for the cyberbullying perpetration emergence group, while the mean score of cyberbullying resistance efficacy increased from 3.84 in grade 10 to 4.16 in grade 11 ($p < 0.001$) for the cyberbullying perpetration cessation group.

Factors by cyberbullying victimization emergence and cessation

Table 2 presents risk factors and protective factors from grades 10 to 11 according to cyberbullying victimization emergence and cessation status. The data show that no cyberbullying victimization group had the lowest risk factors, but that the cyberbullying victimization persistence group did have the highest risk factors. In addition, for the cyberbullying victimization emergence group, some risk factors (e.g., Internet risk behaviors, school bullying victimization) had increased, while for the cyberbullying victimization cessation group, most risk factors had decreased. For example, the mean score of Internet risk behaviors increased from 2.04 in grade 10 to 2.73 in grade 11 ($p < 0.001$) for the emergence group, while the mean score of Internet risk behaviors decreased from 2.46 in grade 10 to 2.27 in grade 11 ($p = 0.002$) for the cessation group.

Baseline and longitudinal effect on cyberbullying perpetration emergence and cessation

Table 3 presents the multiple logistic regression analysis results of the baseline and longitudinal effects of risk/protective factors on youth cyberbullying perpetration emergence and cessation. The data show that students who had higher risk factors (e.g., weekly online game use days, violence media exposure, Internet risk behaviors, cyberbullying victimization, school bullying perpetration) and lower protective factors (cyberbullying resistance efficacy) in grade 10, then experienced an increase in risk factors (e.g., Internet risk behaviors, cyberbullying victimization, school bullying perpetration) from grades 10 to 11 and a decrease in protective factors (cyberbullying resistance efficacy) were more likely to engage in cyberbullying perpetration by grade 11. In contrast, lower risk factors (e.g., cyberbullying victimization, school bullying perpetration) and higher protective factors (cyberbullying resistance efficacy) in grade 10 and a decrease in risk factors followed by an increase in protective factors from grades 10 to 11 predicted the cessation of youth cyberbullying perpetration by grade 11.

Table 1 Factors by cyberbullying perpetration change status, Taiwan, 2010–2011

Variable (score range)	No cyberbullying perpetration (n = 1813)		Cyberbullying perpetration emergence (n = 159)		Cyberbullying perpetration cessation (n = 214)		Cyberbullying perpetration persistence (n = 114)	
	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)
Weekly online game use days (0–7)	1.91 (2.52)	1.74 (2.49)	3.08 (2.94)	2.93 (2.81)	3.02 (2.87)	2.38 (2.67)	3.80 (2.89)	2.77 (2.80)
Media violence exposure (1–5)	2.82 (0.98)	2.71 (0.97)	3.30 (1.03)	3.31 (1.02)	3.28 (1.03)	3.04 (0.98)	3.65 (0.96)	3.27 (0.96)
Internet risk behaviors (1–5)	1.93 (0.75)	2.07 (0.72)	2.12 (0.79)	2.82 (0.90)	2.45 (0.82)	2.28 (0.79)	2.57 (0.95)	2.82 (0.87)
Cyberbullying victimization (%)	8.8	6.9	17.7	63.5	42.5	15.9	64.6	64.0
School bullying perpetration (%)	9.7	4.7	20.1	31.4	34.6	9.9	51.8	44.7
School bullying victimization (%)	9.0	5.4	21.4	24.5	22.4	8.0	34.2	30.7
Cyberbullying resistance efficacy (1–5)	4.35 (0.73)	4.38 (0.79)	4.09 (1.03)	3.85 (1.02)	3.84 (0.98)	4.16 (0.90)	3.65 (0.94)	3.50 (0.99)

Table 2 Factors by cyberbullying victimization change status, Taiwan, 2010–2011

Variable (score range)	No cyberbullying victimization (n = 1741)		Cyberbullying victimization emergence (n = 206)		Cyberbullying victimization cessation (n = 225)		Cyberbullying victimization persistence (n = 126)	
	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)	10th M (SD)	11th M (SD)
Weekly online game use days (0–7)	1.87 (2.50)	1.68 (2.46)	2.89 (2.90)	2.64 (2.72)	3.10 (2.78)	2.56 (2.75)	3.93 (2.97)	3.16 (2.79)
Media violence exposure (1–5)	2.82 (0.99)	2.69 (0.96)	3.17 (1.05)	3.20 (1.01)	3.24 (1.03)	3.01 (1.03)	3.55 (0.97)	3.36 (0.89)
Internet risk behaviors (1–5)	1.92 (0.74)	2.07 (0.72)	2.04 (0.79)	2.73 (0.86)	2.46 (0.86)	2.27 (0.83)	2.57 (0.96)	2.71 (0.87)
Cyberbullying perpetration (%)	7.6	3.8	15.7	46.6	39.6	10.7	61.2	58.7
School bullying perpetration (%)	11.2	5.9	21.8	19.4	23.6	12.5	37.3	29.4
School bullying victimization (%)	8.5	5.1	16.5	21.4	26.2	9.4	31.0	27.8
Cyberbullying resistance efficacy (1–5)	4.33 (0.78)	4.37 (0.79)	4.19 (0.89)	3.96 (1.02)	4.00 (0.99)	4.19 (0.87)	3.70 (0.94)	3.76 (1.01)

No cyberbullying victimization N = 1,741, cyberbullying victimization emergence N = 206, cyberbullying victimization cessation N = 225, cyberbullying victimization persistence N = 126

Baseline and longitudinal effect on cyberbullying victimization emergence and cessation

Table 4 presents multiple logistic regression analysis results of the baseline and the longitudinal effects of factors on youth cyberbullying victimization emergence and cessation. The data show that students who had higher risk factors (e.g., weekly online game use days, exposure to media violence, Internet risk behaviors, cyberbullying victimization, school bullying victimization) in grade 10 and an increase in risk factors (e.g., Internet risk behaviors, cyberbullying perpetration, school bullying victimization) from grades 10 to 11 were more likely to engage in cyberbullying victimization by grade 11. In contrast, lower risk factors (cyberbullying perpetration) and higher protective factors (cyberbullying resistance efficacy) in grade 10 and a decrease in risk factors (cyberbullying perpetration) from grades 10 to 11 predicted the cessation of youth cyberbullying victimization by grade 11.

Discussion

This study was focused on an examination of the factors associated with the emergence and cessation of youth cyberbullying and victimization. The results showed that higher levels of risk factors (online game use, exposure to violence in media, Internet risk behaviors, cyber/school bullying experiences) in the 10th grade coupled with an increase in risk factors from grades 10 to 11 predicted the emergence of cyberbullying perpetration and victimization. In contrast, lower levels of risk factors in the 10th grade

Table 3 Students' factors in grade 10 and longitudinal change from grades 10–11 to predict cyberbullying perpetration and cessation in grade 11 via multivariate analysis, Taiwan, 2010–2011

Variable (score range)	Emergence vs. No cyberbullying perpetration				Cessation vs. cyberbullying perpetration persistence			
	10th (x_{i0})		11th–10th ($x_i - x_{i0}$)		10th (x_{i0})		11th–10th ($x_i - x_{i0}$)	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Weekly online game use days (0–7)	1.11	1.02–1.21	1.05	0.96–1.15	1.03	0.90–1.18	1.08	0.94–1.24
Media violence exposure (1–5)	1.43	1.11–1.84	1.14	0.89–1.45	1.29	0.82–2.03	1.39	0.95–2.04
Internet risk behaviors (1–5)	2.09	1.50–2.91	2.60	1.92–3.53	0.71	0.46–1.10	0.57	0.36–0.90
Cyberbullying victimization (yes = 1, no = 0)	12.33	6.22–24.46	11.59	7.50–17.92	0.08	0.03–0.19	0.10	0.05–0.21
School bullying perpetration (yes = 1, no = 0)	4.23	2.10–8.53	5.06	2.86–8.94	0.12	0.05–0.30	0.13	0.06–0.29
Cyberbullying resistance efficacy (1–5)	0.66	0.49–0.88	0.79	0.59–0.95	1.65	1.03–2.65	1.50	1.07–2.12

Multiple logistic regression was used. *OR* odds ratio, *95 % CI* 95 % confidence interval. Equation: *Logit* $(p(Y_i = 1|X_i = x_i, X_{i0} = x_{i0})) = \beta_0 + \beta_1 x_{i0} + \beta_2(x_i - x_{i0}) + \cdots + \beta_k x_{i0k} + \beta_k(x_{ik} - x_{i0k})$, where k is the number of independent variables considered in the model, i individuals. Thus, x_{i0} is an individual's initial score of predictor variables in the 10th grade, while $(x_i - x_{i0})$ is the longitudinal change in the score of the predictor variable from the 10th to the 11th grade. Cyberbullying perpetration model, total $N = 1859$, yes $N = 149$, no $N = 1710$. Cyberbullying perpetration cessation model, total $N = 305$, yes $N = 205$, no $N = 100$

Table 4 Students' factors in grade 10 and longitudinal change from grades 10–11 to predict cyberbullying victimization emergence and cessation in grade 11 via multivariate analysis, Taiwan, 2010–2011

Variable (score range)	Emergence vs. No cyberbullying victimization				Cessation vs. cyberbullying victimization persistence			
	10th (x_{i0})		11th–10th ($x_i - x_{i0}$)		10th (x_{i0})		11th–10th ($x_i - x_{i0}$)	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Weekly online game use days (0–7)	1.13	1.04–1.22	1.04	0.96–1.13	0.95	0.85–1.07	0.96	0.85–1.08
Media violence exposure (1–5)	1.35	1.09–1.68	1.21	0.98–1.49	0.87	0.61–1.23	0.89	0.66–1.19
Internet risk behaviors (1–5)	1.74	1.30–2.34	2.43	1.85–3.20	0.72	0.49–1.05	0.72	0.50–1.04
Cyberbullying perpetration (yes = 1, no = 0)	13.21	7.20–24.22	9.87	6.53–14.93	0.22	0.10–0.47	0.18	0.10–0.34
School bullying victimization (yes = 1, no = 0)	2.51	1.19–5.29	2.18	1.24–3.85	0.52	0.21–1.25	0.53	0.24–1.17
Cyberbullying resistance efficacy (1–5)	0.99	0.76–1.30	0.83	0.67–1.02	1.65	1.10–2.48	1.29	0.95–1.75

Multiple logistic regression was used. *OR* odds ratio, *95 % CI* 95 % confidence interval. Equation: *Logit* $(p(Y_i = 1|X_i = x_i, X_{i0} = x_{i0})) = \beta_0 + \beta_1 x_{i0} + \beta_2(x_i - x_{i0}) + \cdots + \beta_k x_{i0k} + \beta_k(x_{ik} - x_{i0k})$, where k is the number of independent variables considered in the model, i individuals. Thus, x_{i0} is an individual's initial score of predictor variables in the 10th grade, while $(x_i - x_{i0})$ is the longitudinal change in the score of the predictor variable from the 10th to the 11th grade. Cyberbullying victimization emergence model, total $N = 1{,}742$, yes $0 = 184$, no $N = 1558$. Cyberbullying victimization cessation model, total $N = 309$, yes $N = 196$, no $N = 113$

and higher levels of protective factors coupled with a decrease in risk factors predicted the cessation of cyberbullying perpetration and victimization.

Our results were consistent with those of previous studies (Juvonen and Gross 2008; Kwan and Skoric 2013; Perren et al. 2010; Sourander et al. 2010; Ybarra et al. 2007a) indicating that cyberbullying was often a warning sign of the co-occurrence of school bullying. In this study, 57 % of youth reported using social networking websites such as Facebook during past week. Some students mentioned that someone had attacked him/her online, after which they had experienced fighting at school or some students said they had extended a school quarrel to cyberspace. Teachers should be more aware of the possible linkages between school behavior and online harassment for some youth. It is suggested that school bullying prevention programs should include cyberbullying prevention (Ybarra et al. 2007a).

We found that males were more likely to engage in cyberbullying perpetration and victimization, while females were more likely to cease cyberbullying perpetration. Previous results on gender differences in cyberbullying victimization experiences have been mixed. Some studies found that boys were more likely to be cyberbullies, whereas girls were more likely to be victims of cyberbullying (Walrave and Heirman 2011; Wang et al. 2009). However,

the results from the present study agree with those of other studies (Wang et al. 2010) where boys were more likely to be both cyberbullying perpetrators and victims. Our study found that males spent more time with online games, which may provide more opportunities for involvement in cyberbullying perpetration and victimization.

Previous studies have associated exposure to media violence with aggressive behaviors (Gentile et al. 2011) as well as with seriously violent behavior (Ybarra et al. 2008). This study also found that an increase in exposure to violence in the media was associated with the emergence of cyberbullying perpetration and victimization. Theories in the literature suggest that the short-term effects of exposure to violence in the media on aggressive behaviors are due to priming, arousal processes, and mimicking of behaviors, while the long-term effects seem to be due to observational learning of cognitions and behaviors, activation and desensitization of emotional processes (Huesmann 2007). Port and Anderson reviewed studies and pointed out that the effect that violent media exposure has on aggression has been underestimated in most studies (Prot and Anderson 2013).

In addition, results from the present study showed that more frequent online playing of games in grade 10 predicted the emergence of cyberbullying perpetration in grade 11. Studies (Anderson et al. 2010; Hollingdale and Greitemeyer 2014; Kronenberger et al. 2005) have indicated that exposure to violent video games is a causal risk factor for increased aggressive cognition and behavior in Eastern and Western cultures. A study found that exposure to violent online games was associated with cyberbullying perpetration and victimization (Lam et al. 2013). Consistent with prior studies, this study supports Bandura's social learning theory that found exposure to media violence and playing online games was associated with cyberbullying perpetration and victimization. In this study, more than half of the students reported that they had played online games during the past week, and thus they had many chances to be attacked or to attack others, online. Parents should be more aware of their adolescents' online activities and should restrict their online game playing time to reduce exposure to media violence and involvement in cyberbullying.

Our results are consistent with other studies (Dowell et al. 2009; Mishna et al. 2012; Walrave and Heirman 2011) that found engaging in online risk behaviors such as posting pictures online and giving passwords to friends predicted cyberbullying perpetration and victimization. In this study, 70 % of students reported they had ever posted their pictures and 44 % of the students reported ever posting their personal information online, which may have provided more chances for other people to use this information against them. Moreover, results from the present study showed that reducing youth Internet risk behavior predicts the cessation of cyberbullying perpetration and victimization. Parental training programs and school education should focus on enhancing youth digital literacy and safety skills to reduce youth Internet risk behaviors.

In addition, this study showed that youth cyberbullying resistance efficacy was a protective factor in preventing youth cyberbullying perpetration and in enhancing cyberbullying perpetration cessation. Studies (Couvillon and Ilieva 2011; Heirman and Walrave 2012; Hemphill et al. 2012; Livingstone et al. 2011; Lwin et al. 2012) have suggested that it is important to implement evidence-based bullying prevention programs, to reduce perceived acceptability of youth cyberbullying, and to enhance resilience and digital citizenship skills.

Limitations

This research had some limitations. First, social desirability bias may influence the truthfulness of reports by adolescents of bullying through the Internet or in school. These factors might have led to an underestimation of the prevalence of the cyber/school bullying that the students engaged in. However, confidentiality was emphasized, and trained investigators collected the questionnaires immediately. Second, approximately one-fifth of parents and students refused to participate in the present study, which could mean these students may be at higher risk. Hence, potential biases from the selection and refusal to participate must be considered. Third, one-fifth of students dropped out of the follow-up survey. The baseline analysis indicated that there were no differences in gender or in the prevalence of cyberbullying perpetration and victimization between follow-up students and dropped-out students. Finally, some items for school bullying victimization were measured by how often someone had hit, threatened, or injured the respondent with a weapon in school or outside school. The rate of school bullying victimization may be overestimated. Despite these limitations, the present study adds to the limited amount of literature that addresses the longitudinal predictors of the emergence and cessation of cyberbullying perpetration and victimization.

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