Trajectories of abstinence-induced Internet gaming withdrawal symptoms: A prospective pilot study

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1. Introduction

The historical development of the concept of problematic Internet gaming has its roots in the fields of problem gambling and substance addiction (Starcevic, 2013). Withdrawal is a key addiction concept that has been routinely applied in research on Internet gaming behaviors, on the assumption that gaming activities are liable to produce unwanted or aversive reactions for some users when they are unable to engage in the activity (Kaptsis, King, Delfabbro, & Gradisar, 2016). As a condition requiring further study in the DSM-5, Internet Gaming Disorder (IGD) refers to persistent and recurrent Internet gaming associated with clinical impairment or distress (APA, 2013). Criterion 2 of IGD refers to ‘withdrawal symptoms’ characterized by feelings of irritability, anxiety, or sadness following the removal of Internet games. However, the evidence base on Internet gaming withdrawal is very underdeveloped and is largely composed of retrospective self-report survey-based studies that employ inconsistent definitions of withdrawal (see Kaptsis et al., 2016). Similarly, there is a concerning paucity of qualitative case studies and intervention studies that provide detailed clinical descriptions of symptoms arising from cessation of Internet gaming (Beranuy, Carbonell, & Griffiths, 2013; Chappell, Eatough, Davies, & Griffiths, 2006; King & Delfabbro, 2015; Griffiths, 2010). Therefore, the aim of this study was to examine the nature of Internet gaming withdrawal symptoms, if they occur, and their trajectories under abstinence conditions using a prospective measurement approach.

Withdrawal is considered a fundamental component of addiction (Griffiths, 2005). It is commonly defined as a dysphoric state arising from abstaining from an addictive behavior or substance (Grant, Potenza, Weinstein, & Gorelick, 2010; Tao et al., 2010). Although the presence of withdrawal is not technically necessary for an affirmative addiction diagnosis, the inclusion of withdrawal in the IGD classification (along with other addiction symptoms) is nevertheless foundational to positioning IGD as an addictive disorder (Kardefelt-Winther, 2015; Sim et al., 2012). On the one hand, the IGD classification might be considered a step forward because it has offered consistency to a field plagued by varying approaches to conceptualization and measurement (Griffiths, King, & Demetrovics, 2014; King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Petry et al., 2014). However, the premature adoption of a nomenclatural definition of problematic Internet gaming as an...
addiction without adequate empirical support also has numerous risks that arguably outweigh the initial benefit of consistency. One risk is the greater likelihood of failure to examine alternative conceptualizations that might be more appropriate to account for the nature and course of problematic gaming. Another potential negative consequence is the expenditure of resources on the trialing of treatment approaches tailored for addictive behavior, including those which may deliver negligible benefit (or even negative outcomes) for individuals with Internet gaming problems. It is therefore necessary for researchers to develop a sound research base that underpins the symptomatology of the IGD classification to guide diagnostic and treatment decision-making processes (King et al., 2013).

Research on problematic Internet gaming may benefit from adapting methodologies employed to assess withdrawal symptoms in other addictive disorders, such as gambling and alcoholism (de Castro, Fong, Rosenthal, & Tavares, 2007; Tavares, Zilberman, Hodgins, & El-Guebaly, 2005). To advance understanding of clinical phenomenology of a disorder, it is often helpful to conduct prospective studies with multiple observations over time, rather than relying solely on a single retrospective account. Several studies in the field of addiction have involved prospective assessment of withdrawal symptoms under abstinence or treatment conditions. Some studies of problematic gambling, for example, have conducted assessment of gambling craving during periods of abstinence (de Castro et al., 2007; Tavares et al., 2005; Wray & Dickerson, 1981). These studies have demonstrated that problem gambling report strong craving under abstinence, at comparable levels to those reported by alcoholics. However, there has also been debate as to whether this craving may reflect the loss of an avoidant coping strategy rather than an inability to gamble (Balsczynski, Walker, Sharpe, & Nower, 2008). Similarly, in studies of nicotine dependence, withdrawal symptoms have been assessed prospectively over periods of abstinence following pharmacological intervention (Javitz, Lerman, & Swan, 2012; Piper et al., 2011). A common finding in nicotine studies is the curvilinear trajectory of withdrawal, whereby symptoms initially increase followed by a gradual parabolic decline, highlighting the central mechanism by which addicted users experience heightened urges and mood changes that drive repeated use of a substance or activity (Hallgren et al., 2015; Haughey, Marshall, Schacht, Louis, & Hutchison, 2008). Although withdrawal symptoms have been examined closely in other fields of addiction, there have been no controlled studies that examine the withdrawal symptom profile of abstinent problematic Internet game users, including measurement of the strength of withdrawal effects or their trajectory over time. Examining withdrawal symptoms in IGD would assist not only in improving its description and quantification, but also inform our understanding of IGD’s theorized similarity with other addictive disorders.

1.1. The present study

The aim of this study was to examine the psychological consequences of an 84-h period of Internet gaming abstinence among individuals who endorse the DSM-5 criteria for IGD. It was reasoned that a prospective study of Internet gaming withdrawal using an abstinence-based protocol may offer a novel insight into the presence, nature, and trajectory of Internet gaming withdrawal symptoms. If withdrawal symptoms are a useful clinical marker of IGD status, then withdrawal symptoms would be expected to be significantly greater among the IGD group than the control group at baseline and during abstinence. It was considered more difficult, however, to predict the withdrawal symptom trajectory of IGD without background data, and particularly given that withdrawal symptom profiles vary considerably across addictive disorders (Koob & Le Moal, 2008).

2. Method

2.1. Participants

A total of 24 participants (20 males, 4 females) aged 18 to 36 (M = 24.6, SD = 5.1) were recruited. There were 9 participants who met the criteria for Internet Gaming Disorder (IGD) and 15 who did not (i.e., non-IGD group) (NB: see Internet Gaming Disorder criteria checklist). Participants were predominantly Caucasian (71%), followed by Asian (21%) and Hispanic (8%). Participants were recruited via advertisements posted to the forums of four popular Massively Multiplayer Online Game (MMO) websites, and via paid targeted advertising on Facebook (specified audience: adult video-game players aged 18–25 years). In total, all advertisements were viewed 8236 times. Inclusion criteria were: (1) being at least 18 years old and (2) a current MMO player that played on a weekly basis. MMO players were targeted because they are considered to be more likely to report harmful patterns of gaming behavior than those who engage in other game types (Elliott, Golub, Ream, & Dunlap, 2012; Smyth, 2007). A total of 27 participants were initially recruited. Three individuals exited the study during the baseline survey. Thirty-one individuals declined the invitation to participate and/or expressed hostility that the 84-h abstinence period was too long. Participants who completed the study entered a draw to win a share of $250 in gift vouchers.

2.2. Design and procedure

The study used a repeated-measures design to assess the psychological outcomes of an 84-h gaming abstinence period for individuals with or without an IGD classification. Outcome variables included affect (i.e., positive and negative affect), psychological distress (i.e., depression, anxiety, stress), and Internet gaming withdrawal symptoms (craving/urge, thoughts about gaming, inability to resist gaming). All participants were administrated the baseline survey on Thursday, and then instructed to abstain from all video-gaming for a period of 84 h commencing Friday 12 am and concluding on the following Monday. The weekend period was chosen because it was expected that participants would have more available time for Internet gaming during this period and would therefore experience stronger urges to play. At 12 pm on each day of the abstinence period (i.e., Friday [Day 1] to Monday [Day 4]), online surveys were administered electronically via email link. The abstinence period concluded upon completion of the final survey. The retention rate across all surveys (i.e. Baseline to Day 4) was 100%. The time that surveys were completed was tracked automatically by the survey host, and survey data logs were checked to ensure that responses were completed at the specified time.

To increase compliance with the abstinence protocol, participants were asked to provide the details (i.e., usernames or ‘gamertags’) of their MMO accounts to enable the researchers to check whether they had been active on their account. Additionally, participants were asked to report at each survey whether they had ‘relapsed’ or logged onto their accounts in the course of the abstinence period. Finally, a series of open-ended questions asked participants about their experiences during abstinence, to explore any coping strategies, gaming-related attitudinal changes, and compensatory behaviors. While these measures could not ensure total compliance, participants did in fact report total compliance with the protocol and no participants were observed to play on their accounts during the abstinence period. As a further validity check, written feedback was examined and found to be consistent with their survey responses (see King, Kaptis, Delfabbro, & Gradisar, 2016). An online survey was employed in lieu of a pen-and-paper survey for ease and convenience and also to enable time-stamp data on each survey for validity purposes. Data collection occurred from June to September 2015. Ethical approval was granted by the Social and Behavioural Research Ethics Committee (SBREC) at Flinders University, South Australia.
2.3. Measures

A questionnaire assessed demographic information, i.e., age, gender, ethnicity, education, and employment status. Gaming activity was also examined, including hours of video-gaming in a typical week in the past 3 months, types of games played, and years of involvement with MMOs. Additional psychometric assessment included:

2.3.1. Internet Gaming Disorder (IGD) criteria checklist

The IGD criteria checklist is a 9-item self-report measure to assess the DSM-5 IGD classification (APA, 2013). The item measuring withdrawal symptoms states: “In the past 12 months, did you feel irritable, angry, guilty or sad when attempting to cut down or stop playing or when you were unable to play?” Response options included ‘no’, ‘sometimes’, and ‘yes’. ‘Sometimes’ was considered an affirmative response with half-weighting, in line with some past research (Gentile, 2009), in an attempt to limit effects of participant defensiveness or denial of problems (Howard et al., 2002). Participants were assigned to an IGD group (a score of 5 or more) or a non-IGD group (a score of <5). The half-weighting approach included three individuals (33%) who would be considered only ‘at risk’ (score of 3 or 4) using the binary scoring approach. For ease of reporting, we refer to the 33% ‘at risk’ and 66% ‘clinical’ composite group as the ‘IGD group’. As a validity check of this group allocation method, an additional item asked whether the participant believed they had a gaming problem and if so, how long this had been the case. All 9 participants in the IGD group responded affirmatively to this question (responses: ‘6–12 months’ [n = 1] and ‘over 12 months’ [n = 8]. The internal consistency of the tool was high (α = 0.81).

2.3.2. Internet Gaming Withdrawal Scale (IGWS)

The IGWS is a modified version of the five-item Penn Alcohol Craving Scale (PACS; Flannery, Volpicelli, & Pettinati, 1999), a measure of alcohol withdrawal symptomatology. The PACS assesses frequency and severity. All PACS items were modified to specify MMO use instead of alcohol (e.g., “How intense was your desire/craving to play an MMO at its strongest point?”). Additionally, the time-frame of the measure was modified across surveys to refer to the previous period of time between surveys (e.g., “In the past 24 h... or In the past week”). IGWS response options differed according to the item, but all items were scored from zero to six. A copy of the IGWS is available by request from the corresponding author. A total IGWS score was calculated by summing all individual item responses, with higher scores indicating more intense and frequent symptoms. The IGWS demonstrated excellent internal consistency across all time-points of the study (α = 0.93–0.98).

2.3.3. Depression Anxiety Stress Scales–Short Form (DASS-21)

The DASS-21 is a standardized measure of psychological distress suitable for use in normal and clinical populations. The measure assesses symptoms of depression, anxiety, and stress across three seven-item subscales (Lovibond & Lovibond, 1995). Total subscale scores range from zero to 21 and have established clinical cut-off scores for severity. The internal consistency was adequate across time points for each subscale: depression (α = 0.74–0.92), anxiety (α = 0.85–0.90), stress (α = 0.71–0.80).

2.3.4. Positive and Negative Affect Schedule (PANAS)

The PANAS is a standard 20-item measure of positive affect and negative affect (Watson, Clark, & Tellegen, 1988). The measure is composed of a list of single-word descriptors for affective states (e.g., ‘excited’) with response options ranging from one (‘very slightly or not at all’) to five (‘extremely’). The positive and negative subscales both have 10 items, with total subscale scores ranging from 10 to 50. Internal consistency was adequate across time points for both subscales: positive affect (α = 0.84–0.91) and negative affect (α = 0.70–0.90).

2.4. Statistical analysis

The program IBM SPSS Statistics 22 was used to conduct Linear Mixed Model (LMM) analyses of the trajectory of abstinence outcome variables. LMM analyses were selected because they can account for the non-independence of repeated measures data by modeling between-person variability in intercept and trajectory (i.e., random effects), thereby improving specification of error terms and overall model fit (Tabachnick & Fidell, 2006). Individual models were employed to analyze the trajectory of affect (positive and negative), psychological distress (depression, anxiety, and stress), and Internet gaming withdrawal symptoms (as measured by the IGWS total score). In order to examine separate aspects of withdrawal (i.e., cognitive and urge-related), individual models were conducted for IGWS Item 1 (frequency of thoughts) and Item 3 (intensity of craving at its strongest point). Each model tested for effects of linear trend (i.e., average rate of growth/decline across abstinence), quadratic trend (i.e., change in the rate of growth/decline across time), IGD classification (i.e., average group difference across all time points), and interaction of IGD classification with linear and quadratic trends (i.e., group differences in the average growth/decline rate and its change across time). IGD classification was centered using weighted effects coding to minimize collinearity with interaction terms and to allow for the evaluation of linear and quadratic trends in the context of significant interactions (Aiken & West, 1991). Demographic variables were not included in LMM analyses due to demographic homogeneity (i.e., no significant differences) across IGD-classified groups.

3. Results

3.1. Group characteristics

Table 1 presents a summary of demographic information and gaming activity according to Internet Gaming Disorder (IGD) classification. There were no significant group differences in terms of age, sex, employment status, ethnicity, educational attainment and years playing Massively Multiplayer Online games (MMOs) between the IGD and non-IGD groups. As expected, the IGD group reported engaging in significantly greater video-gaming activity than the non-IGD group (5.5 h/day vs. 2.1 h/day).

To ensure validity of group classification, the symptom profiles of the two study groups (IGD vs. non-IGD group) were examined. The

| Variable           | Group                  | Group differences | Effect size |
|--------------------|------------------------|-------------------|-------------|
|                    | Non-IGD | IGD  | U   | χ²   | r   | Φ    |
| Sex/gender (%)     | Male     | 80.0 | 88.9 | -    | 0.32 | -0.12 |
|                    | Female   | 20.0 | 11.1 | -    | -    | 0.12 |
| Employment (%)     | Unemployed | 46.7 | 66.7 | -    | 0.91 | 0.19 |
|                    | Employed | 53.3 | 33.3 | -    | -    | 0.07 |
| Ethnicity (%)      | Caucasian | 73.3 | 66.7 | -    | 0.12 | -    |
|                    | Other     | 26.7 | 33.3 | -    | -    | 0.37 |
| Education (%)      | Secondary | 20.0 | 55.6 | -    | 3.20 | -    |
|                    | University | 80.0 | 44.4 | -    | -    | 0.37 |
| Gaming (M, SD)     | Hours per week | 14.63 (9.21) | 38.22 (31.10) | 32.00° | -0.43 |
|                    | MMO years  | 7.07 (4.82) | 6.78 (2.95) | 62.00° | -0.07 |
|                    | IGD symptoms | 2.10 (1.26) | 5.89 (0.86) | 120.00°** | -0.82 |
|                    | Age (M, SD) | 25.87 (5.14) | 22.56 (4.50) | 42.50° | -0.31 |

MMO = Massively Multiplayer Online game.  
° p < 0.05.  
** p < 0.01.
IGD group scored significantly higher than the non-IGD group on all IGD checklist items, with the most significant differences on items assessing withdrawal symptoms ($\chi^2[1,N = 24] = 7.73, \Phi = 0.57, p < 0.01$), harm from gaming overuse ($\chi^2[1,N = 24] = 8.00, \Phi = 0.58, p < 0.01$), loss of interest in other activities ($\chi^2[2,1,N = 24] = 8.64, \Phi = 0.60, p < 0.01$), and lies and deception related to gaming activity ($\chi^2[1,N = 24] = 12.80, \Phi = 0.73, p < 0.01$). Given the small sample size, Fisher’s exact tests were conducted in addition to chi-squared tests, but yielded no significant differences.

### 3.2. Abstinence outcome variables

Table 2 presents a comprehensive summary of the means and standard deviations for all study outcome variables across time according to IGD group classification. These data were presented in this concise format in lieu of multiple visual plots, and to assist in the reporting of trajectories in LMM analyses. Given that there are no published controlled or prospective studies of Internet gaming withdrawal symptomatology, it was thought that these results may have some additional utility for guiding further investigations or reviews.

### 3.3. Trajectory of withdrawal symptoms

Table 3 presents Linear Mixed Model analyses of the trajectory of Internet gaming withdrawal symptoms (as measured by the IGWS) during the abstinence period. Significant negative linear trends were observed across all models, indicating that withdrawal scores (i.e., thoughts about gaming, strongest craving for games, and total withdrawal symptoms) decreased, on average, for both IGD and non-IGD groups across the abstinence period. Significant main effects of IGD group classification were also observed across all models, indicating that withdrawal scores were significantly higher, on average, for the IGD group across all time-points (i.e., baseline and abstinence period) than the non-IGD group.

For IGWS thought frequency, there was a positive quadratic trend as well as a significant interaction between the quadratic trend and IGD classification. These results indicated that there was a decreasing rate of decline in thought frequency across time for both groups, with a significantly greater decrease in the rate of decline in the IGD group. For the IGD group only, the decline in thought frequency scores eventually ceased and was followed by an increase in scores between Day 3 to Day 4 of the abstinence period (see Table 2). There was no increase in thought frequency scores for the non-IGD group during the abstinence period.

Fig. 1 presents the group-based trajectories of total withdrawal symptomatology (i.e., total IGWS score). There was a significant positive quadratic trend but no significant interactions (see Table 3). These results indicated that the two groups’ total withdrawal symptoms declined over time with a decreasing rate of decline. For both groups, the decline in total withdrawal symptoms ceased and was followed by an increase toward the end of the abstinence period. Specifically, the
all types of Internet gaming problems.

be formulated without reference to the mechanism of

refers to withdrawal symptoms following cessation of gaming. These

appeared to be inconsistent with IGD withdrawal in the DSM-5, which

drawal symptoms and negative affect under abstinence conditions ap-

period. These observed decreasing trajectories of with-

ing rate of decline in these outcome variables across the abstinence

the IGD group's larger decrease in scores on negative affect, depression,

produced decline in withdrawal symptomatology, affect, and psychological

than the non-IGD group, both groups experienced an abstinence-in-

that, although the IGD group had generally higher withdrawal scores

The DSM-5 conceptualization for Internet Gaming Disorder (IGD)

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ness. This study employed a repeated-measures protocol to examine the psychological consequences of an 84-h Internet gaming abstinence period for individuals who meet the IGD criteria. The results showed that, although the IGD group had generally higher withdrawal scores than the non-IGD group, both groups experienced an abstinence-induced decline in withdrawal symptomatology, affect, and psychological distress. Further, the IGD group experienced its largest decline in withdrawal symptomatology within the first 24 h of abstinence as compared to other time-points. These observed decreasing trajectories of withdrawal symptoms and negative affect under abstinence conditions appeared to be inconsistent with IGD withdrawal in the DSM-5, which refers to withdrawal symptoms following cessation of gaming. These findings suggest that some presentations of disordered gaming could be formulated without reference to the mechanism of 'withdrawal' as it is currently defined. In this way, this study provides preliminary evidence that challenges the validity of applying the addiction model to all types of Internet gaming problems.

non-IGD group demonstrated an increase in total withdrawal symp-
toms between Day 3 and 4, whereas the IGD group experienced a rela-
tively greater increase in total withdrawal symptoms between Day 2 and 4 (see Table 2).

3.4. Trajectories of affect and psychological distress

Table 4 presents the Linear Mixed Model analyses of the trajectories of affect (i.e., positive and negative affect) and psychological distress (i.e., depression, anxiety, and stress) during the abstinence period. Signific-

ificant negative linear trends were observed across all models, indicat-

ing that affect and psychological distress decreased, on average, for both groups over time. Significant main effects of IGD classification were ob-

served for positive affect, negative affect, and depression. This demon-

strated that the IGD group scored significantly lower on positive affect, and scored significantly higher on negative affect and depression, than the non-IGD group, across all time-points. Significant positive quadratic trends were also observed across all models, as reflected by the decreasing rate of decline in these outcome variables across the abstinence period.

There were significant interactions between IGD classification and the linear trends of negative affect, depression, and anxiety. There was also a significant interaction of IGD classification and the quadratic trend for negative affect. These significant modelled interactions reflect the IGD group's larger decrease in scores on negative affect, depression, and anxiety between baseline and Day 1 of the abstinence period as compared to the non-IGD group (see Table 2).

4. Discussion

The DSM-5 conceptualization for Internet Gaming Disorder (IGD) states that withdrawal symptoms following cessation of Internet gaming are a key feature of the disorder (APA, 2013). This suggests that, for individuals with IGD, a sudden cessation or interruption of gaming activity would be associated with a corresponding manifestation or increase in withdrawal symptoms, including irritability, anxiety, or sadness. This study employed a repeated-measures protocol to examine the psychological consequences of an 84-h Internet gaming abstinence period for individuals who met the IGD criteria. The results showed that, although the IGD group had generally higher withdrawal scores than the non-IGD group, both groups experienced an abstinence-induced decline in withdrawal symptomatology, affect, and psychological distress. Further, the IGD group experienced its largest decline in withdrawal symptomatology within the first 24 h of abstinence as compared to other time-points. These observed decreasing trajectories of withdrawal symptoms and negative affect under abstinence conditions appeared to be inconsistent with IGD withdrawal in the DSM-5, which refers to withdrawal symptoms following cessation of gaming. These findings suggest that some presentations of disordered gaming could be formulated without reference to the mechanism of 'withdrawal' as it is currently defined. In this way, this study provides preliminary evidence that challenges the validity of applying the addiction model to all types of Internet gaming problems.

Some past research has noted that withdrawal symptoms under abstinence conditions tend to follow a curvilinear trajectory, whereby symptoms initially increase followed by a gradual parabolic decline over an extended period of time. This trajectory has been documented in controlled studies of substance addictions, including nicotine (Piper et al., 2011), alcohol (Hallgren et al., 2015), and marijuana (Haughey et al., 2008). In line with DSM-5 guidelines, Internet gaming withdrawal was not assumed to involve any physical signs of dependence (e.g., sweating, nausea, headaches, etc.), however it was deemed possible that gaming withdrawal symptoms might follow a similar curvilinear trajectory. However, although the IGD group reported greater baseline withdrawal symptom scores than the non-IGD group, both groups experienced a marked decline in withdrawal symptoms following abstinence. Withdrawal symptoms at baseline were a moderately useful marker to differentiate the normal and clinical groups, however the modelled withdrawal trajectories were largely similar in each group (i.e., both followed a significant negative linear trend in the first two days). Given that the IGWS measure of withdrawal alone may not fully capture the phenomenology of Internet gaming withdrawal (i.e., given its adaptation from the PACS), the PANAS was employed as a secondary measure of the affective features of withdrawal. The observed PANAS (i.e., affect) trajectories were consistent with the withdrawal (IGWS) trajectories for both groups, showing that negative affect also significantly decreased during the period of abstinence. These findings tentatively suggest that Internet gaming withdrawal symptoms may be unlikely to intensify (or they may remain at a constant level) in the initial 84 h of abstinence, irrespective of whether an individual has IGD.

All participants reported greater withdrawal symptom scores at baseline than at any point during the abstinence phase of the study. Therefore, participants experienced stronger withdrawal symptoms in the context of their standard routine of Internet gaming, which presumably did not (or would rarely) involve the trigger of Internet games being ‘taken away’ (i.e., as qualified by the DSM-5 withdrawal criterion). One possibility is that the act of engaging in Internet gaming elicits stronger withdrawal-related symptomatology (e.g., craving and urges to play, thoughts about playing) than situations when Internet gaming cues or opportunities are not present. It may be that, when playing, individuals become more attentive and aware of the complex goals and corresponding rewards (i.e., reinforcers) in the game, which leads to continual urges to maintain game play. Urges may be particularly potent when certain goals or other expectations of reinforcement are not met or are otherwise thwarted, such as a player being defeated by an opponent or making a skill error resulting in loss (Kaptsis et al., 2016).

Complex gaming stimuli, such as time-limited or multi-staged goals known to be common in MMO games, may become significantly less salient to the player when gaming is reduced or discontinued and urges to play may reduce accordingly. A player who disconnects from an MMO (i.e., total restriction of gaming stimuli), even temporarily, may immediately experience a diminished sense of investment in their progress, achievements, and future goals in the game (King & Delfabbro 2014). This finding suggests that the DSM-5 criterion of IGD withdrawal may require revision to emphasize the psychological mechanisms that occur in the process of active play, rather than reactions associated with Internet games being taken away. Alternatively, the current

| Table 4 |
| --- |
| **Trajectories of affect and psychological distress during the abstinence period.** |
| | Positive affect | Negative affect | Depression | Anxiety | Stress |
| Parameter | B | SE | p | B | SE | p | B | SE | p | B | SE | p |
| Intercept | 30.08 | 1.21 | <0.01 | 19.77 | 1.37 | <0.01 | 5.37 | 0.84 | <0.01 | 3.43 | 0.81 | <0.01 | 5.16 | 0.62 | <0.01 |
| Linear | −3.50 | 1.06 | 0.01 | −5.17 | 0.75 | <0.01 | −2.39 | 0.45 | <0.01 | −1.56 | 0.22 | <0.01 | −1.82 | 0.45 | <0.01 |
| Quadratic | 0.59 | 0.24 | 0.02 | 0.82 | 0.16 | <0.01 | 0.35 | 0.10 | 0.01 | 0.26 | 0.07 | 0.01 | 0.34 | 0.11 | 0.02 |
| IGD × linear | −2.08 | 0.94 | 0.03 | 2.60 | 1.06 | 0.02 | 1.52 | 0.65 | 0.03 | 0.97 | 0.62 | 0.13 | 0.93 | 0.48 | 0.06 |
| IGD × quadratic | −0.33 | 0.82 | 0.69 | −1.68 | 0.58 | 0.01 | −0.71 | 0.35 | 0.04 | −0.53 | 0.25 | 0.04 | −0.21 | 0.35 | 0.55 |
| IGD × cubic | 0.15 | 0.19 | 0.43 | 0.27 | 0.13 | 0.04 | 0.98 | 0.08 | 0.22 | 0.10 | 0.06 | 0.07 | 0.03 | 0.08 | 0.68 |
DSM-5 wording that refers to “withdrawal symptoms when Internet games are taken away” should consider a term such as ‘emotional reactivity’, rather than withdrawal which has a connotation with dependence syndromes. This would emphasize the specific reaction to forced removal of an Internet game and not simply any form of reduction or non-participation in a gaming activity. Many highly-engaged adult-aged gamers, particularly those who are single, independent, and/or socially isolated, may only rarely encounter situations when their Internet games are ‘taken away’ and therefore this criterion may lack clinical utility in this population.

4.1. Limitations

This study was the first prospective investigation of Internet gaming withdrawal symptoms using an abstinence protocol. Strengths of the study included: (1) its range of standardized measures of normal and pathological outcomes, (2) frequent (i.e., daily) measurement of outcome variables during the abstinence period; (3) maximum (i.e., 100%) retention rate of participants; and (4) parity of measurement of Internet gaming problems with the currently proposed DSM-5 criteria. However, there were several limitations that warrant acknowledgement. First, this research was a pilot study that involved a relatively small sample of self-selected individuals. The obtained sample was low but was drawn from a prospective pool of almost 10,000 invited individuals, highlighting the challenge of recruiting voluntary Internet game abstainers. Several attempts to recruit from other sources, including a secondary school, were unsuccessful due to the lack of participant interest despite offers of compensation. Future research may wish to consider alternative recruitment methods to increase potential interest. Direct monetary incentive was not helpful, and some caution is advised as this approach may resemble contingency management and therefore could affect participant motivation and emotional states.

Second, the study relied on participants’ self-report of all outcome variables, including self-reported compliance with the study protocol. An alternative methodology might have been for participants to stay in a monitored facility where they were unable to game, however, this approach would have lacked ecological validity given that participants would be in a foreign environment absent of typical cues for gaming. Obtaining account information may have increased the likelihood of compliance due to greater perceived accountability, however, this information does not rule out the possibility of play on alternative accounts. Third, the 84-h abstinence protocol was comparatively shorter than protocols used in past studies (e.g., Javitz et al., 2012; Piper et al., 2011). This pilot study is nevertheless useful in offering an insight into the immediate to short-term impacts of gaming abstinence. Fourth, participation was on a voluntary basis, and therefore study participants may have been more likely to demonstrate greater insight or motivation related to gaming behavior, or they have been less clinically complex as compared to other individuals with IGD. Similarly, all participants were aware of the duration of abstinence, which may have limited the intensity or frequency of withdrawal symptoms.

The sample was predominantly composed of male adults who play MMO games and therefore the results may not generalize to other populations, including adolescents (who may be more likely to experience forced abstinence by a parental authority). It also bears noting that the half-weighting scoring method for the IGD checklist may have over-classified some non-pathological participants as having problems; however, this approach was found to be consistent with the overall self-rating of whether there was a gaming problem. Finally, there may be several non-addiction factors related to MMO gameplay which may induce negative affect and psychological distress, such as social connection with in-game players, or expectation of regular participation from those associations. Further work on other game types may isolate certain variables that are more likely to influence withdrawal symptoms. The use of a clinical sample may be an appropriate extension of this research, however it is advisable that researchers first understand the impacts of gaming abstinence in less complex populations, including documenting any associated adverse events, before commencing this research agenda.

4.2. Conclusions

The present study represents the first systematic attempt to assess the nature and progression of withdrawal symptoms in individuals with IGD. Contrary to expectations, Internet gaming withdrawal symptoms, negative affect, and psychological distress were observed to decrease during short-term abstinence. This study therefore presents preliminary empirical evidence that opens further debate on the application of addiction concepts like withdrawal and tolerance to problematic Internet gaming behaviors. This study also highlights the need to examine the complex stimuli of Internet gaming and their psychological impact on players in the course of active participation in gaming activities (King & Delfabbro, 2016). Further research attention on the processes of Internet gaming as distinct from the consequences of gaming may provide better insights into pathological types of gaming behavior. This preliminary work was methodologically novel and requires replication, but demonstrated the potential for investigations of significantly larger scope, involving larger samples and a longer period of abstinence. It is hoped that this work stimulates further research on the mechanisms that initiate and maintain disordered patterns of gaming.

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Contributors

Author B designed the study and wrote the protocol. Authors A and B conducted literature searches and provided summaries of previous research studies. Author A conducted the statistical analysis. Authors A and B wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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None to declare.

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