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# Parental Influences on Pathological Symptoms of Video-Gaming Among Children and Adolescents: A Prospective Study

**Hyekyung Choo · Timothy Sim · Albert K. F. Liau · Douglas A. Gentile · Angeline Khoo**



**Abstract** Although empirical studies and media reports have suggested that a number of children and adolescents play video-gaming excessively, resulting in pathological symptoms of video-gaming, longitudinal research on parental predictors of pathological symptoms of video-gaming is inadequate. By analyzing two-wave longitudinal data from 2,974 primary and secondary school students in Singapore, we examined the main effects of parent–child closeness and parental restriction of child video-gaming on children and adolescents' pathological symptoms of video-gaming over time and five interaction terms, namely parental restriction of child video-gaming by parent–child closeness, parent–child closeness by gender, parental restriction of child video-gaming by gender, parent–child closeness by age, and parental restriction of child video-gaming by age. Analyses of random intercept models and hierarchical multiple regression models consistently revealed that higher parent–child closeness at Wave 1 had a significant main effect on the decreased number of pathological symptoms at Wave 2 while parental restriction of child video-gaming at Wave 1 had no main effect, and that the effect of parent–child closeness was significantly stronger for boys than for girls. These results imply that restrictive rules and regulations set by parents on the child's video-gaming behaviors may not be an effective way of reducing the pathological symptoms of video-gaming. Instead, they highlight the importance of the parent–child bond and possible gender differences in this predictor in assessment and preventive measures for children and adolescents presenting pathological symptoms of video-gaming.

**Keywords** Pathological video-gaming · Video-gaming addiction · Parent–child closeness · Parental restriction · Singapore

H. Choo (✉)
Department of Social Work, National University of Singapore, Singapore 117570, Singapore
e-mail: swkch@nus.edu.sg

T. Sim
Hong Kong Polytechnic University, Kowloon, Hong Kong

A. K. F. Liau · A. Khoo
National Institute of Education, Singapore, Singapore

D. A. Gentile
Iowa State University, Ames, IA, USA

## Introduction

For the last two decades, empirical studies and media reports have suggested that a number of children and adolescents play video-games excessively, and consequently suffer from dysfunctional or pathological symptoms (Tejeiro Salguero and Bersabé Morán 2002). Recently, the American Psychiatric Association has recognized the significance of this problem in its decision to include Internet gaming disorder in Section III of the fifth version of the diagnostic and statistical manual of mental disorders (DSM-5) (American Psychiatric Association 2013).

Although what constitutes pathological video-gaming or video-gaming addiction is still debated by researchers and clinicians, studies have typically included symptoms of preoccupation, tolerance, loss of control, withdrawal, escape, and disruptions in schooling, family, and other social relationships in measures of pathological video-gaming (e.g., Griffiths and Dancaster 1995; Griffiths and Hunt 1998; Johansson and Götestam 2004). As such,

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pathological video-gaming can be defined as gaming activities that damage an individual's social, occupational, family, school, and psychological functioning, with addictive symptoms of preoccupation, tolerance, loss of control, withdrawal, and escape. Research based on this definition and a corresponding measure has attempted to estimate the prevalence and profiles of pathological video-gamers by using a cut-off value of a half or more symptoms (e.g., 5–6 symptoms) out of the total number of symptoms (e.g., 9–11 symptoms) to differentiate pathological gamers from non-pathological gamers (e.g., Gentile 2009; Porter et al. 2010; Rehbein et al. 2010). Studies that applied such a cut-off point have reported that about 8–14 % of their study participants were classified as pathological gamers; this was found in American adolescent gamers (Gentile 2009), gamers in New Zealand (Porter et al. 2010), and German adolescent gamers (Rehbein et al. 2010).

Along with such efforts to gauge the prevalence of pathological video-gaming, prior research has also focused on establishing the psychometric properties of measures or exploring various correlates with pathological video-gaming. As a result, a wide range of correlates have been identified (Chiu et al. 2004; Yoo et al. 2004). However, at present, the above correlational studies have limited utility in constructing an etiology of pathological video-gaming. From the perspective of the bio-psycho-social model for addiction, currently known correlates are predominantly clustered around psychological or intrapersonal factors, for example, boredom, loneliness, low self-esteem, hostility, impulsivity, lack of self-control, and motivation, in addition to several biological markers found in psychiatric research (see Kuss and Griffiths 2012 for a review). In contrast, empirical research on social relationships or environmental predictors, such as the parent–child relationship or parental interventions in child gaming behaviors, is relatively inadequate.

Although a few studies examined the association between parental factors and excessive or pathological use of video-games (Kwon et al. 2011; Punamäki et al. 2009), indicating the importance of parental roles in pathological symptoms of video-gaming among children and adolescents, findings from prior research are compromised due to conceptual and methodological limitations. First, most previous studies did not conceptualize parental variables within the etiological framework for the pathology of video-gaming. While there is ample evidence suggesting that the parent–child relationship and parenting process are robust predictors of the use of almost any type of addictive substance among young people (Walters 1999), the majority of the extant correlational and qualitative studies interpreted the negative parent–child relationship as a consequence of excessive or pathological video-gaming, rather than a predictor of it (e. g., Griffiths et al. 2004; Peng and Liu 2010). Second, this conceptual limitation remains unresolved partly due to the lack of longitudinal data: The use of cross-sectional data did not allow for the previous studies to establish a temporal order between parental predictors and the outcome of pathological symptoms of video-gaming. Hence, whether parental variables contribute to changes in pathological symptoms of video-gaming over time is largely unknown. Third, few researchers simultaneously examined more than one parental variable in a single study to determine their independent effects and interaction effects on changes in pathological symptoms of video-gaming, for example, parent–child bond and parental restriction of child video-gaming.

By analyzing two-wave longitudinal data from primary and secondary school students in Singapore, this study aims to examine whether parents contribute to longitudinal changes in their children's pathological symptoms of video-gaming through parent–child closeness and parental restriction on their children's gaming behaviors. It also aims to determine whether there are interactions between parental variables, between each parental variable and gender, and between each parental variable and age in such changes in the pathological symptoms.

In an attempt to examine the commonalties of various addictive disorders (i.e., alcohol, drug, sex, eating) about two decades ago, Loughead (1991) suggested codependence as an underlying dynamic of the process, pervasive in addictive disorders. Codependence is believed to develop due to long-term exposure to highly stressful family relationships, such as the present living situation, or more commonly a dysfunctional family of origin (Loughead 1991). Chiu et al. (2004), based on a cross-sectional Taiwanese sample, found that children and adolescents with better family functioning reported lower levels of video-game addiction. They postulated that when families function better, there is more emphasis on their children's education and leisure, which facilitates children's healthier social adjustment and exposure to a greater variety of educational and leisure opportunities. This prevents children from being easily addicted to a single leisure activity, such as game playing.

Among various family issues, the parent–child relationship is particularly important in children and adolescents' pathological video-gaming, as the parent–child subsystem process is conceived to directly contribute to overall family functioning. Thus far, a few studies on child video-gaming have consistently suggested significant associations between the parent–child relationship quality and pathological or excessive video-gaming. From the analysis of 478 Finnish children and early adolescents, Punamäki et al. (2009) found a significant negative correlation between levels of openness of communication with mother and intensity of playing video-games; the latter is

generally positively associated with pathological video-gaming. Kwon et al. (2011) also provided further empirical support for the effect of the parent–child relationship quality on pathological video-gaming; their multiple regression analyses showed that the levels of hostility in the parent–child relationship were positively associated with the degrees of pathological use of Internet games among Korean adolescents. However, as these studies are cross-sectional, it is unclear whether the quality of parent–child relationship is a protective predictor of pathological video-gaming or a consequence of it.

Parental restriction of child video-gaming is another parental variable that may affect children and adolescents' pathological symptoms of video-gaming. Literature on media use often advise parents to monitor or control their children's media use (e.g., Chiu et al. 2004; Nickel 2006). Indeed, parents commonly mediate children's interaction with the media through restricting children's media use in terms of the type of content and the amount of exposure to the particular media (Shin and Huh 2011). To our knowledge, however, no empirical research has examined the effect of such parental restriction of child video-gaming on children and adolescents' pathological symptoms of video-gaming in particular. Instead, evidence from a few studies on the amount and frequency of gaming and Internet addiction (Lee and Chae 2007; Ramirez et al. 2011; Shin and Huh 2011; van den Eijnden et al. 2010) suggests that parents' restrictive mediation in child video-gaming may not be an effective way to mitigate the problem. With the exception of Ramirez et al.'s (2011) findings based on adolescents' reports, these investigations consistently reported the non-significant effect of parents' restrictive mediation in child video-gaming on the outcomes of child game or Internet use. Rather, Van den Eijnden et al. (2010) found the levels of openness in parental communication about Internet use to be negatively associated with Internet addiction; they then argued that adolescents who feel comfortable and understood, and are taken seriously by their parents during conversations about their Internet use are at lower risk of developing Internet addiction. Overall, these studies conclude that a strict restriction of child media use may not be effective in curbing Internet addiction, or reducing the frequency of or time spent on playing video-games; interactive parental mediation based on an open and caring parent–child relationship may prove more effective.

Integrating the above literature on parent–child relationships and parental restriction of child gaming, it appears that a positive parent–child relationship is essential to the success of parents' rule-setting for preventing or alleviating children and adolescents' pathological symptoms of video-gaming. This observation is in line with an integrative model of parenting style and parenting practices suggested by Darling and Steinberg (1993). Through an extensive review of theories and empirical findings regarding the influences of various aspects of parenting on child and adolescent outcomes, Darling and Steinberg have posited that parenting style, which is defined as a constellation of attitudes towards the child and an emotional climate between parents and the child, can play a critical role as a contextual variable that moderates the association between a specific parenting practice, such as parental restriction, and a specific outcome of children and adolescents. However, as none of the studies reviewed above examined such an interaction effect on pathological symptoms of video-gaming, the potential moderating effect of the parent–child relationship on the link between parents' restrictive mediation of child video-gaming and pathological symptoms of video-gaming has yet to be investigated.

In understanding behavioral and adjustment outcomes of children and adolescents, gender is a key variable in most research; this is also the case for research on pathological video-gaming. Pathological video-gaming is well-known to be a gendered phenomenon, with significantly more boys than girls being classified as pathological gamers (e.g., Gentile et al. 2011). This study is particularly interested in potential gender differences in parental influences on children and adolescents' pathological symptoms of video-gaming, not only because pathological gamers are more likely to be male than female, but also because the parent–child relationship and parents' restriction of child media use, the key constructs of this study, are known to have different effects on children and adolescents' outcomes depending on the child's gender. One available study with relevant implications for pathological symptoms of video-gaming is that conducted by Wallenius and Punamäki (2008). From the analysis of the three-way interaction between game violence, parent–child communication, and gender, they found that parent–child communication had a moderating effect in reducing the impact of game violence only on male adolescent aggression. This indirectly indicates that the effect of the parent–child relationship on pathological symptoms of video-gaming may be stronger for boys than for girls. Potential gender differences in the effects of parental restriction on child media are also expected. A few studies have evidenced that higher parental restriction on digital media use is exercised for girls than for boys (Nikken and Jansz 2006; van den Eijnden et al. 2010).

Age is another variable that may moderate the parental influences on pathological symptoms of video-gaming. However, differences in pathological video-gaming by age are not as well-established as gender differences as the majority of prior research on pathological video-gaming was conducted with samples of adolescents, not with

children in primary schools (see Kuss and Griffiths 2012). Therefore, this study also examines age differences in parental influences on children and adolescents' pathological video-gaming. As older children, particularly those who are moving towards adolescence, tend to become more estranged from their parents and conflicts with parents are often found to be at the highest in early adolescence (Smetana et al. 2006), the parent–child relationship may have a differential effect on pathological video-gaming by age. Moreover, age differences in the effects of parental restriction on child media may also exist. A few studies have found that parents with younger children tend to use restrictive mediation on gaming and Internet use more often than those with older children do (Nikken and Jansz 2006; van den Eijnden et al. 2010). Despite the likely gender and age differences in the above parental variables and pathological symptoms of video-gaming, little research has explicitly examined the potential moderating effects of gender and age on associations between the parental variables and pathological symptoms of video-gaming.

Based on the above literature review, the following study hypotheses were formulated. When the pathological symptoms of video-gaming in a previous year and socio-demographic characteristics are controlled for, (1) there will be a main effect of parent–child closeness on pathological symptoms of video-gaming (the stronger the parent–child closeness, the lower the number of pathological symptoms of video-gaming); (2) there will be no main effect of parental restriction of child video-gaming on pathological symptoms of video-gaming; (3) there will be a moderating effect of parent–child closeness on the association between parental restriction of child video-gaming and pathological symptoms of video-gaming (the stronger the parent–child closeness, the stronger the effect of parental restriction of child gaming on pathological symptoms of video-gaming); (4) there will be a moderating effect of gender on the association between parent–child closeness and pathological symptoms of video-gaming (the effect of parent–child closeness on pathological symptoms of video-gaming will be stronger for boys than girls); (5) there will be a moderating effect of gender on the association between parental restriction of child video-gaming and pathological symptoms of video-gaming (the effect of parental restriction of child video-gaming on pathological symptoms of video-gaming will be stronger for girls than boys); (6) there will be a moderating effect of age on the association between parent–child closeness and pathological symptoms of video-gaming (the effect of parent–child closeness on pathological symptoms of video-gaming will be stronger for younger children than older children); and (7) there will be a moderating effect of age on the association between parental restriction of child video-gaming and pathological symptoms of video-gaming (the effect of parental restriction of child video-gaming on pathological symptoms of video-gaming will be stronger for younger children than older children).

## Method

Data for this study were drawn from a large scale research project entitled "Effects of Digital Gaming on Children and Teenagers in Singapore (EDGCTS)". The EDGCTS study is a four-wave longitudinal survey examining the positive and negative effects of digital games on children and adolescents in Singapore. Five key areas, namely learning and cognitive benefits, pro-social and empathic tendencies, social interactions, aggressive tendencies, and pathological video-gaming, were explored in relation to various gaming factors and gaming behaviors, using a survey questionnaire with approximately 400 questions. The current study retrieved Wave 1 and Wave 2 data only on parental variables and pathological symptoms of video-gaming to test the study hypotheses formulated.

### Participants

Through convenience sampling, 2,974 children in Primary 3 (third grade) (n = 732), Primary 4 (fourth grade) (n = 698), Secondary 1 (seventh grade) (n = 900) and Secondary 2 (eighth grade) (n = 644) as of the year 2006 (Wave 1) participated in the study and were followed up 1 year after (Wave 2). The students were recruited from six primary and six secondary schools. Out of these 12 schools, five were boys' schools and the other 7 were co-ed schools. Because school principals and teachers who were briefed about the EDGCTS project before recruitment have commonly observed video-gaming related problems to be more prevalent among boys than girls, many of the schools that were most keen to participate in this study for understanding their students' gaming behaviors and related problems were boys' schools. As a result, the final sample turned out to consist of a considerable number of boys' schools—five out of twelve schools in total. However, the 12 schools were widely distributed across Singapore and included both public and private schools from each main region (e.g. East, West, South, and North regions). Each school chose four classes from each school year to participate in the study.

The initial response rate was 99 % after approaching 3,004 students, which left 2,974 study participants in Wave 1. Of these, 2,601 participated in the Wave 2 survey with an attrition rate of 12.5 %. Apart from ethnicity and housing type, there was no statistically significant difference in all the variables included for this study between the attrition group and the non-attrition group. Compared to the

non-attrition group, the attrition group had higher proportions of Malay students, those under the ethnic category of Others, and those living in private housing. However, further analysis of attrition indicated that it was mostly because some classes in schools with a high proportion of Malay students or those of other ethnicities, and schools with a high proportion of students living in private housing were too busy with other school matters (e.g., school examinations) to participate in the Wave 2 survey during the given timeline, not because students with such characteristics individually refused to participate.

The overall average age of participants in Wave 1 was 11.2 years (*Standard Deviation* (*SD*) = 2.05; primary school students *Mean* (*M*) = 9.2 years, *SD* = 0.7; secondary school students *M* = 13.0 year, *SD* = 0.8). The sample included 2,158 males and 816 females. The ethnic composition was 72.6 % Chinese, 14.2 % Malay, 8.8 % Indian, and 4.3 % of other ethnicities. All levels of socio-economic status were represented, as assessed by housing type, with 18.6 % living in 3-room or smaller public housing, 26.7 % living in 4-room public housing, 27.0 % living in 5-room public housing or government-built Executive flats, and 27.7 % living in private housing. Housing type, which is classified by the size of residence, is a major demographic characteristic as a proxy indicator of socio-economic status (SES) in the Singapore context. Although the study sample is over-representative for males (72 % of the study sample vs. 51.3 % of the national population aged 10–14), and students living in private housing (27.7 % of the study sample vs. 18.5 % of the national population aged 10–14), overall, the relative distributions in the ethnic composition and the other housing types are fairly representative of those of the national population aged 10–14 (See "Appendix").

## Procedures

Informed consent from the parents and child assent were sought through the schools. A liaison teacher from each school collated the information, and confidentiality of the students' responses was assured by requiring the teachers to seal collected questionnaires in the envelopes provided in the presence of the students.

## Measures

Based on the above literature review, we selected parent–child closeness and parental restriction of child video-gaming at Wave 1 as key predictive variables and the number of pathological symptoms of video-gaming at Wave 2 as the outcome variable. Age, gender, ethnicity, housing type as a SES indicator, impulsivity, the number of hours of playing video-games, and the number of pathological symptoms of video-gaming at Wave 1 were included as control variables. Specific measures for these study variables are as follows:

*Parent–child closeness* was measured with six items from a parent-family connectedness scale, originally developed by Resnick et al. (1997). Respondents were asked to indicate their agreement level from strongly disagree (1) to strongly agree (4) on three statements for each parent—mother and father respectively: For example, "I feel close to my mother/father," "I think my mother/father cares about me," and "I am happy with the relationship with my mother/father." The averaged sum of these six items was used for analysis, with a higher mean score indicating closer relationships with parents. The internal consistency reliability of these six items at Wave 1 was 0.90.

*Parental restriction of child video-gaming behavior* was measured with three items. The three items, which were originally constructed by Abelman and Pettey (1989) for parental television-viewing mediation, were modified to measure parental restriction of child video-gaming in particular for this study. The three statements include, "My parents restrict or ban me from playing certain video-games they consider undesirable," "My parents set specific playing video-game hours," and "My parents specify video-games that I cannot play." Respondents were asked to indicate the frequency of their parents' restriction described in each statement on a 4-point scale from never (0), one or two times a month (1), one or two times a week (2), to every day or almost every day (3). The averaged sum of these three items was used for analysis. The internal consistency coefficient for these three items was 0.66.

*The number of pathological symptoms of video-gaming* at Wave 1(for control) and Wave 2 (as the outcome) was measured with a 10-item screening instrument derived from the pathological gambling items of the DSM-IV (American Psychiatric Association 1994). This type of scale based on the DSM-IV pathological gambling criteria has been used previously in several other studies (Gentile 2009; Porter et al. 2010; Tejeiro et al. 2002). Participants could respond "no," "sometimes," or "yes," scored as 0, 0.5 and 1 symptom respectively, to each of the 10 symptoms. The internal reliability $\alpha$ scores tested for this study were yielded to be 0.70 at Wave 1 and 0.75 at Wave 2. The specific items with each corresponding dimension of pathological video-gaming in its definition are as follows:

In the past year,

1. Has your schoolwork suffered because you spent too much time playing computer/video-games? (Damage to schooling)
2. Have you ever skipped your studies or co-curricular activities to play more computer/video-games? (Damage to schooling)

3. Do you need to spend more and more time and/or money on video-games to feel the same amount of excitement? (Tolerance)
4. Have you played video-games to escape from problems, bad feelings, or stress? (Escape)
5. Are you thinking about computer/video-games more and more? (Preoccupation)
6. Have you stolen a video-game from a store or a friend, or stolen money in order to buy a video-game? (Damage to social functioning: antisocial behavior)
7. Have you tried to play video-games less often or for shorter periods of time, but are unsuccessful? (Loss of control/Unsuccessful attempts to quit)
8. Have you become restless or irritable when trying to cut down or stop playing computer/video-games? (Withdrawal)
9. Have you ever lied to family or friends about how much you play video-games? (Damage to social relationships: family and friends)
10. Have you ever needed to borrow money so you could get or play computer/video-games? (Damage to social relationships)

*Impulsivity* was included for control in the analysis as it has been found to be associated with pathological video-gaming in prior research (Gentile 2009). Impulsivity at Wave 1 was measured with 14 items. The instrument was adapted from the International Personality Item Pool for Impulse Control (International Personality Item Pool 2006) and the Barratt Impulsiveness Scale (Patton et al. 1995). Respondents were asked to indicate their agreement level on a 4-point scale from strongly disagree (1) to strongly agree (4) for each item. The items include "I keep my feelings under control," "I often say things that I wish I had not when I am upset," and "I often make things worse because I act without thinking." The averaged sum of 14 items was used with a higher score indicating higher impulsivity. The reliability of this measure was 0.69.

*The number of hours of playing video-games per week at Wave 1*, which ranges 0–106 h, was also included for control in the analysis ($M = 20.7$ h, $SD = 25.8$) as it has a significant positive correlation with the number of pathological symptoms of video-gaming (Gentile et al. 2011). Respondents were asked to indicate their estimated number of hours of playing games on a usual weekday and the hours of playing on a weekend day, respectively. The hours of playing per usual weekday were multiplied by five, and the hours of playing on a weekend day were multiplied by two. The sum of these two quantities was used as the total number of hours of playing video-games per week. As demographic variables for control, *age*, which is a self-reported, continuous variable ranging from 8 to 17 years old, was included for analysis. *Gender* was coded as 0 for female and 1 for male. *Ethnicity* was coded as 1 for Chinese, 2 for Malay, 3 for Indian and 4 for Others. The SES of student respondents, which was measured by their *housing type* as explained above, was coded as 1 for 3-room or smaller public housing, 2 for 4-room public housing, 3 for 5-room public housing or government-built Executive flats, and 4 for private housing, with a higher number indicating a higher SES.

## Data Analysis

We first conducted descriptive analyses to report the distribution of the number of pathological symptoms of video-gaming at Wave 1 and Wave 2 for the entire sample, and levels of parent–child closeness and parental restriction of child video-gaming and the average number of pathological symptoms of video-gaming at Wave 1 and Wave 2 for two sub-samples by gender (boys vs. girls). A correlation analysis was also performed to see bivariate relationships between all of the continuous independent variables and the outcome variable in the multivariate analysis models.

As the study sample was recruited through the schools and by class, we assumed that there might be nested effects by class and school. Hence, we estimated two-level (i.e., individual level and classroom level) and three-level (i.e., individual level, classroom level, and school level) random intercept models to examine the main effects of parental variables (Model 1A for two-level modeling and Model 2A for three-level modeling) and the interaction effects between the parental variables, between the parental variables and gender, and between the parental variables and age (Model 1B for two-level modeling and Model 2B for three-level modeling). In total, five interaction terms were included in the multilevel analysis. Instead of analyzing only a three-level random intercept model, we estimated the two separate multilevel models to determine which level of nesting effect, if any nesting effect exists, makes a significant difference to the variance in explaining the outcome when each multilevel model is compared with a linear regression model. To test for this, we used likelihood ratio tests.

In addition, we also performed hierarchical multiple regression analyses to provide stricter tests for the relative contribution of each parental variable and each interaction term found to be significant in the multilevel modeling. In Step 1, we included only socio-demographic variables, impulsivity, the number of hours of playing video-games per week, and the number of pathological symptoms at Wave 1 to predict the number of pathological symptoms at Wave 2. In each subsequent step, we first added the variable of parent–child closeness, which was found to be the only significant parental variable from the random intercept

**Table 1** Number of pathological symptoms reported at Wave 1 and Wave 2

| | Wave 1 (N = 2,680) | Wave (N = 2,457) |
|---|---|---|
| Average number of symptoms (*SD*) | 2.28 (1.78) | 2.06 (1.86) |
| *Non-pathological gamers with* | | |
| 0–0.5 symptoms (%) | 21.6 | 29.7 |
| 1–4.5 symptoms (%) | 68.5 | 61.5 |
| *Pathological gamers with* | | |
| 5 or more symptoms (%) | 9.9 | 8.8 |

**Table 2** Descriptive statistics of key study variables by gender

| | Boys (N = 2,158) *M (SD)* | Girls (N = 816) *M (SD)* | Difference by gender *t* value |
|---|---|---|---|
| Parent–child closeness | 3.37 (0.61) | 3.40 (0.60) | 1.13 |
| Parental restriction | 2.18 (0.90) | 1.85 (0.86) | −8.58*** |
| Number of PVG at wave 1 | 2.49 (1.83) | 1.76 (1.55) | −9.70*** |
| Number of PVG at wave 2 | 2.29 (1.93) | 1.46 (1.48) | −10.14*** |

*PVG* pathological symptoms of video-gaming

*** $p < .001$

models estimated above (Step 2), and then added the interaction term of parent–child closeness by gender, which was also found to be only one significant interaction term from the random intercept models (Step 3). We examined $R^2$ changes between steps to determine the relative contribution among all of these variables in Steps 1–3. We used STATA 12.0 for all of the analyses.

## Results

From the descriptive analysis of key study variables, as shown in Table 1, we found that the average number of pathological symptoms of video-gaming in the sample is about 2 (2.28 symptoms at Wave 1; 2.06 symptoms at Wave 2). The specific distributions of symptoms show that about 21 % (Wave 1) and 29 % (Wave 2) of the respondents reported no pathological symptom or 0.5 symptoms, 9.9 % (Wave 1) and 8.8 % (Wave 2) reported 5 or more symptoms, which is often used as a cut off for identifying pathological gamers in other studies, and 68.5 % at Wave 1 and 61.5 % at Wave 2 endorsed 1–4.5 symptoms. Although the proportion of potentially pathological gamers is <10 %, respondents who endorsed at least 1–4.5 symptoms outnumbered those who reported zero or 0.5 symptoms in the study.

Table 2 demonstrates striking gender differences in the gaming-related variables—parental restriction of child video-gaming, pathological symptoms of video-gaming at Wave 1, and those at Wave 2. The differences were mostly in favor of girls: Boys reported more frequent parental restriction of their video-game playing ($M = 2.18$, $SD = 0.90$ for boys vs. $M = 1.85$, $SD = 0.86$ for girls; $t = -8.58$, $p = .000$) and more pathological symptoms of video-gaming at Wave 1 ($M = 2.49$ symptoms, $SD = 1.83$ for boys vs. $M = 1.76$ symptoms, $SD = 1.55$ for girls; $t = -9.70$, $p = .000$) and Wave 2 ($M = 2.29$ symptoms, $SD = 1.93$ for boys vs. $M = 1.46$ symptoms, $SD = 1.48$ for girls; $t = -10.14$, $p = .000$) than girls. In contrast, we found no significant difference in parent–child closeness between boys and girls.

A correlation analysis of continuous variables (Table 3) revealed that parent–child closeness was negatively correlated with age ($r = -0.20$, $p = .000$), the number of pathological symptoms of video-gaming at Wave 1 ($r = -0.15$, $p = .000$) and Wave 2 ($r = -0.15$, $p = .000$), as expected, whereas higher parental restriction of child video-gaming was significantly correlated with younger age ($r = -0.13$, $p = .000$), and more pathological symptoms of video-gaming ($r = 0.04$, $p = .04$ for Wave 1; $r = 0.04$, $p = .04$ for Wave 2). However, there was no significant correlation between parent–child closeness and parental restriction in the study sample.

Table 4 presents results from multilevel modeling analyses of the main effects and interaction effects. For Model 1A, Model 1B, Model 2A, and Model 2B, statistic scores from their likelihood ratio tests demonstrated that there were no significant differences between a linear regression model and each multilevel random intercept model estimated, suggesting that no nesting effect exists at either group level ($\chi^2 = 0.000$, $df = 1$, $p = 1.000$ for Model 1A; $\chi^2 = 0.000$, $df = 1$, $p = 1.000$ for Model 1B; $\chi^2 = 3.29$, $df = 2$, $p = .193$ for Model 2A, $\chi^2 = 2.37$, $df = 2$, $p = .306$ for Model 2B).

In Model 1A where only the class level nesting effect was controlled for, we found a significant main effect of parent–child closeness on the number of pathological symptoms of video-gaming ($b = -0.14$, $SE = 0.06$, $z = -2.16$, $p = .031$) as hypothesized. However, parental restriction of child video-gaming was not found to be a significant predictor of the number of pathological symptoms of video-gaming at Wave 2 as expected. When the five interaction terms, namely parent–child closeness by parental restriction of child video-gaming, parent–child closeness by gender, parental restriction of child video-gaming by gender, parent–child closeness by age, and parental restriction of child video-gaming by age, were

**Table 3** Correlation matrix among continuous study variables

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Age | – | | | | | | |
| 2. Impulsivity | 0.181*** | – | | | | | |
| 3. Hours of playing games per week | 0.108*** | 0.163*** | | | | | |
| 4. Parent–child closeness | −.202*** | −.180*** | −.131*** | – | | | |
| 5. Parental restriction | −.129*** | 0.013 | −.056** | 0.033 | – | | |
| 6. PVG at wave 1 | 0.086*** | 0.302*** | 0.329*** | −.151*** | 0.042* | – | |
| 7. PVG at wave 2 | 0.092*** | 0.241*** | 0.194*** | −.146*** | 0.044* | 0.476*** | – |

*PVG* pathological symptoms of video-gaming

* $p < .05$, ** $p < .01$, *** $p < .001$

**Table 4** Multilevel modeling for predictors of pathological symptoms of video-gaming

| | Model 1A | | Model 2A | |
|---|---|---|---|---|
| | *b* | *SE* | *b* | *SE* |
| *Main effect model* | | | | |
| Age | 0.02 | 0.02 | 0.02 | 0.03 |
| Male | 0.47*** | 0.08 | 0.55*** | 0.09 |
| *Ethnicity (omitted: Chinese)* | | | | |
| Malay | 0.07 | 0.11 | 0.03 | 0.11 |
| Indian | −0.22 | 0.13 | −0.19 | 0.14 |
| Others | 0.08 | 0.20 | 0.05 | 0.20 |
| *Housing type: SES (omitted: 1- to 3-room flat)* | | | | |
| 4-room flat | 0.06 | 0.11 | 0.05 | 0.11 |
| 5-room or executive flat | 0.00 | 0.11 | 0.01 | 0.11 |
| Private housing | −0.28* | 0.11 | −0.23# | 0.12 |
| Impulsivity at wave 1 | 0.43*** | 0.10 | 0.42*** | 0.10 |
| Hours of playing games per week | 0.00 | 0.00 | −0.00 | 0.00 |
| PVG at wave 1 | 0.41*** | 0.02 | 0.41*** | 0.02 |
| Parent–child closeness | −0.14* | 0.06 | −0.14* | 0.06 |
| Parental restriction of child video-gaming | 0.06 | 0.04 | 0.06 | 0.04 |
| | Model 1B | | Model 2B | |
| | *b* | *SE* | *b* | *SE* |
| *Interaction effect model* | | | | |
| Parent–child closeness by parental restriction of child video-gaming | −0.02 | 0.07 | −0.02 | 0.07 |
| Parent–child closeness by Gender | −0.41** | 0.13 | −0.40** | 0.13 |
| Parental restriction of child video-gaming by gender | −0.10 | 0.09 | −0.10 | 0.09 |
| Parent–child closeness by age | 0.01 | 0.03 | 0.01 | 0.03 |
| Parental restriction of child video-gaming by age | 0.03 | 0.02 | 0.03 | 0.02 |

*PVG* pathological symptoms of video-gaming

# $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

added to Model 1A, the analysis results revealed that only the effect of parent–child closeness on the pathological symptoms of video-gaming was significantly moderated by gender as shown in results from Model 1B ($b = -0.41$, $SE = 0.13$, $z = -3.0.08$, $p = .002$), indicating that the effect of parent–child closeness was stronger for boys than for girls in the study sample. However, the analysis did not support the other study hypotheses regarding the moderating effect of parent–child closeness on parental restriction of child video-gaming, the moderating effect of gender on parental restriction of child video-gaming, the moderating effect of age on parent–child closeness, and the moderating effect of age on parental restriction of child video-gaming

A further analysis based on three-level random intercept modeling also confirmed the significant main effect of parent–child closeness ($b = -0.14$, $SE = 0.06$, z = $-2.15$, $p = .032$ in Model 2A) and the significant interaction effect between parent–child closeness and gender ($b = -0.40$, $SE = 0.13$, z = $-2.96$, $p = .003$ in Model 2B). The significant predictors of the pathological symptoms of video-gaming at Wave 2 remained the same in Model 2A and Model 2B where nesting effects at the classroom level and the school level were simultaneously controlled for. In sum, results from the two-level and three-level random intercept models consistently indicate that children and adolescents who were closer to their parents at Wave 1 reported fewer pathological symptoms of video-gaming in the subsequent year, and that the effect of parent–child closeness on the pathological symptoms of video-gaming was significantly greater for boys than girls.

As the likelihood ratio tests suggested that multilevel random intercept models did not significantly differ from linear regression models, hierarchical multiple regression models were estimated to determine the relative contribution of parent–child closeness and that of the interaction between parent–child closeness and gender to the variance in the number of pathological symptoms of video-gaming at Wave 2. Since the study sample was clustered by school and class, the assumption of independence across observations for the ordinary linear regression is violated. Hence, we adjusted standard errors by using the *vce* (cluster) function in STATA to estimate the linear regression models. Results from the hierarchical regression models are presented in Table 5. We first conducted a linear regression in which we entered socio-demographic variables including age, impulsivity at Wave 1, the number of hours of playing video-games per week, and the number of pathological symptoms of video-gaming at Wave 1 in Step 1. After that, we introduced parent–child closeness in Step 2, and the interaction term between parent–child closeness and gender in Step 3. Parent–child closeness contributed a significant amount of variance only at the level of $p < .10$ ($b = -0.14$, $SE = 0.07$, $p = .056$, $\Delta R^2 = 0.004$) when controlling for socio-demographic variables (i.e., age, gender, ethnicity, and SES), impulsivity, the number of hours of playing video-games per week and the number of pathological symptoms at Wave 1. The gender variable as a moderator for parent–child closeness also contributed a significant amount of additional variance at $p < .01$ level ($b = -0.44$, $SE = 0.12$, $p = .001$, $\Delta R^2 = 0.005$). Together with the control variables, these two variables measured at Wave 1 accounted for 27.0 % of the variance in the number of pathological video-gaming at Wave 2. Specifically, as shown in Fig. 1, we found the effect of parent–child closeness on pathological symptoms of video-gaming to be significantly stronger for boys than girls in our study sample.

**Table 5** Hierarchical regression analyses predicting pathological symptoms of video-gaming

| Predictor | *b* | SE | $R^2$ | $\Delta R^2$ |
|---|---|---|---|---|
| Step 1 | | | 0.264 | |
| Age | 0.03 | 0.02 | | |
| Male | 0.50*** | 0.08 | | |
| *Ethnicity (omitted: Chinese)* | | | | |
| Malay | 0.03 | 0.11 | | |
| Indian | −.27# | 0.14 | | |
| Others | 0.03 | 0.20 | | |
| *Housing type: SES (omitted: 1- to 3-room flat)* | | | | |
| 4-room flat | 0.04 | 0.11 | | |
| 5-room or executive flat | −.05 | 0.12 | | |
| Private housing | −.32** | 0.11 | | |
| Hours of playing games per week | 0.00 | 0.00 | | |
| Impulsivity at Wave 1 | 0.44*** | 0.11 | | |
| PVG at Wave 1 | 0.42*** | 0.03 | | |
| Step 2 | | | 0.268 | 0.004# |
| Parent–child closeness | −.14# | 0.07 | | |
| Step 3 | | | 0.272 | 0.005** |
| Parent–child closeness by Gender | −.44** | 0.12 | | |

*PVG* pathological symptoms of video-gaming

# $p < .10$; ** $p < .01$; *** $p < .001$

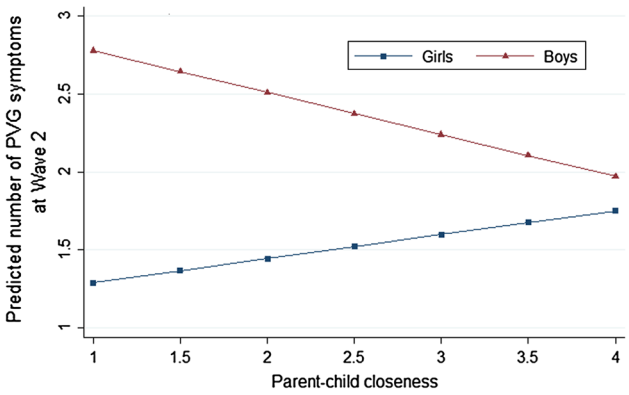


**Fig. 1** Moderation of gender on the effect of parent–child closeness on pathological symptoms of video-gaming

## Discussion

The significant main effect of parent–child closeness is consistent with prior research findings from literature on

pathological video-gaming or video-gaming addiction. In this study, an independent, main effect of the parent–child relationship as a predictor of pathological symptoms of video-gaming was confirmed through the analysis of longitudinal data. As this finding is consistent across studies, the importance of the parent–child relationship quality cannot be over-emphasized. Also, the absence of a main effect of parental restrictions on child video-gaming is in line with findings from prior research on children's media use and parental interventions. It needs to be noted that this finding does not lend empirical support to common suggestions often made by researchers and practitioners regarding setting restrictions on the time, place, and content of child video-gaming to prevent excessive gaming or reduce the symptoms (e. g., Chiu et al. 2004). One plausible explanation for the non-significant effect concerns the pathological nature of the symptoms examined in this study. As defined previously, pathological video-gaming is not merely a repetitive behavior or a habit of playing games excessively, but also entails preoccupation, withdrawal, tolerance, and loss of control. These addiction symptoms may be a reflection of deep-seated psychosocial needs that require more than behavioral modification through rule-setting or controlling methods.

Contrary to the study hypothesis, the effect of parental restriction of child video-gaming was also found not to depend on levels of parent–child closeness in this study. Nevertheless, this non-significant interaction effect directs future research attention to Stattin and Kerr's (2000) argument for a bidirectional model of parent–child interaction. Acknowledging that effective parental supervision or monitoring may not come as a mere result of a positive parent–child relationship, they insisted that of greater importance may be whether the positive parent–child relationship is translated into a bidirectional process of parental monitoring or restriction, where the child's active role and willingness to share his or her thoughts and experiences with parents are matched by the parents' well-meaning attempts to intervene in the child's behavior. As for video-game playing in particular, the importance of a two-way process of parental mediation has also been highlighted by a few other researchers. Finding no significant effect of the number of rules set by parents regarding gaming, and a significant effect of the interaction between the number of rules and the degree of parent–child agreement about the rules, Ramirez et al. (2011) emphasized the importance of sufficiently communicating these rules to children for mutual agreement in reducing the amount of playing games. Discovering that parents' stopping their child from playing video-games had no significant effect on the frequency of the child's game playing, Shin and Huh (2011) have also suggested that a more interactive, two-way mediation, such as active mediation based on parent–child discourse, would be more effective than a one-way strict restriction on teenagers' video-gaming. Unfortunately, data used for this study and those used in the prior studies do not have information about whether parental restrictions of child's video-gaming behaviors were set based on the reciprocal process of children's negotiation, cooperation, and mutual agreement between parents and the child, or were imposed solely by parents. Also, we were not able to examine whether or not parents followed through with their rules with appropriate consequences. Previous research has suggested that how well consequences are managed is a primary determinant of children's problem behaviors (Granic and Patterson 2006). If future research explores such parent–child interactions in the process of setting parental restrictions of the child's game play, the effect of association between parent–child closeness and parental restriction on children and adolescents' pathological symptoms of video-gaming would be more clearly identified.

Another noteworthy finding is the significant moderating effect of gender on the association between parent–child closeness and pathological symptoms of video-gaming. The analysis discovered that the effect of parent–child closeness on pathological symptoms was stronger for boys than for girls. Although it is still unclear why the effect of parent–child closeness on pathological symptoms of video-gaming is stronger for boys than for girls, this finding might be explained by gender differences in motivation for gaming and online gaming addiction. In a study on Taiwanese adolescents, Ko et al. (2005) found that boys are more likely than girls to be motivated to play online games for social contacts. Probably, the stronger effect of parent–child closeness for boys implies that boys have a greater need for social bonding than girls. In relation to Ko et al's finding, this result suggests that the weaker their bond with parents, the more likely boys are to play video-games, seeking social bonds from their gaming peers to compensate for the lack of parent–child closeness. Another possible explanation is that the weaker effect of parent–child closeness for girls might be due to a floor effect. That is, the average number of pathological symptoms for girls is so low ($M = 1.76$, $SD = 1.55$ at Wave 1) that a notable decrease cannot be observed. Also, a relatively small number of girls in the study sample might be another reason for the weaker effect of parent–child closeness for girls. Overall, there are few theoretical explanations available from the literature for the stronger effect of the parent–child relationship on excessive or problematic video-gaming for boys, despite the issue being a gendered phenomenon, with pathological gamers being predominantly male, as found in many other studies. However, the results from this study suggest that the etiology of children and adolescents' pathological symptoms of video-gaming

may differ by gender. Future research can also build on this study to explore theories that may provide a plausible explanation for gender differences in the association between the parent–child relationship and pathological symptoms of video-gaming, and subject the theoretical framework to an empirical investigation.

Regarding implications for future research, the following limitations of this study are worth mentioning. The use of a convenience sample, despite a large sample size of about 3,000, limits the generalizability of the study findings. Fortunately, as the sample turned out to be fairly representative of children from Primary 3–4 and adolescents from Secondary 1–2 in Singapore in terms of their ethnic composition, socio-economic status distribution, and school regions, the findings are generalizable to children and adolescents to a certain degree. However, as boys, known to be more vulnerable to pathological video-gaming than girls, are over-represented in the sample, the magnitude of pathological symptoms of video-gaming might have been over-estimated. Future research will need to use a probability sample to enhance its generalizability to the children and adolescent population in Singapore.

Also, the study findings may not be applicable to children and adolescents in countries other than Singapore. For example, Internet cafes, the availability of which is related to pathological symptoms of gaming, are more common in Asia than in the West (Gentile et al. 2011). However, the major findings of this study—the significant main effect of parent–child closeness and the non-significant effect of parental restriction of child video-gaming on pathological symptoms—are similar to findings from several prior studies conducted on general gaming behaviors, Internet addiction, and pathological video-gaming in other countries such as Finland (Punamäki et al. 2009), Korea (Kwon et al. 2011), China (Liu et al. 2012), and U.S.A. (Ramirez et al. 2011; Shin and Huh 2011). In addition, it has been reported that case descriptions of Internet addiction from the US, encompassing online video-gaming addiction, are remarkably similar to those from Asian countries (Block 2008). As such, the study findings are not entirely irrelevant or inapplicable to other cultural contexts; similar research still needs to be replicated in many other countries to test whether or not these relations between parental variables and pathological symptoms of video-gaming are unique to Singapore.

A few other limitations arise from measurement issues in the data. First, information about parent–child closeness and parental restriction of child video-gaming was collected only from children and adolescents, not from their parents. Second, the psychometric properties of the measure for parental restriction of child video-gaming need improvement, given that it was measured with three items with an internal consistency score of 0.66. Therefore, the non-significant effect of parental restriction of child video-gaming should be interpreted with caution despite the large sample size of this study that renders some support for the validity of the null effect of the variable.

In this study, we found more than 90 % of child and adolescent respondents to be non-pathological gamers. Some may interpret such a finding as indicating that video-gaming problems among children and adolescents in Singapore are benign. However, as the majority of the respondents—over 60 %—reported at least one or more symptoms, as opposed to no symptoms, strategic efforts based on empirical evidence for its etiology would be essential in preventing any pathological symptom(s) of video-gaming from increasing or deteriorating over time. In this regard, our main study findings highlight the importance of parent–child relationship issues for prevention strategies for children and adolescents with pathological symptoms of video-gaming. Currently, the most common preventive measure for pathological video-gaming is public education. Public education programs conducted by various agencies, such as government ministries, schools, and community organizations in Singapore, teach students how to identify pathological symptoms of video-gaming and how to develop healthy gaming habits, and provide tips for parents to help their children develop healthy gaming habits to prevent the development of pathological video-gaming (see Media Development Authority 2011). Specifically, these programs aim to help parents and school personnel better understand child video-gaming behaviors in general (e.g., game rating, game genres, motivation of gaming), guide them to instruct their children to seek permission before using the computer and to have a time limit for the use of computer. However, these programs do not acknowledge the role and importance of the parent–child relationship quality in the development of pathological symptoms of video-gaming among children and adolescents. Given the consistent empirical evidence of the significant effect of parent–child closeness found in this study and other studies, it would be beneficial for parents if information on how the parent–child relationship quality influences the development of pathological symptoms of video-gaming is incorporated into public education programs. In addition, when school counselors or other practitioners notice their students starting to show pathological symptoms related to excessive gaming, we recommend that they assess the students' relationship with their parents and directly work with their parents to strengthen the parent–child bond, rather than merely educating the parents about what pathological video-gaming is and how to set limits on their child's gaming to prevent the escalation of the video-gaming problems.

Another consideration is that gender differences may exist not only in the prevalence or degree of pathological video-gaming, but also in the effect of parent–child closeness on pathological video-gaming. As parent–child closeness was found to have a stronger effect for boys than for girls in the current study sample, the suggested prevention approach above may not be useful for girls with pathological symptoms of video-gaming. However, as little empirical research has been conducted on gender differences in the ecological etiology of pathological video-gaming, further exploration and replication of gender differences in the etiology are required to guide practitioners in deciding whether gender-specific programs are necessary.

## Appendix

Comparison of study sample and census population age 10–14

| | Study sample (%) | Singapore residents aged 10–14 (%) |
|---|---|---|
| Male | 72.6 | 51.3 |
| Female | 27.4 | 48.7 |
| Chinese | 72.6 | 68.8 |
| Malay | 14.2 | 17.8 |
| Indian | 8.8 | 9.8 |
| Others | 4.3 | 3.6 |
| 1- to 3-room | 18.6 | 14.7 |
| 4-room | 26.7 | 32.7 |
| 5-room or executive | 27.0 | 33.2 |
| Private | 27.7 | 18.5 |
| Others | 0.0 | 0.6 |

*Source* Census of Population 2010, Singapore Department of Statistics

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