



Withdrawal symptoms in internet gaming disorder: A systematic review



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HIGHLIGHTS

- We review the literature on Internet gaming withdrawal and craving.
- Clinical qualitative studies of gaming withdrawal offer limited description.
- We identify 25 different scale items that measure withdrawal as an affective state.
- Internet gaming problems may arise without associated withdrawal symptoms.
- Research on the salient stimuli of Internet gaming may advance knowledge.

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ABSTRACT

Internet gaming disorder (IGD) is currently positioned in the appendix of the DSM-5 as a condition requiring further study. The aim of this review was to examine the state of current knowledge of gaming withdrawal symptomatology, given the importance of withdrawal in positioning the disorder as a behavioral addiction. A total of 34 studies, including 10 qualitative studies, 17 research reports on psychometric instruments, and 7 treatment studies, were evaluated. The results indicated that the available evidence on Internet gaming withdrawal is very underdeveloped. Internet gaming withdrawal is most consistently referred to as 'irritability' and 'restlessness' following cessation of the activity. There exists a concerning paucity of qualitative studies that provide detailed clinical descriptions of symptoms arising from cessation of internet gaming. This has arguably compromised efforts to quantify withdrawal symptoms in empirical studies of gaming populations. Treatment studies have not reported on the natural course of withdrawal and/or withdrawal symptom trajectory following intervention. It is concluded that many more qualitative clinical studies are needed, and should be prioritised, to develop our understanding of gaming withdrawal. This should improve clinical descriptions of problematic internet gaming and in turn improve the quantification of IGD withdrawal and thus treatments for harmful internet gaming.

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1. Introduction

There is a growing body of research suggesting that problematic use of internet gaming may, under certain conditions, be associated with clinically significant harm across multiple domains of functioning (King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Kuss & Griffiths, 2012; Sim, Gentile, Bricolo, Serpollini, & Gulamoydeen, 2012). However, there is currently no consensus on the classification of problematic internet gaming within mental health nomenclatural systems, including the DSM-5 and ICD (Griffiths et al., *in press*). For example, in August 2015, the World Health Organisation hosted an international meeting on behavioral disorders associated with excessive use of internet games to discuss proposals for a range of potential clinical descriptions and standard diagnostic guidelines. A key observation tabled in this meeting was the poorly established terminology used to refer to internet gaming problems, particularly in relation to core addiction concepts such as tolerance and withdrawal. Additionally, it was unclear what exactly problematic gamers were craving when experiencing withdrawal and how this craving might relate to tolerance. Although the concept of withdrawal has long been established as a physiological feature of substance use disorders such as alcohol, tobacco, and heroin addictions (Baynard, McIntyre, Hill, & Woodside, 2004; Hughes & Hatsukami, 1986; Koob, Maldonado, & Stinus, 1992), defining its presentation in disorders that do not involve the ingestion of a chemical substance has long proven to be a difficult task (Grant, Potenza, Weinstein, & Gorelick, 2010; Marks, 1990; Rosenthal & Lesieur, 1992), particularly in the case of internet gaming (Pies, 2009). The aim of this review was to systematically examine current knowledge of the nature of withdrawal symptoms in internet gaming, given the centrality of these symptoms in positioning the disorder as a behavioral addiction.

The historical development of the concept of problem video gaming has its roots in the field of problem gambling and substance use (Kardefelt-Winther, 2015). Early studies of video game arcade machine playing in the 1990s, for example, often employed assessment tools adapted from questionnaires used in pathological gambling research (e.g., Fisher, 1994). Similarly, core addiction concepts within substance dependence were often applied to video gaming behaviors, perhaps on the basis that these activities were viewed as being similarly absorbing, time-consuming, and liable to produce negative affective reactions among users (e.g., hostility, sadness) when they were unable to engage in the activity (Griffiths & Hunt, 1998). Similarly, within the frequently cited ‘components’ model (Griffiths, 2005), problematic internet gaming is characterised by aversive or unpleasant physical or psychological states that accompany a reduction or cessation of gaming activity. This is thought to be consistent with the typical definition of withdrawal in dependence syndromes that refers to repeated urges to engage in a particular behavioral sequence that produces mounting tension until the sequence is completed (Edwards, 1986). Following these approaches, it has perhaps been assumed (rather than empirically demonstrated) that internet gaming problems may be most appropriately conceptualised as having features that are identical to other addictive behaviors. Although this assumption has not gone unchallenged over the past two decades (Griffiths et al., *in press*; Kardefelt-Winther, 2015; Pies, 2009; Wood, 2008), it is clearly evident in contemporary nomenclature (e.g., DSM-5) and academia (Tao et al., 2010; Petry et al., 2014) that internet gaming problems should be viewed as functionally maintained by fear of withdrawal processes and symptoms.

The introduction of internet gaming disorder (IGD) to the appendix of the DSM-5 arguably represents the clearest formal endorsement of gaming as an addictive behavior. Its clinical description refers to “persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress” (American Psychiatric Association, 2013, p.795). Specifically, the criteria for IGD include: “withdrawal symptoms when internet gaming is taken away” with a qualifier that withdrawal is not necessarily physiological in nature (American Psychiatric Association, 2013, p.795). This adaptation of behavioral addiction criteria to internet gaming was viewed as a step forward for the field, which was often plagued by inconsistent approaches to conceptualisation and measurement (Griffiths, King, & Demetrovics, 2014). However, by the same token, the inclusion of withdrawal symptoms in clinical criteria must be sufficiently informed by research that demonstrates the presence and nature of withdrawal symptoms. There may be substantial risks associated with prematurely adopting new criteria prior to following a necessary process of validity testing. One such risk is that it could lead to the exclusion of other conceptualisations that could offer greater insight into the nature and course of problematic gaming, with associated benefits for treatment (e.g., identifying barriers to behavioral change). On this basis, it was considered timely to evaluate the evidence for considering withdrawal as a fundamental process in IGD presentations.

1.1. The present study

The primary aim of this review was to summarise and critique available empirical and treatment evidence on IGD withdrawal. A secondary aim was to critically examine whether the empirical literature aligns with the DSM-5 description of gaming withdrawal. Although several recent reviews of the internet gaming literature have examined aetiology and risk factors (Kuss & Griffiths, 2012), prevalence (Ferguson, Coulson, & Barnett, 2011), assessment (King et al., 2013; Lortie & Guitton, 2013), cognitive factors (King & Delfabbro, 2014), treatment efficacy (Winkler, Dörsing, Rief, Shen, & Glombiewski, 2013) and methodological quality of evidence (King, Delfabbro, Griffiths, & Gradisar, 2011), this review was distinctive due to its focus on withdrawal. No previous reviews have focussed specifically on evaluating internet gaming withdrawal symptoms, despite the disorder being widely considered, as well as positioned in the DSM-5, as a behavioral addiction. It was intended that this review would contribute to critical discussion of current formulations of harmful internet gaming, including the necessity of withdrawal within the DSM-5 classification of IGD.

2. Method

2.1. Study selection

An electronic database search of PsycINFO, PubMed, Scopus and Google Scholar was conducted, using the following search terms and logic: (patholog* OR problem* OR addict* OR compulsive OR dependen* OR disorder*) AND (video OR computer OR internet) gam*. Searches were limited to full-text articles published from 2000 to 2015, because studies conducted during this era of “internet gaming” were determined to be most relevant to internet gaming disorder (see King &

Delfabbro, 2014). These search parameters yielded the following number of hits in each database: PsycINFO (435), PubMed (216), Scopus (9328), and Google Scholar (~17,900). Given the large number of search results on Scopus and Google Scholar, only the first 30 pages of results were examined, whilst all results were examined on PsycINFO and PubMed. The reference lists of systematic reviews of internet gaming research were also examined (Douglas et al., 2008; Ferguson et al., 2011; King et al., 2013; Kuss & Griffiths, 2012; Sim et al., 2012), as were the reference lists of studies identified for selection.

Studies were initially selected on the basis of including a conceptual definition or method of identifying or assessing IGD withdrawal symptoms. An initial pool of 52 studies was identified, which was subdivided according to one of three categories: (1) qualitative studies (N = 15), (2) primary references for an instrument for gaming withdrawal (henceforth, “instrument studies”) (N = 26), and (3) treatment studies (N = 11). Studies were excluded if they were published in a language other than English (N = 2) or if they referred to internet use where gaming was not the primary activity (N = 7). Some additional exclusion criteria were applied to the category of instrument studies, including: (i) not using an instrument for specifically assessing IGD (N = 3), (ii) failure to report instrument items (N = 5), and (iii) the lack of an item that refers to withdrawal symptoms (N = 1). The final sample consisted of 10 qualitative studies, 17 instrument studies, and 7 treatment studies.

2.2. Study assessment

The purpose of the review was to identify withdrawal symptoms specific to IGD. A broad definition of withdrawal (i.e., a dysphoric state arising from abstaining from the behavior [Grant et al., 2010]) was employed to guide the identification and analysis of relevant study material. All studies were independently analysed by the first two authors according to assessment criteria specific to each category of study (e.g., qualitative studies) (See Sections 2.2.1–2.2.3). Identified characteristics of each study were then discussed by the first two authors and systematically entered into a computer database using Microsoft Excel© 2010. Misunderstandings and/or discrepancies in coding occurred for five studies, and were resolved by consultation among the first two authors.

The nature of withdrawal symptoms and their identification or assessment methods were analysed for their consistency with the IGD withdrawal criterion (American Psychiatric Association, 2013). The phenomenological experience of desiring or “craving” following internet gaming cessation was included in this analysis, on the basis that craving is sometimes referred to as a feature of withdrawal (e.g., Jarvik et al., 2000). However, it was acknowledged that the concept of craving is often considered an internal trigger for addictive behavior, rather than withdrawal per se (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004).

2.2.1. Qualitative studies

Qualitative studies were included on the basis that these studies might provide a more detailed description of withdrawal experiences. Qualitative studies were examined according to the following salient features: (1) the conceptual definition of withdrawal, (2) descriptions of withdrawal symptomatology, and (3) contextual information, including the setting in which withdrawal was assessed (e.g., outpatient), study methodology, and researcher qualifications. Further considerations included the type of research study (e.g., case study) and population (i.e., clinical or general).

2.2.2. Instrument studies

The primary focus of the review of instrument studies was to examine test items used to measure withdrawal symptoms. These studies

were assessed in terms of the following features: (1) item wording, (2) time scale and item sensitivity, and (3) dimensionality, including affective, cognitive, and/or physical symptoms of withdrawal. Affective symptoms were defined as negative emotional states (e.g., sadness, guilt, irritability). Cognitive symptoms were defined as maladaptive or irrational thoughts (e.g., negative expectancies, negative self-concept, catastrophic thinking) and cognitive impairment associated with abstinence (e.g., attention, concentration, and memory difficulties, and impaired decision-making). Physical symptoms were defined as somatic complaints, including (but not limited to): headaches, upset stomach, loss of appetite, physical weakness, heart racing, muscle aches, and difficulty breathing (Rosenthal & Lesieur, 1992).

2.2.3. Treatment studies

The purpose of reviewing IGD treatment studies was to explore the presentation of withdrawal symptoms in IGD-affected populations under conditions where symptoms may be more likely to occur and be observed by clinicians. Although information about treatment being offered was collected, it should be noted that the impact, if any, of treatment response on withdrawal symptomatology was not the focus of this analysis. The following characteristics of these studies were examined: (1) treatment phase of measurement (baseline, post-treatment, and follow-up), (2) population characteristics (clinical or general), and (3) relevant instrumentation to assess withdrawal symptoms.

3. Results

3.1. Qualitative studies

Table 1 presents a summary of the extant qualitative research on IGD withdrawal. In terms of study characteristics, half of the studies shared a common author (i.e., Griffiths: Beranuy, Carbonell, & Griffiths, 2013; Chappell, Eatough, Davies, & Griffiths, 2006; Griffiths, 2000, 2010; Hussain & Griffiths, 2009) and most studies were conducted by a team predominantly qualified in psychology (Beranuy et al., 2013; Chappell et al., 2006; Griffiths, 2000, 2010; Hussain & Griffiths, 2009; Wood, 2008). The extent of clinical training and/or experience among researchers was not clear across studies. The total sample of participants across all 10 studies was only N = 118, with the majority identified as male (N = 82). Notably, the majority of participants (N = 71) were involved in a single study (Hussain & Griffiths, 2009) and had been recruited and participated via online correspondence only.

It was notable that there were very few qualitative studies on the topic of addiction and internet gaming, particularly as compared to the high volume of population survey studies in this area (e.g., 63 studies were identified in King et al. (2013)). Other key observations included: (1) two studies did not provide a conceptual definition of withdrawal (Beranuy et al., 2013; Tsai & Lin, 2003); (2) only two studies considered potential withdrawal-like symptoms from a non-addiction perspective (Allison, von Wahlde, Shockley, & Gabbard, 2006; Shapira et al., 2003); and (3) the presence of IGD withdrawal symptoms were reported findings in only half of the studies (Beranuy et al., 2013; Chappell et al., 2006; Griffiths, 2010; Shapira et al., 2003; Tsai & Lin, 2003). Although the conceptual definition of IGD withdrawal was mostly consistent across studies conducted in psychology, given their shared reference to the ‘core components’ model of addiction (Chappell et al., 2006; Griffiths, 2000, 2010; Hussain & Griffiths, 2009; Wood, 2008), this consistency could be attributed to the common author of these studies (i.e., Griffiths) rather than consensus among research groups.

Currently there exists no structured interview for examining internet gaming-related problems, including withdrawal symptoms. The majority of studies employed an unstructured or semi-structured clinical interview to examine internet gaming issues and associated withdrawal symptoms. It was not clear how each interview was developed (e.g., in terms of format of questions or queries) to gather specific

Table 1
The identification of withdrawal symptoms in IGD qualitative studies.

| Author | Study | Population (N) | Setting | Methodology | Researcher qualifications | Conceptual definition of withdrawal | Identified symptoms |
|------------------------------|----------------------|------------------------------------|--|---|--|--|---|
| Allison et al. (2006) | Case report | Clinical: adolescent (1) | Outpatient | Semi-structured interview; psychological testing | Psychiatry; psychology; social Work Psychology | Not provided ¹ | Discomfort arising from the thwarted expression of the ideal self |
| Beranuy et al. (2013) | Qualitative analysis | Clinical: adult and adolescent (9) | Inpatient and outpatient | Semi-structured interview | Psychology | Not provided | 1. Feeling “anxious” and “nervous” following cessation of internet video-gaming 2. “Craving or longing for playing” following internet video-gaming cessation |
| Chappell et al. (2006) | Qualitative analysis | General (12) | Internet discussion forum | Analysis of personal accounts posted online | Psychology | See Griffiths (2000) | 1. “Withdrawal pains” 2. A strong “desire” to re-engage in video-gaming following cessation |
| Griffiths (2000) | Case report | General: adult and adolescent (5) | Internet discussion group | Unstructured interview | Psychology | The unpleasant feeling states and/or physical effects that occur when the particular activity is discontinued or suddenly reduced (e.g. the shakes, moodiness, irritability, etc.) | None |
| Griffiths (2010) | Case report | General: adult (2) | Internet correspondence | Unstructured interview | Psychology | The unpleasant feeling states and/or physical effects that occur when online gaming is discontinued or suddenly reduced (e.g. the shakes, moodiness, irritability, etc.) | 1. An “irresistible urge” to re-engage in video gaming following cessation 2. Feeling “extremely moody, anxious, depressed and irritable” when unable to play internet video-games |
| Hussain and Griffiths (2009) | Qualitative analysis | General: adult (71) | Internet correspondence | Semi-structured interview | Psychology | See Griffiths (2000) | None |
| Lee (2011) | Case report | Clinical: adolescent (1) | Outpatient | Not reported | Nursing | Feelings of anger, tension, and/or depression when the computer is inaccessible | None |
| Shapira et al. (2003) | Case report | Clinical: adult (3) | Outpatient | Semi-structured interview; structured clinical interview; psychiatric testing | Psychiatry | Not provided ² | Increasing sense of “tension” prior to using the internet (including for games) and relief of this tension upon access to the internet |
| Tsai and Lin (2003) | Qualitative analysis | General: adolescent (10) | Face-to-face discussion; internet correspondence | Semi-structured interview | Education | Not provided | Feeling “depressed” following cessation of internet use (including Internet video-gaming) |
| Wood (2008) | Case report | General: adult and child (4) | Internet correspondence/-discussion forum | Unstructured interview; analysis of personal account posted online | Psychology | See Griffiths (2000) | None |

¹ The authors considered the social role function of gaming.

² An impulse control disorder classification was employed.

Table 2
The identification of withdrawal symptoms in IGD quantitative studies.

| Author | Instrument | Identified withdrawal item(s) | Item sensitivity | Time scale | Dimensions | | |
|--|--|--|------------------|------------|------------|-----------|-----------|
| | | | | | Physical | Affective | Cognitive |
| American Psychiatric Association (2013) | Proposed DSM-5 criteria for internet gaming disorder | "Withdrawal symptoms when internet gaming is taken away. (These symptoms are typically described as irritability, anxiety, or sadness, but there are no physical signs of pharmacological withdrawal)" | Yes/no | 12 months | – | ✓ | – |
| Charlton and Danforth (2007) | Addiction-Engagement Questionnaire (revised) | "When I am not playing Asheron's Call I often feel agitated" | 7-point | NR | – | ✓ | – |
| Danforth (2003) | Engagement-Addiction Questionnaire | "When I am not playing computer/video games, I feel restless or irritable" | 6-point | NR | – | ✓ | – |
| Demetrovics et al. (2012) | Problematic Online Gaming Questionnaire (POGQ) | 1. "How often do you get restless or irritable if you are unable to play games for a few days?" 2. "How often do you feel depressed or irritable when not gaming only for these feelings to disappear when you start playing?" 3. "How often do you get irritable, restless or anxious when you cannot play games as "much as you want?" 4. "How often do you get irritable or upset when you cannot play?" | 5-point | NR | – | ✓ | – |
| Hussain and Griffiths (2009) | Exercise Addiction Inventory (adapted) | "If I have to miss an online gaming session I feel moody and irritable" | 5-point | NR | – | ✓ | – |
| King et al. (2011) | Problem Video Game Playing Test (PVGT) | "Do you feel depressed, moody, or nervous when you are not playing video games, which goes away when you are back playing video games?" | 5-point | NR | – | ✓ | – |
| Lemmens, Valkenburg, and Peter (2009) | Game Addiction Scale (GAS) | 1. "Have you felt bad when you were unable to play?" 2. "Have you become angry when unable to play?" 3. "Have you become stressed when unable to play?" | 5-point | 6 months | – | ✓ | – |
| Meerkerk, Van den Eijden, Vermulst, and Garretsen (2009) | Compulsive Internet Use Scale (CIUS) | "How often do you feel restless, frustrated, or irritated when you cannot use the internet?" | 5-point | NR | – | ✓ | – |
| Petry et al. (2014) | Modified DSM-5 Internet gaming disorder criteria | "Do you feel restless, irritable, moody, angry, anxious or sad when attempting to cut down or stop gaming, or when you are unable to play?" | Yes/no | 12 months | – | ✓ | – |
| Pontes, Kiraly, Demetrovics, and Griffiths (2014) | IGD-20 Test | 1. "When I am not gaming I feel more irritable" 2. "I feel sad if I am not able to play games" 3. "I tend to get anxious if I can't play games for any reason" | 5-point | 12 months | – | ✓ | – |
| Porter, Starcevic, Berle, and Penech (2010) | Video Game Use Questionnaire | "When unable to play, the person feels restless or irritable" | Yes/no | NR | – | ✓ | – |
| Rehbein, Kleimann, and Möble (2010) | Video Game Dependency Scale (KFN-CSAS-II) | 1. "If I can't play, I am irritable and dissatisfied" 2. "If I don't play for a while, I become restless and nervous" | 4-point | NR | – | ✓ | – |
| Salguero and Moran (2002) | Problem Videogame Playing (PVP) Scale | "When I can't use the video games I get restless or irritable" | Yes/no | 12 months | – | ✓ | – |
| Sim et al. (2012) | Adapted DSM-IV-TR criteria for pathological gambling | "In the past year, have you become restless or irritable when attempting to cut down or stop video gaming" | Yes/no | 12 months | – | ✓ | – |
| Van Rooij, Schoenmakers, van de Eijnden, Vermulst, and van de Mheen (2012) | Video Game Addiction Test (VAT) | "Do you feel restless, frustrated, or irritated when you cannot game?" | NR | NR | – | ✓ | – |
| Young (1998) | Young Diagnostic Questionnaire (YDQ) | "Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?" | Yes/no | NR | – | ✓ | – |
| Young (1998) | Young Internet Addiction Test (YIAT) | "How often do you feel depressed, moody or nervous when you are off-line, which goes away once you are back on-line?" | 5-point | NR | – | ✓ | – |
| Zhou and Li (2009) | Online Game Addiction Index (OGAI) | "I feel depressed whenever I need to stop playing online games" | NR | NR | – | ✓ | – |

NR = not reported. N/A = not applicable.

information about withdrawal symptoms, duration of episode(s), and whether any symptoms may be attributed to or indicate other possible disorders (e.g., anxiety). Several studies referred to the physical effects of withdrawal in their introductory sections (i.e., reference to the 'core components' model), but these symptoms were not then examined in the study itself (i.e. Chappell et al., 2006; Griffiths, 2000, 2010; Hussain & Griffiths, 2009; Wood, 2008). Therefore, there was no reported evidence of physical withdrawal effects in any of these studies.

Five qualitative studies described participants who reported experiences of withdrawal. Consistent with the proposed IGD withdrawal criterion in the DSM-5 (American Psychiatric Association, 2013), these symptoms included anxiety, moodiness, depression, irritability, tension,

and nervousness following cessation of internet games (see Table 1). The term "withdrawal pains" was mentioned in one study (Chappell et al., 2006, p. 211) but it was not clear if this was a physical or affective symptom. Three studies (Beranuy et al., 2013; Chappell et al., 2006; Griffiths, 2010) referred to a desiring or "craving" for internet games following cessation of gaming. Interestingly, Allison et al. (2006) eschewed the term 'withdrawal' in making clinical observations. Instead, they described possible withdrawal-like symptoms from a psychodynamic perspective, stating that discomfort related to gaming abstinence could be due to deprivation of "meaningful...peer group interaction as well as the opportunity to develop a more consolidated sense of [self]" (p.384). The remaining studies did not report observations of

withdrawal symptomatology (Griffiths, 2000; Hussain & Griffiths, 2009; Lee, 2011; Wood, 2008), including the study with the largest sample (N = 71; Hussain & Griffiths, 2009).

3.2. Instrument studies

Table 2 presents a summary of the 17 identified instruments that contain internet gaming withdrawal-related items. The withdrawal criterion (i.e., item 2) in the IGD classification in the DSM-5 was also included. A total of 25 unique items were identified, although the majority of these items were somewhat comparable in wording. Some items used slightly different qualifiers (e.g., “If I have to miss an online game...” vs. “When I am not gaming...”). Item sensitivity and time-scales varied greatly across items. The DSM-5 IGD withdrawal criterion refers to cessation of internet gaming due to games being “taken away”; however, the majority of identified instrument items specified that gaming cessation followed an “inability” or being “unable” to play. These differences in wording may therefore separately refer to two different instances: (1) an oppositional reaction to an enforced denial of gaming by a partner or parental guardian (i.e., an intervention), or (2) a reaction to situational factors that prevent gaming (e.g., computer failure, interrupted internet service, and so on).

The dominant description of withdrawal across all instruments referred to a negative affective experience. This was consistent with the affective symptoms of “irritability, anxiety, or sadness” described in the DSM-5 (American Psychiatric Association, 2013, p.795). A broad range of descriptors were employed to denote these experiences. Seventeen out of 25 items referred to two or more descriptors in the same item. The most frequent withdrawal symptom item referred to “irritability” (15 items), followed by “restlessness” (11 items). Fewer items referred to the experience of “sadness” (N = 2) or feeling “depressed” (N = 5). Anxiety-related experiences were also less frequently observed, with only three items each referring to “anxious” and “nervous”. Other affective terms included “moody” (N = 5), “angry” (N = 2), “frustrated” (N = 2), “agitated” (N = 1), “stressed” (N = 1), “upset” (N = 1), “dissatisfied” (N = 1), and “feeling bad” (N = 1). None of the instrument items referred to physical or cognitive aspects of withdrawal. It is also notable that the majority of items have referred to the frequency of emotional symptoms but do not specify the degree of interference or other impacts associated with these experiences.

3.3. Treatment studies

Table 3 presents a summary of withdrawal symptoms identified or assessed in IGD treatment studies. The total sample size across all studies was N = 273, including 232 males (85%). Most studies involved a psychological intervention (e.g., CBT, family therapy) and participants who were of adolescent age or older. With respect to measurement of withdrawal, six of the seven studies employed the Young Internet

Addiction Test (Young, 1998), which screens for withdrawal using the following item: “How often do you feel depressed, moody or nervous when you are offline, which goes away once you are back online?”. All studies examined withdrawal at baseline and post-treatment, with three studies (Han et al., 2009; Kim, Han, Lee, & Renshaw, 2012; Li & Wang, 2013) also employing a follow-up examination. However, six studies did not report any information related to withdrawal, including the presence or severity of symptoms at baseline, post-treatment, and follow-up. Therefore, there was only limited information regarding changes in the trajectory of withdrawal and craving symptoms across time. Similarly, information concerning the natural course of withdrawal symptoms for participants was not provided (i.e., withdrawal symptomatology in comparison or control groups which abstained from gaming but did not receive treatment).

4. Discussion

The purpose of this review was to examine the state of current knowledge of withdrawal in IGD, given the importance of this component to positioning the disorder as a behavioral addiction. A secondary aim of this review was to critically examine whether the empirical literature aligns with the DSM-5 description of gaming withdrawal. Overall, the results indicated that the current evidence on internet gaming withdrawal symptoms is very underdeveloped. Although addiction scholars have referred often to conceptual ‘debate’ in the IGD field, there appears to be minimal evidence of expanded discussion on the topic of gaming withdrawal and its defining features.

Notably, there is a concerning paucity of qualitative studies that provide clinical descriptions of symptoms arising from cessation of internet gaming. In practical terms, gaming withdrawal symptoms have been documented in fewer than 50 individuals across five qualitative studies. In contrast, by our count, there have been more than 200 survey-based studies of internet use-related disorders conducted, employing at least 25 differently worded items to describe the phenomenological experience of withdrawal. Many studies have therefore proceeded on an assumption, rather than empirical observation, that disordered gaming is a condition characterised by withdrawal. Similarly, alternative conceptualisations of gaming problems that do not include withdrawal symptomatology (e.g., ‘harmful’ or ‘binge’ gaming) have rarely been considered.

4.1. The nature of internet gaming withdrawal

Qualitative studies of problematic gaming were generally guided by the component model of addiction, which refers to affective and/or physical aspects of withdrawal (Griffiths, 2005). Many studies were conducted by research teams united by a shared conceptual model, and produced mixed findings concerning the presence of withdrawal. Withdrawal generally referred to rising feelings of anxiety, as well as

Table 3
The identification of withdrawal symptoms in IGD treatment studies.

| Author | Population | N | Intervention | Instrument(s) | Withdrawal symptoms | | |
|--|----------------------|----|---------------------------------|--|-----------------------|-----------------------|-----------|
| | | | | | Baseline | Post-treatment | Follow-up |
| Han et al. (2010) | Adult and adolescent | 19 | Bupropion | YIAT; visual analogue scale for “craving” | Self-reported craving | Self-reported craving | – |
| Han et al. (2009) | Child | 62 | Methylphenidate | YIAT | NR | NR | NR |
| Han, Kim, Young, and Renshaw (2012) | Adolescent | 30 | Family therapy | YIAT | NR | NR | – |
| Kim et al. (2012) | Adolescent | 65 | CBT + Bupropion | YIAT | NR | NR | NR |
| Li and Wang (2013) | Adolescent | 28 | CBT | YIAT; Online Game Cognitive Addiction Scale (OGCAS) | NR | NR | NR |
| Thorens et al. (2014) | Adult and adolescent | 57 | CBT + Motivational Interviewing | YIAT | NR | NR | – |
| Pallesen, Lørvik, Bu, and Molde (2015) | Adult and adolescent | 12 | Eclectic psychotherapy | Game Addiction Scale (GAS); Problem Video Game Playing Scale (PVP) | NR | NR | – |

YIAT = Young Internet Addiction Test. NR = Not reported.

moodiness, sadness, and irritability following abstinence. However, the level of persistence, intrusiveness, and intensity of these feelings has not been routinely examined, as a means of distinguishing normal and clinical reactions to ceasing a pleasurable activity. Notably, some studies (i.e. Beranuy et al., 2013; Griffiths, 2010; Han, Hwang, & Renshaw, 2010) referred to a desire or craving to play a video game, and it is perhaps debatable as to whether this specific feature should be considered an aspect of withdrawal. A clearer conceptualisation of adverse craving for internet games seems needed to better differentiate it from normal pleasure-seeking. Only two qualitative studies (i.e. Allison et al., 2006; Shapira et al., 2003) adopted a non-addiction perspective to withdrawal-like symptoms in problematic gaming on the basis that withdrawal was a contentious concept. For example, Allison et al. formulated withdrawal-like symptoms following abstinence as emotional reactivity to a threat to self-concept. It is possible that apparent withdrawal may instead be a normal reaction to other stress unrelated to gaming, but where symptoms are typically reduced or managed by regular gaming activity.

IGD instruments were similarly narrow in their scope for defining gaming withdrawal. All 25 survey items referred only to affective symptoms, such as irritability, anxiety, and sadness. This was consistent with the fact that physical symptoms are excluded in the DSM-5 category of IGD. This may highlight that there is uncertainty about the cognitive features of gaming withdrawal. It may be challenging to distinguish between (1) cognitive functions (e.g., memory, attention) that have been influenced by excessive gaming, and (2) cognitive changes that specifically arise in withdrawal (e.g., irrational thinking, expectancies). Advancing our understanding may be difficult using brief self-report questionnaires, particularly if cognitions or cognitive changes occur subconsciously or demand high reflective capacity of respondents.

Treatment studies reported only minimal detail on gaming withdrawal, despite representing the best possible opportunity for clinicians to document these experiences. Hence, the natural course of withdrawal or withdrawal symptom trajectory in gaming disorders has not been reported. It was therefore not possible to determine: (1) whether gaming withdrawal is similar in type and severity to withdrawal experiences described in other behavioral addictions, such as gambling, and (2) how withdrawal symptoms might change in response to different interventions (e.g., CBT vs. pharmacological). As noted by King and Delfabbro (2014), studies often fail to report the *specific* symptoms of IGD, including withdrawal, that change and the magnitude of this change following intervention.

4.2. *Withdrawal is not present in all gaming problems*

Withdrawal symptoms were not reported or identified in many cases where internet gaming problems were otherwise present, including within treatment-seeking gamers. Five (50%) of the qualitative studies and six (86%) of the treatment studies reported no withdrawal symptoms in their samples. This might indicate: (1) withdrawal was not properly assessed in these studies and therefore was not identified; (2) withdrawal symptoms might have occurred across a range of presentations of problem gaming but were mild and not clinically meaningful; (3) that severely problematic gamers modify their environment to ensure it is maximally conducive to continuous, uninterrupted gaming, thereby reducing or eliminating the likelihood of withdrawal, or (4) withdrawal may occur in only a specific 'addictive' subtype of problem gaming, and not across all subtypes of problem gaming. The final possibility suggests that the IGD classification may be less relevant to cases of internet gaming 'overuse' or 'binge' episodes without associated withdrawal. One option may be to conceptualise internet gaming as having multiple types of harmful use, following the practice of health and clinical classifications for alcohol use (e.g. American Psychiatric Association, 2013, p.490–503). Another possibility is that it might be premature to include withdrawal symptomatology within the criteria

for IGD, or that another term should be employed to avoid connotation with physiological symptoms.

Tolerance is an addiction concept closely associated with withdrawal (Baker et al., 2004). The DSM-5 IGD defines tolerance as the need to spend an increasing *amount of time* engaged in gaming (American Psychiatric Association, 2013). This definition does not specify any particular goals or activities associated with gaming, thereby implying that simply playing a video game in any way would be sufficient to appease withdrawal and craving. An alternative definition by Saunders (2015) suggests that gaming tolerance refers to the need to engage in "increasingly intricate, challenging or graphic gaming activities". King and Delfabbro (2014) have referred to an increasingly inflexible adherence to a protocol of gaming that maximises reward payout. These definitions eschew the concept of time spent playing in favour of satisfying drives toward accomplishment or escape motivations, or the achievement of other goals that serve a compensatory function for the individual (see Przybylski, Rigby, & Ryan, 2010). On this logic, it may be possible for a problematic gamer to experience withdrawal even while playing a game if certain requirements of the activity are not met. This suggests the need to better understand the salient stimuli of internet gaming and their relationship to craving, withdrawal, and tolerance.

4.3. *Consistency of research with the DSM-5*

There are minor differences in the psychometric approach to IGD withdrawal and the IGD definition of withdrawal proposed in the DSM-5 (American Psychiatric Association, 2013). Instruments have employed 25 different wordings for withdrawal items but have tended to refer to an affective reaction to being unable to play. This differs slightly to the DSM-5 wording emphasising (perhaps, unintentionally) reactivity to *removal* of gaming (e.g., by a partner or guardian). The DSM-5 definition may therefore capture an oppositional reaction toward others, such as verbal and physical aggression, which might overlap with the criterion about interpersonal conflict. As Petry et al. (2014) state, withdrawal symptoms associated with gaming must be distinguished from "emotions that arise in response to an external force preventing or stopping a gaming episode" (p.4). Instruments that specify an inability to play for any reason may be more inclusive of situations involving, for example, computer failure or loss of internet connection, or temporary unavailability to play due to schooling, work responsibilities, or loss of privileges. Future revisions might consider rewording the IGD withdrawal criterion to reflect a general inability to play, rather than an imposed denial of gaming. Additionally, psychometric research should examine the clinical validity of all known scale items to filter out items that lack diagnostic relevance, including items that pathologize normal gaming behavior. This may help to address a longstanding problem in the IGD field concerning the high variability of prevalence rates across studies as a function of the choice of survey instrument.

4.4. *Future research directions*

A significant weakness of the IGD field is the lack of theory-building, qualitative studies on problematic gaming. The most logical starting point is to prioritise research agendas with a focus on gathering qualitative clinical data on internet gaming problems from various independent research groups. Researchers should encourage transparency in the reporting of interviewing and assessment methods employed (e.g., via the inclusion of interviews in appendices or supplementary files). Greater research consultation with the online gaming community, as well as the gaming industry, to understand the nature of normal gaming may benefit these agendas. The concept of problematic gaming has inherited its clinical features from gambling and substance use disorders (Kardefelt-Winther, 2015), and it now seems timely to reconsider the validity of this approach, particularly in relation to tolerance and withdrawal. The continued practice of conducting survey-based studies

using brief screening tools adapted from ostensibly similar disorders (e.g., gambling disorder) is unlikely to advance the IGD field beyond its current status of uncertainty in the DSM-5 and health-related taxonomies.

The study of withdrawal may require more novel empirical approaches than currently employed. Retrospective, self-report studies, particularly in adolescent samples, are unlikely to provide accurate statements regarding course and trajectory of withdrawal symptoms. Experimental paradigms involving abstinence from electronic media in controlled settings provides a novel and useful method for clinical observation (Uhls et al., 2014). Although not included in this review, there are reports of 'boot camp-style' programs (typically located in China, Japan, and South Korea) that involve enforced abstinence of gaming for children and adolescents (see Koo, Wati, Lee, & Oh, 2011). Such programs may present terrific opportunities to include psychiatric observation and standardised measurement of withdrawal. As Pies (2009) states, there is a need for systematic data on autonomic nervous function in subjects diagnosed with internet-related addictions who are prohibited from using the internet, and thus, in a putative withdrawal state. These efforts may lead to the development of survey items that can more accurately capture the clinically relevant outcomes of ceasing or reducing internet gaming activity.

4.5. Limitations of the review

The review contained several limitations that warrant acknowledgement. First, many of the identified studies predate the publication of the DSM-5 IGD classification, and therefore a degree of inconsistency in clinical descriptions should be expected. Second, this review focussed on IGD, as distinct from a broader category of 'internet addiction', and therefore excluded studies that did not contain specific reference to gaming. This may have excluded some studies of relevance. Additionally, this review did not include purely theoretical and debate papers on the topic of gaming withdrawal. Due to the focus on definitions and descriptions of withdrawal symptoms, the weight of evidence (e.g., effect sizes) and methodological quality was not assessed. Another potential issue was the use of the Google Scholar and Scopus search engine which yielded a very high number of results (i.e., >9000). Searching for papers related to problematic gaming often identifies research related to the non-relevant areas of gambling, computer software, and IT medical applications due to overlapping terminology (i.e., "gam*", "comput*" and "problem"). Our method of searching only the first 3000 results may have introduced some bias, however it was noted that only 1.1% of results in this subsample were relevant. Relevant papers for inclusion were not identified beyond the first 2000 results (i.e., a subsample five times greater than the two other databases employed), suggesting that relevance ranking by keyword may have been effective within the first quartile of search results. Additional checks and search methods (i.e., use of other search engines, checking citation lists of included articles) may have minimised the potential error of overlooking relevant articles. Finally, it should be noted that the databases used to identify reviewed studies may not have identified studies published in non-English journals, such as South Korean and Chinese journals. Future reviews should consider cross-cultural collaboration to overcome this limitation.

4.6. Conclusions

The criterion of withdrawal is fundamental to the notion that internet gaming may be an addictive disorder. Internet gaming withdrawal is most consistently referred to as 'irritability' and 'restlessness' following cessation of the activity. However, there exists a significant lack of qualitative studies that provide detailed clinical descriptions of symptoms arising from cessation of internet gaming. This is a major weakness of the evidence base, which has compromised efforts to quantify withdrawal experiences. Research agendas should prioritise qualitative

clinical studies to validate the phenomenon of gaming withdrawal. Treatment and experimental studies are required to document the natural course of withdrawal and/or withdrawal symptom trajectory following abstinence or intervention. These research efforts may ultimately deliver more consistency in classifying non-addictive subtypes of gaming behavior, thereby improving clinical nomenclature on problem gaming as well as guidelines for healthy gaming activity. It is hoped that this work might also add to scientific discussion on the broad nature of human relationships with digital technologies beyond the topic of internet games.

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