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Attention Problems and Pathological Gaming: Resolving the 'Chicken and Egg' in a Prospective Analysis

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Abstract Pathological gaming (PG) behaviors are behaviors which interfere with other life responsibilities. Continued debate exists regarding whether symptoms of PG behaviors are a unique phenomenon or arise from other mental health problems, including attention problems. Development of attention problems and occurrence of pathological gaming in 144 adolescents were followed during a 1-year prospective analysis. Teens and their parents reported on pathological gaming behaviors, attention problems, and current grade point average, as well as several social variables. Results were analyzed using regression and path analysis. Attention problems tended to precede pathological gaming behaviors, but the inverse was not true. Attention problems but not pathological gaming predicted lower GPA 1 year later. Current results suggest that pathological gaming arises from attention problems, but not the inverse. These results suggest that pathological gaming behaviors are symptomatic of underlying attention related mental health issues, rather than a unique phenomenon.

Keywords Video games · Addiction · Pathological gaming · Attention problems · Grades

Abbreviations

PG	Pathological gaming
GPA	Grade point average

What's known PG behaviors affect a small number of youth video game players. Pathological gaming appears to be correlated with other mental health problems such as attention deficit symptoms.
What this study adds the current study examines prospective links between attention problems and pathological gaming. Evidence suggests that attention problems increase the potential for pathological video game playing, but that the inverse is not true.

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Pathological gaming (PG) is defined as the persistent and recurrent inability to control excessive gaming habits despite associated social and/or emotional problems [1–3]. There has been significant debate about the phenomenon and whether it is a unique condition or better perceived as a consequence of other mental health problems [2, 4–7]. The American Psychiatric Association has held off including video game or internet addiction as a formal diagnosis in the forthcoming DSM-5 due to uncertainty as to whether PG represents a specific syndrome or a consequence of underlying mental health disorders [8]. Although many studies have implicitly assumed that pathological involvement leads to increasingly excessive gaming binges and health concerns, their cross-sectional approach could not address a causal relationship [3, 9].

Children and adolescents with attention problems may be more vulnerable to problematic video game play [10] and internet use [11]. The relationship between behaviors identified as PG and attention problems is complex and discrepancies in measuring PG and attention problems between studies have further clouded the issue [3]. Despite recent negative attention, there are also positive effects of video games on development. Visuospatial skills and motor development may be positively influenced by video game play [12–15]. Furthermore, video games can be used in treatment of youth [16, 17]. Unfounded concerns may hinder appropriate use of video games by children and clinicians who work with them. Therefore, distinguishing healthy engagement in video games from pathological patterns of play is an important step to ensure optimal benefit for youth [18–20].

Prospective studies that examine the link between PG and attention problems while controlling for potentially confounding variables are needed. This study examines developmental pathways between PG and attention problems using a prospective analysis of youth engagement in varying degrees of video game play.

Methods

Participants

The current study included 144 English-speaking adolescents from a small city. Participants were recruited using snowball sampling from the local community. Parent and adolescents were provided with informed consent forms and informed of study procedures prior to giving consent. No incentive was offered for participation, thus participation was fully voluntary. All procedures were designed to comport with federal human participant research standards and met with local IRB approval.

Measures

Pathological Gaming

In the absence of a clear criteria for diagnosis or definition of PG, a recent meta-analytic review measures of pathological gaming that focused on the interfering nature of the symptoms were found to have the greatest precision and validity [4]. Building upon previous efforts [2], and attending particularly to the interfering nature of symptoms, a 7-item scale of pathological gaming was developed. Example items include “I think about video games so often it makes it hard to focus on other important stuff like schoolwork” and “The time I spend playing video games has stopped me from exercising or hanging out with friends.” At Time-2 the questions were reformulated so as to collect information from

parents regarding perceptions of their child's pathological gaming behaviors (e.g. "My child think about video games so often it makes it hard for him/her to focus on other important stuff like schoolwork", "The time my child spends playing video games or using the internet has stopped him/her from exercising or hanging out with friends"). Using different respondents helped reduce testing related effects and single responder bias was diffused by using different respondents (Coefficient alpha was 0.81 at Time-1 and 0.72 at Time-2.)

Attention Problems

Attention problems were measured using the Child Behavior Checklist (CBCL) [21], a well-validated index of mental health problems in children. Parents respond to the CBCL items, reporting on symptoms of psychopathology. Coefficient alpha was 0.78 at Time-1 and 0.82 at Time-2.

Grade Point Average (GPA)

Parents were requested to provide the latest full-year GPA for their child from the latest report card the child had received. This data were used to examine the influence of pathological gaming on academic performance.

Social Factors

Two social risk/protective factors, family attachment and peer delinquency were used to control for potential influences in the social environment. Relevant scales from the Negative Life Events Questionnaire [22] were used to control for these factors at Time-1. Previous research has indicated that family and peer influences are associated with trajectories of attention problem symptoms and thus were considered important to control [23, 24]. Coefficient alpha for family attachment was 0.80 and for peer delinquency 0.84. These items were answered by youth respondents.

Statistical Analyses

Primary analyses consisted of OLS regression analyses in which the prospective relationship between attention problems and pathological gaming was tested controlling for other social risk factors (parenting and peers). Two sets of regressions were conducted, to examine both potential developmental directions, that is attention problems leading to problematic gaming and problematic gaming leading to attention problems. The impact of attention problems and problematic gaming on school GPA were also considered in prospective analyses. Co-linearity diagnostics on all regressions were run, with no evidence of co-linearity found. All VIF scores were below 1.5. Secondary analyses will consist of path analysis to examine developmental models of problematic gaming and attention problems.

Results

One hundred and forty four adolescents participated in the study. Most of the youth were of Hispanic origin (94.4 %) consistent with the demographic makeup of greater population

sampled. Participants were about equal in regards to gender (male $n = 76$, 52.8 %). Most youth were born in the United States (91 %) with the remainder born in Latin America. The average age at the Time-1 assessment was 12.7 (SD = 1.96). Follow up assessments occurred 1 year later.

The Phenomenology of Pathological Gaming in Youth

Analysis of the pathological gaming variable suggested that pathological gaming is rare among youth. Figure 1 presents the histogram for parent reported pathological gaming at Time-2. Child reported pathological gaming at Time-1 displayed a similar pattern of positive skew with the most common response indicating absence of any symptoms. Due to the positive skew, a square root transformation was used with these variables to make them appropriate for use in regression equations.

Total game playing frequency at Time-1 was related to pathological gaming in bivariate analyses at Time-2 ($r = 0.35$, $p < 0.01$).

Pathological Gaming as a Predictor of Attention Problems

In the first regression equation, pathological gaming at Time-1 was considered as a predictor of attention problems at Time-2, controlling for child age, gender, as well as family and peer environment and Time-1 attention problems. These results are presented in Table 1. As can be seen, attention problems at Time-2 were predicted by male gender ($\beta = 0.17$) and Time-1 attention problem score ($\beta = 0.44$), but not by pathological gaming score. When this regression was rerun with pathological gaming replaced by total hours per week spent gaming, results did not significantly differ and total exposure to video games was not predictive of attention problems a year later ($\beta = -0.02$).

Attention Problems as a Predictor of Pathological Gaming

In the second regression equation attention problems at Time-1 were considered as a predictor of pathological gaming at Time-2 controlling for child age, gender, as well as family and peer environment and Time-1 pathological gaming. These results are presented in Table 1. Pathological gaming at Time-2 was predicted by male gender ($\beta = 0.46$) and Time-1 attention problem score ($\beta = 0.19$).

Attention Problems and Pathological Gaming as a Predictor of GPA

In the third regression equation attention problems and pathological gaming at Time-1 were considered as a predictor of school GPA at Time-2 controlling for child age, gender, as well as family and peer environment and Time-1 school GPA. These results are presented in Table 1. GPA at Time-2 was predicted by GPA at Time-1 ($\beta = 0.58$) and Time-1 attention problem score ($\beta = -0.23$).

Path Analysis of Pathological Gaming and Attention Problems

Time sequenced pathways between pathological gaming and attention problems at Times 1 and 2 were analyzed through path analysis. Alternating models were tested with pathological gaming at Time-1 leading to Time-2 attention problems, attention problems at

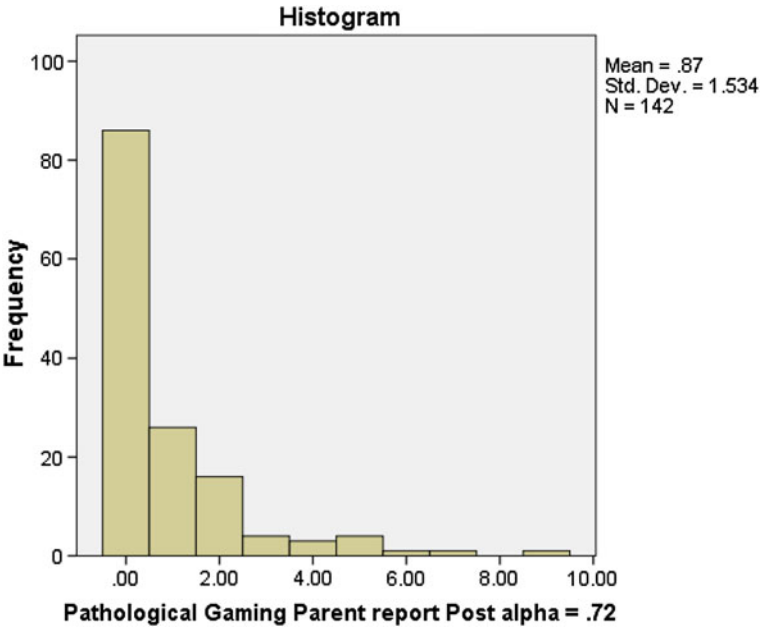

Fig. 1 Distribution of parent reported pathological gaming scores at Time-1

Table 1 OLS regression results for problematic gaming, attention problems and GPA

Time-2 outcome variable			
Predictor variable	Attention problems	Problematic gaming	GPA
Age	−0.16	−0.16	0.10
Male gender	0.17 (0.01, 0.32)	0.46 (0.32, 0.58)	−0.03
Family attachment	0.09	0.04	−0.04
Peer delinquency	−0.06	0.02	−0.03
Pathological gaming time-1	0.05	0.05	0.11
Attention problems time-1	0.44 (0.30, 0.56)	0.19 (0.03, 0.34)	−0.23 (−0.07, −0.38)
GPA Time-1	N/A	N/A	0.58 (0.46, 0.68)
Adjusted R^2	0.19	0.23	0.34

Numbers in parentheses represent 95 % confidence intervals for statistically significant effect sizes for standardized regression coefficients

Time-1 leading to Time-2 pathological gaming, and a bidirectional model. Path analyses revealed that the best fit was for the model in which attention problems at Time-1 lead to pathological gaming 1 year later, but not the inverse (NFI = 1.00, CFI = 1.00, RMSEA = 0.01). Pathways for pathological gaming at Time-1 leading to later attention problems were not significant in any model. This provides further evidence that pathological gaming arises from attention problems rather than the inverse. The final path model is presented in Fig. 2.

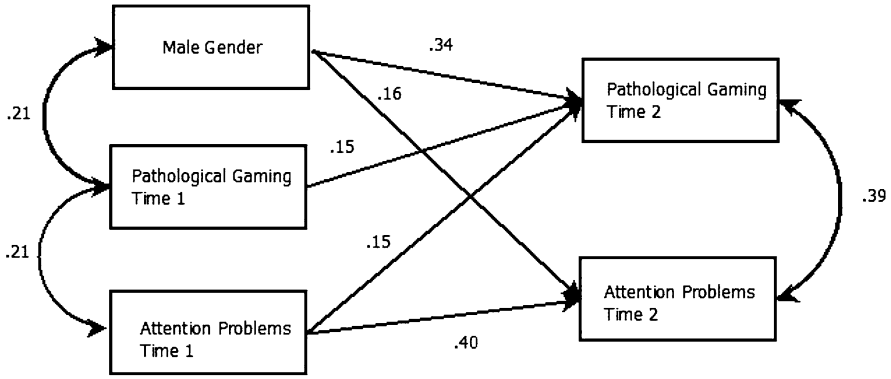

Fig. 2 Final path model for attention problems and pathological gaming

Discussion

This study is the first to examine the prospective link between pathological gaming and attention problems using well-validated clinical measures and controlling for potentially confounding family variables. Consistent with previous cross-sectional approaches, coexistence of attention problems and pathological gaming was found at both time points in this study [10]. Path analyses showed the direction of causality, and suggest that attention problems may lead to pathological gaming in adolescents. Imaging studies have also suggested an important role of certain brain structures in preconditions for heavy video game play rather than being the consequence of excessive gaming [25].

Two reasons may explain how attention problems may result in pathological gaming. First, associated impulse dysregulation may make it more difficult for an adolescent to disengage from the immersive and absorbing nature of video game play [26, 27]. As a result, adolescents with attention problems may spend more time playing video games than those without. Second, lower GPA among youth with attention problems is a common finding [26, 28], may be associated with perception of underachievement fueling an overall dissatisfaction or reduced needs met for an adolescent and may lead to compulsive nature of video game play [29].

Male adolescents were more likely to engage in pathological gaming at the endpoint in this study and previous research supports this finding [3, 30]. A recent survey reported a significant gender difference in frequency and duration of playing video games on a gaming console (e.g., Xbox 360, Playstation 3, Wii, etc.) among adolescents [31]. Therefore the adolescent boys may be at increased risk of engaging in pathological gaming and related consequences, such as lowered GPA or having less opportunity than their peers to cultivate protective experiences that require active social, intellectual, or athletic engagement [32].

In addition to its prospective nature, using different respondents helped reduce testing related effects and diffused single responder bias, thus further strengthening this study. Yet, several limitations need to be considered. First, the study sample focused specifically on Hispanic ethnicity adolescents based on regional convenience and may not reflect gaming tendencies of adolescents from other racial or ethnic backgrounds. For example, effects of PG may be more significant for black male adolescents who were reported to spend more time on most forms of media [31]. Larger studies with more heterogenous

study populations may control for ethnic and racial factors. Second, attention problems measured in this study probably consisted of a heterogeneous group of psychiatric conditions and continuum of normality. Different diagnoses may lead to attention problems, and each may have unique effects on gaming habits. Children with a primary attention regulation disorder may differ in their gaming habits and motivations from those who may have an underlying mood disorder. However, absence of any effect from baseline attention problem at baseline to pathological gaming measured at end-point suggests the latter is an outcome of various psychological problems. Third, although input from multiple responders was gathered at Time-2, only adolescents reported their gaming habits at Time-1. However, reports of adolescents and parents at Time-2 corresponded ($r = 0.38$, $p < 0.001$), suggesting children and parents had a shared view of gaming habits of former group. It is also worth noting that a standardized, clinically-validated measure of pathological gaming has yet to exist. Although we based the current measure on previous research on best practices, in the absence of a standardized tool, measurement error is always a factor to consider.

This study extends the existing research literature through its prospective approach with multiple responders and opens up more questions than it answers. Attention problem is a risk factor for developing pathological gaming habits; however, it is not yet known whether treatment of attention problems would effect pathological gaming. We need to learn more about effect of psychiatric conditions on pathological gaming and effects of relevant treatment. Meanwhile, clinicians are well advised to screen their patients' gaming habits, particularly those with attention problems and help them incorporate changes in gaming habits as part of healthy life style adjustment.

Conflict of interest Neither author have conflicts of interest to declare. The authors have no financial relationships relevant to this article to disclose.

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