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# Trajectories of Problem Video Gaming Among Adult Regular Gamers: An 18-Month Longitudinal Study

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## Abstract

A three-wave, longitudinal study examined the long-term trajectory of problem gaming symptoms among adult regular video gamers. Potential changes in problem gaming status were assessed at two intervals using an online survey over an 18-month period. Participants ( $N=117$ ) were recruited by an advertisement posted on the public forums of multiple Australian video game-related websites. Inclusion criteria were being of adult age and having a video gaming history of at least 1 hour of gaming every week over the past 3 months. Two groups of adult video gamers were identified: those players who did ( $N=37$ ) and those who did not ( $N=80$ ) identify as having a serious gaming problem at the initial survey intake. The results showed that regular gamers who self-identified as having a video gaming problem at baseline reported more severe problem gaming symptoms than normal gamers, at all time points. However, both groups experienced a significant decline in problem gaming symptoms over an 18-month period, controlling for age, video gaming activity, and psychopathological symptoms.

## Introduction

A MAJOR OBSTACLE IMPEDING the inclusion of one or more proposed pathologies related to video game use (e.g., video game *addiction*, video game *dependency*, *pathological* video gaming) within reputable clinical nomenclature (e.g., the upcoming Diagnostic and Statistical Manual of Mental Disorders (5th edition) (DSM-V)) is the lack of convergent empirical evidence and professional opinion on the validity of such disorders.<sup>1-6</sup> Recent reviews<sup>7,8</sup> have reported that fewer than 60 empirical studies in the last decade have investigated video game-related pathologies and that these studies vary significantly in terms of type of methodology employed, sample size, methodological rigor, and conclusions. Additionally, these reviews have highlighted the dearth of longitudinal research on the course and severity of problems associated with pathological video game use. Although several large studies<sup>9-12</sup> of (mainly adolescent) gamers have been published over the last 5 years, as yet, there has been no research that focuses specifically on the course of pathological gaming among video gamers of adult age.

It has been contended that many video gaming-related problems should not be considered as addictive in nature,<sup>1,6,13</sup> but rather as relatively minor and transient problems that will typically resolve spontaneously.<sup>14</sup> Further, some researchers have argued that excessive gaming behav-

ior should in many cases be considered as a secondary problem or coping mechanism that occurs in response to more primary psychological difficulties<sup>5</sup> or poor time management skills.<sup>6</sup> A counterargument is that any behavior of clinical concern that does not fall within established clinical criteria of a pre-existing psychological disorder or health problem should be conceptualized separately as a comorbidity.

A recent longitudinal research has reported that pathological video gaming may persist for up to and over 6 months, and increase the risk of comorbid Axis I disorders and other life difficulties. Gentile et al.<sup>9</sup> reported that 84 percent of youth initially identified as pathological video gamers ( $N=219$ ) were still pathological gamers at a 2-year follow-up. In van Rooij et al.'s<sup>12</sup> study of Dutch schoolchildren aged 13 to 16 years (Time 1:  $N=1,572$ ), a subsample of online gamers (3 percent) met their criteria for video game addiction. Half of this subgroup was classified as "addicted" at a 12-month follow-up. These two studies and others<sup>11,15,16</sup> suggest that high levels of video game involvement among children and adolescents can be maintained for months, and even years, with associated negative mental health, academic, and social outcomes.

The purpose of the present study was to examine the long-term trajectory of problem gaming symptoms among adult regular video gamers. Specifically, this research assessed changes in problem gaming symptoms at two intervals over

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an 18-month period, comparing those players who did ( $N=37$ ) and those who did not ( $N=80$ ) identify themselves as having a serious gaming problem at the initial survey intake. In the absence of a recognized gold standard assessment of pathological video gaming, self-diagnosed problem video gaming was considered to be the most clinically meaningful group division given that individuals who do not feel that their gaming is a problem would be unlikely to voluntarily seek treatment. Data were analyzed to assess whether these two groups' (i.e., problem versus normal gamers) problem gaming symptoms changed significantly over time. Based on limited literature demonstrating long-term persistence of symptomology,<sup>9,12</sup> it was predicted that participants who reported having a problematic video gaming habit at baseline would also report problem gaming symptomology at 6-month and 18-month follow-up periods, whereas those participants without a self-diagnosed gaming problem would report significantly fewer problem symptoms over time.

## Method

### Sample

Participants agreed to participate in a confidential online survey about video games and mental health. In Wave 1, there were 393 adult respondents ( $M=360$ , 91.2 percent;  $F=33$ , 8.3 percent). The initial sample is described in detail elsewhere.<sup>17</sup> Nonadults (<18 years of age) in this sample were excluded. A total of 117 respondents with at least 95 percent completed survey data remained at Wave 3 (overall attrition: 71 percent). Dropout may be attributed to anonymous and voluntary participation, and the online sampling method. However, attrition analysis of the initial sample at baseline ( $N=393$ ) and the sample at final follow-up ( $N=117$ ) revealed no significant differences in terms of age, gender, gaming activity, and severity of problem gaming symptoms. Missing data occurred in fewer than 5 percent of variable cases and was handled by substitution of the mean. The overall sample was predominantly male (92 percent; 8 percent female) and had a mean age of 24 years ( $SD=5.5$ ).

### Procedure

A three-wave, longitudinal survey about problematic video game use approved by the Human Research Ethics Subcommittee at the University of Adelaide was hosted on a popular survey hosting website. Participants were recruited by an advertisement posted on the public forums of multiple Australian video game-related websites. A range of websites was chosen to minimize bias in participants' preferences for specific video game types, such as online role-playing games. Eligibility for inclusion was video game playing for at least 1 hour every week for 3 months before the survey. Participants were directed to the survey by following the link provided in the advertisement. Data were collected from January 2010 to August 2011, with Wave 2 and 3 collected at 6-month and 18-month follow-ups. Each wave of data was collected by email invitation, over a 4-week time period only. A reminder email was sent following a nonresponse period of 7 days following invitation. All analyses were conducted using the statistical package SPSS for Microsoft Windows (v.18.0; Chicago, IL). The significance level of all statistical tests was set at  $p < 0.05$ .

### Materials

Basic demographic information and video gaming history was obtained at baseline. Self-evaluation of problem video gaming status was assessed by responding either "yes" or "no" to the item: "Do you think that currently you may have a problem video gaming habit?" Research on the related area of Internet addiction has shown that asking a single self-diagnostic question relating to addictive behavior shows high correlations with standardized internet addiction tests (IATs).<sup>18</sup> The following questionnaires were administered at each wave.

**Video game play survey.** This survey measured frequency and duration of video game play across multiple video game systems. Participants were instructed to record average hourly values of gaming activity based on the preceding 3-month period in a  $4 \times 7$  matrix (*video game system*: [personal computer, gaming console, handheld gaming device, arcade machine]  $\times$  *days of the week*: [Monday to Sunday]). Hourly values were computed to yield an overall measure of weekly gaming activity.

**Problematic video game playing test.** The problematic video game playing test (PVGGT) is an adapted version of the IAT, a 20-item measure of Internet addiction developed by Young<sup>19</sup> that is frequently used in clinical trials despite some methodological drawbacks.<sup>4</sup> Items are based on Diagnostic and Statistical Manual of Mental Disorders (4th edition, text Revision) (DSM-IV-TR) criteria for pathological gambling, including preoccupation, loss of control, repeated unsuccessful attempts to reduce gaming behavior, and harmful consequences of excessive gaming.<sup>20</sup> Total PVGT scores range from 20 to 100, with higher scores indicating greater severity of problems associated with the video game use.

**Depression anxiety stress scales.** The depression anxiety stress scales (DASS) is a 42-item self-report instrument designed to measure the three negative emotional states of depression, anxiety, and stress. The sound psychometric properties of the DASS in adult populations are well-documented.<sup>21</sup>

## Results

At baseline, there were 37 self-identified problem gamers, and 80 self-identified normal gamers. A criterion validity check found that problem gamers scored significantly higher on a test of problem video gaming symptoms (i.e., PVGT) at baseline than normal gamers ( $M_1=56.3$ ,  $SD=13.1$  vs.  $M_2=41.6$ ,  $SD=9.6$ ,  $t(115)=6.79$ ,  $p < 0.001$ ), and reported consistently higher levels of weekly gaming activity (in hours) than nonproblem gamers (Wave 1:  $M=22.1$ ,  $SD=13.1$  vs.  $18.3$ ,  $SD=12.4$ ; Wave 2:  $M=21.4$ ,  $SD=15.3$  vs.  $16.9$ ,  $SD=12.7$ ; Wave 3:  $M=19.3$ ,  $SD=16.9$  vs.  $15.5$ ,  $SD=10.2$ ). Independent-sample  $t$ -tests revealed problem gamers scored significantly higher on all 20 individual items of the PVGT than normal gamers. A Mann-Whitney U test indicated that gender was not significantly related to problem video gaming. Table 1 presents a summary of each group's demographic characteristics and video gaming activities.

A 2 Problem Gaming Status (Problem vs. No Problem)  $\times$  3 Time repeated measures ANCOVA was conducted to assess the effect of baseline problem gaming status on PVGT scores,

TABLE 1. CHARACTERISTICS OF SELF-IDENTIFIED PROBLEMATIC (N=37) AND NORMAL (N=80) ADULT VIDEO GAMERS AT BASELINE

Variable	Normal		Problem		t/F	p	Cohen's d
	M	SD	M	SD			
Age	23.8	5.7	22.7	5.2	0.89	0.38	0.20
Gender (% male)	91.3	-	94.6	-	0.63	0.53	0.15
Relationship status <sup>a</sup>	56.2	-	45.8	-	1.18	0.17	0.23
Employment							
Unemployed (%)	27.5	-	27.0	-	0.08 (F)	0.78	-
Part-time/Casual (%)	32.5	-	43.2	-	-	-	-
Full-time (%)	40.0	-	24.3	-	-	-	-
Education							
High school (%)	30.0	-	21.6	-	0.16 (F)	0.69	-
Tertiary (%)	41.3	-	51.9	-	-	-	-
Video game Weekly hours playing	19.1	14.6	22.8	13.6	1.30	0.20	0.26
Number of VGs played <sup>b</sup>	3.2	1.5	3.1	1.4	0.14	0.89	0.07
History (years)	14.9	6.1	13.9	6.4	0.85	0.40	0.16
Video game genre							
Shooting (%)	85.0	-	78.4	-	0.88	0.38	0.19
Role-playing (%)	63.8	-	67.5	-	0.26	0.80	0.06
MMORPG (%)	28.8	-	24.3	-	0.50	0.62	0.11
Sports/Racing (%)	25.0	-	24.3	-	0.08	0.94	0.02
Puzzle (%)	21.3	-	21.6	-	0.05	0.96	0.02

<sup>a</sup>Partnered or married.

<sup>b</sup>In the previous 6-month period.

VG, video game; MMORPG, massively multiplayer online role playing game; NB, percentages (%) presented for ease of readability and interpretation.

controlling for effects of age, weekly gaming activity (hours), and DASS symptomology. Before analyses, data for all of the variables were screened for missing values, normality, and outliers. There was homogeneity of variance between groups as assessed by the Levene's test for equality of error variances. The Mauchly's Test of Sphericity was violated; hence, the Huynh-Feldt correction was used in subsequent analyses.

There was a weak, but significant Time × Problem Gaming Status interaction in relation to problem gaming symptoms (PVGST score),  $F_{1,8,201.5} = 5.86, p < 0.001; \eta^2 = 0.05$ . There was also a significant main effect of Problem Gaming Status,

$F_{1,114} = 33.99, p \leq 0.001; \eta^2 = 0.23$ , and a significant main effect of time,  $F_{1,8,203.8} = 30.44, p \leq 0.001; \eta^2 = 0.21$ . The size of the main effects was medium, according to Cohen.<sup>22</sup> Figure 1 presents a graphical representation of the mean trajectories of problem gaming symptoms for the two groups of regular video gamers.

Ignoring the effect of time, regular gamers who initially identified as having a serious gaming problem scored approximately 10 points higher on the PVGT (adjusted  $M = 49.9, SE = 1.53$ ) than those gamers who did not identify as problem gamers (adjusted  $M = 39.2, SE = 1.02$ ). Assessing the main effect of group, pairwise comparisons of estimated marginal means using Bonferroni adjustment indicated that there was a significant reduction in PVGT scores between baseline and 18-month follow-up ( $M = 48.7$  [95 percent confidence interval (CI): 46.6 to 50.8] vs.  $M = 41.0$  [95 percent CI: 38.8 to 43.1],  $p \leq 0.001$ ), as well as baseline and 6-month follow-up ( $M = 48.7$  [95 percent CI: 46.6 to 50.8] vs.  $M = 44.1$  [95 percent CI: 41.9 to 46.2],  $p \leq 0.001$ ), and 6-month follow-up and 18-month follow-up ( $M = 44.1$  [95 percent CI: 41.9 to 46.2] vs.  $M = 41.0$  [95 percent CI: 38.8 to 43.1],  $p < 0.05$ ). Therefore, the hypothesis that problem gamers' PVGT scores would be consistent (i.e., maintained) over time was not supported.

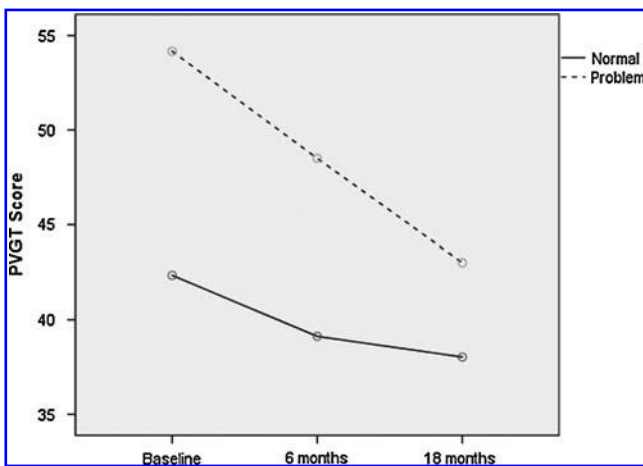


FIG. 1. Mean trajectories of problem gaming symptoms for problem (N=37) and nonproblem adult gamers (N=80). The X-axis is not drawn to scale.

**Discussion**

The present study examined the longitudinal course of problem gaming symptoms among two groups of adult regular gamers, those who had a self-identified problem gaming habit and those who did not. Both groups experienced a significant decline in problem gaming symptoms

over an 18-month period, controlling for age, gaming activity, and psychopathological symptoms. This result differs from Gentile et al.'s<sup>9</sup> study of adolescents, who reported that problem gaming status at baseline was a strong predictor of future problem gaming. An explanation for this general decline in problem gaming symptoms in both groups is not readily apparent based on these data although the concept of maturing out over time is well established in the addiction literature.<sup>23</sup> Inspection of problem gaming trajectories may suggest that a spontaneous recovery effect occurred among all gamers, as has been observed in studies that have monitored problem gamblers not receiving treatment.<sup>24</sup>

It may be that problem gaming symptoms at baseline generally represented the most severe stage of respondents' problem gaming habit, at which point problem symptoms remitted naturally over the course of the study. An alternate explanation is a general bias in reporting (i.e., overestimation) decreased over time as respondents became more familiar with the survey items. Similarly, participants may have felt obliged to report improvement in problem gaming status due to social desirability biases. Another (admittedly, less likely) explanation is that research participation itself led to increased self-awareness of, or personal insight into, gaming excesses, producing efforts to reduce gaming to healthy levels.

Interestingly, the results showed that regular gamers who self-identified as having a video gaming problem at baseline reported more severe problem gaming symptoms than normal gamers, at all time points. This finding suggested that using a one-item screening question to determine problem gaming status may have clinical utility in terms of assessment because affirmative responses generally indicated more severe short- and long-term problem gaming symptoms.

Several limitations in the study's design warrant caution in interpretation. First, all measures were self-report and were not verified by a trained clinician. All participants were self-selected, which may have affected generalizability of findings. Although an online, anonymous survey format may facilitate greater self-disclosure, asking participants to self-diagnose their problem gaming status may have excluded persons with denial issues and/or low insight into problem gaming. As such, adults with a chronic gaming problem may be unlikely to respond to and maintain involvement in an online survey on problem gaming. Second, long intervals between measurements may have reduced sensitivity to changes in problem gaming at other times. Third, it would have been useful to include additional measures (e.g., personality, level of social support, pathological use of other media) to control for potential confounds.

## Conclusions

This study provides some preliminary insights into the natural trajectory of problem gaming symptoms among adult regular gamers. These data suggest tentatively that problem gaming symptoms may decline steadily over time among adult regular gamers, including among those who report initially having a self-diagnosed problem gaming habit. These data may offer a useful comparison when assessing outcomes of control groups (i.e., placebo or waiting list) in future clinical treatment trials of problem gamers. Further

longitudinal research involving larger samples of adult video gamers is required. There is also a need for research on the short- and long-term efficacy of treatment interventions for problem video gaming.<sup>25</sup>

## Author Disclosure Statement

No competing financial interests exist.

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