

Withdrawal, Withdrawal Symptoms, and Craving in Gaming Disorder – Systematic Review

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INTRODUCTION: This systematic review aims to synthesize and summarize the available evidence on the definitions of craving and withdrawal, the nature and presence of withdrawal symptoms, the duration of abstinence, the prevalence and nature of craving.

RESULTS: A total of 29 studies met the inclusion criteria. Inconsistencies were revealed in definitions of craving and abstinence, as well as in the specific withdrawal symptoms that might be present among players. Furthermore, there is a predominance of exploration of affective symptoms compared to cognitive and physical symptoms. Mini meta-analyses indicate a significant difference in depression, anxiety, and craving between players with Internet Gaming Disorder (IGD) and regular players. Most studies typically used short-term abstinence, during which participants refrain from specific behaviours for periods ranging from a few days. A majority of studies did not provide information on the occurrence of craving. **CONCLUSIONS:** Emphasizing craving reduction may alleviate gaming-related withdrawal severity. Longitudinal and qualitative research is essential for understanding craving and withdrawal

phenomenology. Bridging the empirical-clinical gap in gaming disorder requires interdisciplinary studies. Investigating prevalent withdrawal symptoms aids in comprehensive research and refined treatments. Prioritizing craving assessment before, during, and after abstinence is crucial.

Keywords | Craving – Withdrawal – Affective-Cognitive-Physical Symptoms – Gaming Disorder – Gaming Addiction

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1 INTRODUCTION

Withdrawal and withdrawal symptoms are significant criterion in screening for Internet Gaming Disorder (IGD) (Ko et al., 2020; Fernandez et al., 2020). Craving is an additional feature in ICD-11 but not a primary diagnostic criterion, and it does not appear in the DSM-V criteria for Internet gaming disorder (IGD). However, together with withdrawal, they show strong diagnostic accuracy. Ko et al. (2014) found a diagnostic utility of craving at approximately 88.7% and withdrawal also showed a utility of approximately 84.6% (Ko et al., 2014), 88% (Müller et al., 2019) and 87.7% (Ko et al., 2020). Researchers, such as Gomez et al. (2022), argued, based on their findings, that withdrawal is a particularly important criterion for understanding IGD. However, it is worth noting that not all experts share the same opinion.

The Delphi study by Castro-Calvo et al. (2021) highlighted the disagreement among experts on including craving and withdrawal as criteria for gaming disorder. These disagreements may stem from experts' caution towards new criteria, given existing criteria (possible unwillingness to accept a new potential criterion, craving, because of pre-existing criteria). Differences of opinion (e.g., on the withdrawal criterion) might result from inconclusive evidence or theoretical gaps (Castro-Calvo et al., 2021). This theoretical coherence is lacking in both cases, which is evident when reviewing the literature and studies. These gaps appear as unanswered questions regarding their definitions as well.

One of the gaps in the understanding of these constructs arises from their abstract nature. Karhulahti et al. (2023) argue that good content validity criteria are well-operationalized criteria if, they do not contain abstract constructs (e.g., lies related to amount of gaming). More abstract variables lead to vague descriptions and lower content validity. Craving and withdrawal belong to the category of abstract constructs lacking a clear congruence between their constitutive definition and operationalization. Their ambiguous definitions require better specification (Karhulahti et al., 2021). To better understand these constructs, it would also be beneficial to investigate how players with gaming disorder experience and describe both craving and withdrawal (in the form of withdrawal symptoms) and inclusion of their perspectives would provide valuable knowledge and improve identifying the importance of the variables in question in relation to the gaming disorder.

Another ambiguity contributing to a gap in the overall understanding of craving is the difficulty of categorizing it (Fernandez et al., 2020). In certain studies, craving is described as one of the characteristics of withdrawal (Jarvik et al., 2000), while others consider it an internal trigger of addictive behaviour, separate from withdrawal symptoms (Baker et al., 2004). Therefore, it is also necessary to focus on what role craving takes, whether it occurs out of withdrawal, and whether anyone has examined it before, during, and after abstinence.

There is also a notable discrepancy concerning the duration of withdrawal that has been investigated. In certain studies, players abstained for a few days (King et al., 2018; Zheng et

al., 2022), while others examined period of abstinence lasting several months (Li et al., 2018). Despite the presence of several studies (King et al., 2018; Zheng et al., 2022) where a gradual decrease in the intensity and frequency of withdrawal symptoms can be observed, this duration is not explicitly addressed in the definitions. The information regarding the duration of withdrawal could provide valuable insights into potential withdrawal symptoms, including their occurrence, duration, and the potential for reduction during a period of abstinence.

In addition, there is inconsistency in withdrawal symptoms during abstinence. The DSM-V identifies sadness, anxiety, and irritability as withdrawal symptoms of Internet Gaming Disorder (IGD) (APA, 2013). However, beyond these symptoms, researchers have explored additional potential manifestations, including depression (Kaptsis et al., 2016; King et al., 2018), stress (King et al., 2018; Ryu et al., 2019), and anger/aggression (Ryu et al., 2019).

The following ambiguities characterize the research to date:

- Unclear definition of withdrawal and craving constructs
- Unclear prevalence and nature of craving among players with gaming disorder
- Lack of information about the duration of withdrawal in players
- Unclear nature and presence of withdrawal symptoms in players with gaming disorders

These inconsistencies highlight areas where further research and investigation is needed to better understand the constructs of withdrawal and craving in the context of gaming disorder.

The aim of the present systematic review is to provide more detailed description about the topics mentioned above. Specifically, how are withdrawal and craving defined, what is the nature of withdrawal symptoms in players with gaming disorder, how long players in the research studies abstained, what is the prevalence and nature of craving, and how craving is described by the participants themselves in the qualitative studies.

If the literature offers an adequate number of effect sizes, it is my intention to conduct meta-analyses focusing on craving, withdrawal, and the prevalent withdrawal symptoms.

2 METHODS

2.1 Eligibility criteria

We established specific eligibility criteria to identify relevant studies for our analysis. Articles were deemed eligible if they examined gaming disorder and included at least one of the investigated variables—craving, withdrawal, or withdrawal symptoms. Conversely, studies were excluded if they did not

focus on withdrawal or craving in relation to gaming disorder. Additionally, exclusions encompassed duplicate studies, other systematic reviews, studies utilizing brain function associated with IGD (fMRI scanning brain activation), and studies comparing IGD with other constructs not specifically related to craving or withdrawal. The inclusion criteria included published and unpublished articles, preprints, and dissertations until 31 December 2022.

As the sole author involved in the study selection process, any disagreements were addressed through a systematic approach. Prior to the commencement of the study selection, clear inclusion and exclusion criteria were established to guide the process. In the event of uncertainty or disagreement regarding the eligibility of a study, I meticulously reviewed the criteria and used bias minimize measures (AXIS and JBI).

2.2 Information sources

A comprehensive search was conducted using a predefined search string: (“gaming disorder” OR “gaming” OR “excessive gam*” OR “gam* addict*” OR “gam* depend*” OR esport* OR “competitive gam*” OR “competitive play*” OR “pathological gam*”) AND (“withdrawal” OR “withdrawal sy*”) AND crav*). PubMed, Scopus, ProQuest, Web of Science, OSF (Open Science Framework), and Google Scholar were searched to retrieve relevant articles. Forward citation search was also employed to identify additional relevant literature. This approach aimed to capture a diverse range of studies related to gaming disorder and the specified variables.

2.3 Study selection and synthesis

The study selection process adhered to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines, ensuring transparency and robust reporting for this systematic review and also in the meta-analysis. Initially, 532 articles were identified through the search process. We conducted a two-phase analysis, with the first phase involving a screening of titles, abstracts, and keywords to determine if they met the criteria. In the second phase, selected articles underwent a detailed examination to confirm their focus on the variables of interest—craving, withdrawal, or withdrawal symptoms—in the context of gaming disorder. Ultimately, 29 articles met the inclusion criteria and were included in the synthesis. Adults and adolescents were included in the systematic review.

For more details on the process, see Figure 1. Specific search strings are available at: <https://osf.io/9a4p8>

2.4 Statistical analysis

If a sufficient number of eligible articles meeting the inclusion criteria are obtained, a meta-analysis will be conducted to synthesize and quantitatively analyse the collective findings. Meta-analyses will be conducted using Jamovi software.

Critical appraisal of research

The risk of bias was evaluated utilizing two assessment tools: the JBI (The Joanna Briggs Institute) (Lockwood et al., 2015) for qualitative studies and AXIS (the Appraisal tool for Cross-Sectional Studies) (Downes et al., 2016) for quantitative studies. AXIS was primarily used for cross-sectional studies, yet it proved applicable for the majority of quantitative studies because of its suitability and relevance to various research designs. Given the diverse nature of these studies, encompassing validation, pilot, experimental, correlational, and causal studies, we chose AXIS as a unified methodology suitable for a wide range of quantitative research designs. Both tools assess the credibility, relevance, and the validity of the reported results in the other studies. A comprehensive critical appraisal of the results is available at: <https://osf.io/d4752>

3 RESULTS

3.1 Studies defining withdrawal in gaming disorder

Researchers have commonly defined withdrawal by referencing the official definition of the DSM-V (APA, 2013). Withdrawal and its associated symptoms are described as feelings of irritability, anxiety, or sadness that emerge after cessation of gaming (Karhulahti et al., 2023; Ryu et al., 2019; King et al., 2018; Yen et al., 2022; Kaptsis et al., 2016; King et al., 2016; Ko et al., 2020). Some researchers have provided additional descriptions. Yen et al. (2022) added that withdrawal symptoms encompass unpleasant feeling states and may involve physical effects after gaming cessation (Griffiths et al., 2010). Kaptsis et al. (2016) and King et al. (2016) defined withdrawal as a dysphoric state resulting from withdrawal from an addictive behaviour or substance, potentially leading to irritability and aggressive behaviour (Grant et al., 2010; Müller et al., 2015).

Thirteen studies did not specify their withdrawal definition. Readers might infer these researchers referenced DSM-V IGD withdrawal symptoms (Petrovskaya, 2022; Ko et al., 2014; Castro-Calvo et al., 2021; Müller et al., 2019; Cross, 2016; Lee et al., 2017; Adamkovic et al., 2022; Holm et al., 2021; Zheng et al., 2022; Dong et al., 2020; Kim et al., 2018; Liu et al., 2022; Yuan et al., 2022; Gomez et al., 2022). Chappell et al. (2006) classified withdrawal as a core symptom included under addictions. Evans et al. (2018) adopted Edwards’ (1990) definition, which characterizes withdrawal as an unpleasant and undesirable response to discontinuation of an addictive stimulus, commonly associated with substance addictions like alcohol and tobacco. They also noted that the DSM-V refers to gaming withdrawal, which occurs when a game is withdrawn from the player (APA, 2013). They suggest this might be especially relevant to adolescents, as parents could suddenly restrict game access. According to Jo et al. (2019), withdrawal comprises experiencing irritability, moodiness, anger, anxiety, or sadness when attempting to reduce play or facing an inability to play. Dong et al. (2019) defined withdrawal as an operationalized way of enforced mandatory break.

3.2 Studies on duration of withdrawal

In several studies, a withdrawal period was included, during which participants temporarily ceased gaming. In most cases, this involved short-term withdrawal. For example, in three studies, gamers stopped playing for 7 days (King et al., 2018; Evans et al., 2018; Zheng et al., 2022), in two studies it was a period of 84 hours (Kaptsis et al., 2016; King et al., 2016), and in another study, participants could voluntarily withdraw from gaming for several days at their discretion (Yen et al., 2022). Withdrawal was performed in a total of 8 studies, which are detailed in *Table 1*.

3.3 Examined withdrawal symptoms in gaming disorder

The most frequently studied symptoms were affective symptoms, namely anxiety (Petrovskaya, 2022; Karhulahti et al., 2021; Ryu et al., 2019; King et al., 2018; Evans et al., 2018; Yen et al., 2022; Kaptsis et al., 2016; Chappell et al., 2006; Müller et al., 2019; Adamkovič et al., 2022; Jo et al., 2019; Kim et al., 2018; Yuan et al., 2022; Beranuy et al., 2013), depression (Ryu et al., 2019; King et al., 2018; Evans et al., 2018; Yen et al., 2022; Kaptsis et al., 2016; Müller et al., 2019; Chappell et al., 2006; Holm et al., 2021; Jo et al., 2019; Kim et al., 2018; Liu et al., 2022; Yuan et al., 2022; Beranuy et al., 2013), sadness (Karhulahti et al., 2021; Chappell et al., 2006; Adamkovič et al., 2022; Jo et al., 2019; Yuan et al., 2022; Beranuy et al., 2013), irritability (Petrovskaya, 2022; Karhulahti et al., 2021; Yen et al., 2022; Ko et al., 2014; Adamkovič et al., 2022; Jo et al., 2019; Yuan et al., 2022), and stress (Karhulahti et al., 2021; Ryu et al., 2019; King et al., 2018; Evans et al., 2018; Kaptsis et al., 2016; Beranuy et al., 2013). Of the physical withdrawal symptoms studied pressure in their chest (Petrovskaya, 2022), headaches (Petrovskaya, 2022; Holm et al., 2021), somatic complaints (Holm et al., 2021), neglect of own health (Adamkovič et al., 2022) and withdrawal pain (Chappell et al., 2006). Cognitive symptoms as cognition (King et al., 2018; Adamkovič et al., 2022), impaired control (Müller et al., 2019), thought prob-

lems, attention problems (Müller et al., 2015) were found. The following Table 2 presents the withdrawal symptoms assessed by the researchers and their corresponding categories (affective, cognitive, physical).

Measurement tools for withdrawal and craving

The individual withdrawal was not typically examined separately; rather, it was often part of tools used to diagnose IGD or GD. The most commonly used standalone tool was the Internet Gaming Withdrawal Scale (IGWS) (Kaptsis et al., 2016). The most frequently utilized scales for withdrawal symptoms were the Depression, Anxiety, Stress Scale (DASS-21) (Lovibond & Lovibond, 1995) and the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988). For craving, open-ended questions proposed by the study authors were most commonly employed (Evans et al., 2018; King et al., 2016; King et al., 2017; Lee et al., 2017). Additionally, the 10-item Gaming Urge Questionnaire, modified from a smoking urge questionnaire (Cox et al., 2001), was also utilized. The withdrawal and craving measurement tools used in these studies are available at: <https://osf.io/q8c2p>

3.4 Effects found by mini-meta-analyses

Due to diverse participant groups, withdrawal symptom examined, and measurement methods, only three meta-analyses were possible. All three compared IGD players with regular players. IGD participants met ≥ 5 out of 9 symptoms, while regular players scored < 5 symptoms or fell below IGD/GD thresholds.

From the 29 studies included in this review, 5 effects were separately extracted, examining and comparing regular gamers without IGD to gamers with IGD in craving. Subsequently, six effects were extracted to explore depression and anxiety among regular gamers without IGD compared to gamers with IGD. These were research studies where the same groups were compared across variables (craving, depression, anxiety). A criterion for conducting a meta-analysis was a minimum of 15 effects; however, due to the diverse nature of

Table 1 | Abstinence periods in gaming withdrawal studies

Reference	Abstinence Period	Description
King et al., 2018	7 days	
Evans et al., 2018	7 days	Participants abstained for 7 days
Zheng et al., 2022	7 days	
Kaptsis et al., 2016	3.5 days (84 h.)	Participants abstained for 84 hours
King et al., 2016	3.5 days (84 h.)	
Yen et al., 2022	variable: 0.5 to 1 day, 2 to 3 days, >3 days	Participants had freedom to abstain
Dong et al., 2019	4 minutes	Withdrawal as a forced break during play.
Li et al., 2018	3 months	The MORE program

Note: abstinence period denotes the duration for which the players were studied for withdrawal (symptoms), craving

Table 2 | Withdrawal measures, types of studied Withdrawal symptoms studied and findings

Reference	Affective WS	Cognitive WS	Physical WS	Type of WS
Petrovskaya (2022)	1	0	1	irritability, anxiety, physical symptoms (pressure in their chest, headaches)
Karhulahti et al. (2021)	1	0	0	irritability, anxiety, sadness (DSM-5), IGDS-23, PIE-9, CVAT 2.0 - feelings of stress, annoyance, anger, frustration, restlessness, worry or sadness, - tendency to inquire less typical possible symptoms
Ryu et al. (2019)	1	0	0	depression, anxiety, stress, impulsivity, aggression
King et al. (2018)	1	1	0	depression, anxiety, stress, cognition (overvaluing of game reward, inflexible rules about gaming, gaming for self-esteem, gaming for social identity and acceptance)
Evans et al. (2018)	1	0	0	depression, anxiety, stress, positive/negative affects
Yen et al. (2022)	1	1	0	depression, anxiety, irritability, frustration, Anhedonia (boredom, inability to experience pleasure, disinclination for activity and inability to identify activities to do per a previous review of withdrawal symptoms (Piper, 2015))
Kaptsis et al. (2016)	1	1	0	depression, anxiety, stress, positive/negative affects
Chappell et al. (2006)	1	0	1	sadness/depression/anxiety (crying), withdrawal pain, death thoughts
Ko et al. (2014)	1	0	0	irritability
Müller et al. (2019)	1	1	0	depression, anxiety, social phobia, impaired control
Adamkovic et al. (2022)	1	1	1	irritability, anxiety, sadness, gaming cognition, loneliness, self-control, neglect of own health
Müller et al. (2015)	1	1	1	aggressive behavior, rule-breaking behavior, social problems (social withdrawal), thought problems, somatic complaints, attention problems
Holm et al. (2021)	1	1	1	depressed, restless, headaches, increased sleeping
Zheng et al. (2022)	1	1	0	detection automatic bias, negative affects
Jo et al. (2019)	1	0	0	restless, irritability, depression, anxiety, sadness
Kim et al. (2018)	1	0	0	depression, anxiety
Liu et al. (2022)	1	0	0	loneliness, depression
Yuan et al. (2022)	1	0	0	irritability, anxiety, sadness
Beranuy et al. (2013)	1	0	0	nervous, depression, sad, anxiety, stress

Notes: 1=yes, 0=no, WS-Withdrawal Symptoms

the identified studies, only a few effects were found. We set a minimum of at least five effects in one mini-meta-analysis. These effects were separately compared for craving, anxiety, and depression. From these studies, we extracted the means for each group (M, SD) and the number of participants for each group separately (n).

Meta-analyses were conducted using Jamovi software especially with MAJOR package. All meta-analyses, results, and descriptions are available at: <https://osf.io/s5pfg>

3.5 Studies defining craving

The prevailing terminology commonly used to describe craving in the context of gaming addiction is as follows: craving is generally regarded as an intense or strong desire to play games (Cross, 2016; Ko et al., 2014; King et al.,

2018; Ryu et al., 2019). King et al. (2018) extends this definition by attributing craving to include both the desire to play games and the ability to resist games, along with the urge to play. Ko et al. (2014) describe craving as one of the diagnostic criteria in the DSM-V for substance addictions (APA, 2013), characterized by an intense desire or urge for addictive substances, contributing to the risk of relapse and serving as a key marker for treatment response in substance addictions (Tiffany & Wray, 2011). Cross (2016) adds that craving can be defined as a strong desire to use a substance and extends this definition to include intense desires and strong intentions to engage in specific behaviours, including excessive online gaming. Petrovskaya (2022) explores craving from a subjective perspective, focusing on people's own experiences, and considers craving as an integral part of addiction. She characterizes craving and the urge to play games as the desire to play games for a certain amount of time when stopping playing, particularly after quitting. Yen

Table 3 | Studies examining craving vs. studies where craving was found

Reference	Craving was measured	Craving was found
Petrovskaya, E. (2022)	1	1
King et al. (2018).	1	0
Evans et al. (2018).	1	1
Yen et al. (2022).	1	1
Kaptsis et al. (2016).	1	1
King et al. (2016).	1	1
Chappell et al. (2006).	1	1
Ko et al. (2014)	1	1
King et al. (2017).	1	1
Castro-Calvo et al. (2021)	1	0
Müller et al. (2019).	1	1
Cross. (2016).	1	1
Lee et al. (2017).	1	0
Adamkovic et al. (2022).	1	1
Li et al. (2018).	1	1
Holm et al. (2021)	1	1
Zheng et al. (2022).	1	1
Jo et al. (2019).	1	1
Dong et al. (2020).	1	1
Kim et al. (2018).	1	0
Dong et al. (2019).	1	1
Beranuy et al. (2013).	1	1

Note: 1 – yes, 0 - no

et al. (2022) observed that craving decreases over time during abstinence from gaming, a claim adopted from Kaptsis et al. (2016). They further argue that problem players report strong craving for withdrawal, comparing it to levels reported by alcoholics. They propose that this craving may reflect the loss of an avoidant coping strategy rather than an inability to play (Blaszczynski et al., 2008). Müller et al. (2019) argue that craving is commonly perceived as a motivating factor initiating drug-seeking behaviour. Other research studies support the notion that craving is an essential com-

ponent of addiction in general (Beranuy et al., 2013; Kim et al., 2018; Chappell et al., 2006).

An examination of craving

Of the 29 research studies, 22 studies examined craving in gaming disorder. Of these, 18 studies found craving to be significant (Zheng et al., 2022; Adamkovič et al., 2022; Yen et al., 2022; Petrovskaya, 2022; Holm et al., 2021; Dong et al., 2020; Müller et al., 2019; Dong et al., 2019; Jo et al., 2019; Evans et

Table 4 | Critical appraisal of qualitative research (JBI)

Reference	Questions									
	JBI_Q_1	JBI_Q_2	JBI_Q_3	JBI_Q_4	JBI_Q_5	JBI_Q_6	JBI_Q_7	JBI_Q_8	JBI_Q_9	JBI_Q_10
Petrovskaya, E. (2022).	●	●	●	●	●	◐	◐	●	●	◐
Karhulahti et al. (2021).	●	●	●	●	●	●	●	●	◐	●
King et al. (2016).	◐	●	●	●	●	◐	◐	●	●	◐
Chappell et al. (2006).	◐	●	●	●	●	●	◐	◐	○	●
King et al. (2017).	●	●	●	◐	●	◐	●	◐	●	●
Beranuy et al. (2013).	●	●	●	●	●	◐	◐	●	●	●

notes: colors means 0 (yes) ●, 2 (unclear) ◐, 1 (no) ○,

Table 5 | Critical appraisal of quantitative research (AXIS)

Reference	Questions																			
	AXIS_1	AXIS_2	AXIS_3	AXIS_4	AXIS_5	AXIS_6	AXIS_7	AXIS_8	AXIS_9	AXIS_10	AXIS_11	AXIS_12	AXIS_13	AXIS_14	AXIS_15	AXIS_16	AXIS_17	AXIS_18	AXIS_19	AXIS_20
Ryu et al. (2019).	●	●	○	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	○	●
King et al. (2018).	●	●	○	●	●	●	●	●	●	●	●	●	○	●	●	●	●	●	○	●
Evans et al. (2018).	●	●	●	●	●	●	●	○	●	●	●	●	○	○	●	●	●	●	○	●
Yen et al. (2022).	●	●	○	●	●	●	●	○	●	○	○	○	○	●	○	●	○	○	○	●
Kaptsis et al. (2016).	●	●	○	●	●	●	●	○	●	●	●	●	○	●	●	●	●	●	○	●
Ko et al. (2014).	●	●	○	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●	○	●
Castro-Calvo et al. (2021).	●	●	●	●	●	●	●	●	●	●	●	●	○	○	●	●	●	●	○	●
Müller et al. (2019).	●	●	○	●	●	●	●	●	●	●	●	●	●	○	●	●	●	●	○	●
Cross. (2016).	●	○	○	●	○	●	●	●	●	●	●	●	●	○	○	●	●	●	○	○
Lee et al. (2017).	●	●	●	●	○	●	○	●	○	●	●	○	○	○	●	●	●	●	○	●
Adamkovic et al. (2022).	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	●	●	●	○	●
Ko et al. (2020).	●	●	●	●	●	●	○	●	●	●	●	●	○	○	●	●	●	●	○	●
Li et al. (2018).	●	○	●	●	○	●	●	○	●	●	●	○	○	○	●	●	●	●	○	●
Müller et al. (2015).	○	●	○	○	○	●	●	●	●	○	●	○	○	○	●	●	●	●	○	●
Holm et al. (2021).	●	●	●	●	○	●	○	●	●	●	●	●	○	○	●	●	●	●	○	●
Zheng et al. (2022).	●	●	○	●	○	●	○	●	○	●	●	○	○	○	●	●	●	●	○	●
Jo et al. (2019).	●	●	○	●	○	●	●	●	●	●	○	○	○	○	●	●	●	○	○	●
Dong et al. (2020).	●	●	●	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Kim et al. (2018).	●	●	○	●	●	●	●	○	●	●	●	○	○	○	○	○	○	○	○	○
Liu et al. (2022).	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Dong et al. (2019).	●	●	○	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Yuan et al. (2022).	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Gomez et al. (2022).	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

notes: colors means 0 (yes) ●, 1 (no) ○, 2 (dont know) ◐

al., 2018; Li et al., 2018; King et al., 2017; Kaptsis et al., 2016; King et al., 2016; Cross, 2016; Beranuy et al., 2013; Ko et al., 2014; Chappell et al., 2006) (see *Table 3*).

3.6 The prevalence of craving

Among the 13 research studies (56.5%), there was no mention of the prevalence of craving during episodes, either during withdrawal or before and after withdrawal (Chappell et al., 2006; Ko et al., 2014; King et al., 2017; Castro-Calvo et al., 2021; Müller et al., 2019; Cross, 2016; Lee et al., 2017; Adamkovic et al., 2022; Li et al., 2018; Holm et al., 2021; Jo et al., 2019; Dong et al., 2020; Kim et al., 2018). In three studies (13%), craving was examined both before and during the withdrawal episode (Evans et al., 2018; Zheng et al., 2022; Dong et al., 2019). In contrast, the other 3 studies (13%) solely investigated craving during the withdrawal episode (Petrovskaya, 2022; Kaptsis et al., 2016; King et al., 2016). A study by Yen et al. (2022) (4.3%) examined craving

during and after a withdrawal episode. However, in the remaining studies (13%), data on craving episodes were not available.

Description of craving by sample

In the qualitative research by Petrovskaya (2022), participants expressed that gaming appealed to them due to the element of social connection it offered, which provided the social support they lacked. The absence of adequate social connections and the lack of friends led them to seek social elements such as team gaming, contributing to their desire to play. Additionally, external factors such as the pandemic situation further fuelled their craving for gaming. Evans et al. (2018) mentioned boredom as the predominant trigger for participants’ desire to play, emphasizing its recurrent occurrence among participants. Furthermore, the accessibility of gaming at home and the knowledge that friends were playing also played significant roles in stimulating their desire to engage in gaming activities. These findings were further supported by the work of King et al.

(2016), where participants frequently cited boredom as the primary internal trigger for their gaming cravings. The feeling of boredom was particularly strong during periods of abstinence, leading to a heightened urge to engage in gaming activities.

Detailed descriptions of craving from the perspective of participants in each qualitative study are available at: <https://osf.io/q8c2p>

4 DISCUSSION

The systematic review underscores the need for standardized terminology to precisely and consistently delineate withdrawal and craving across studies. Notably, definitions of withdrawal varied. Some tools highlighted forced cessation of gaming activity (e.g. CSAS), while others (IGDC, IFDS9-SF) described it as an 'unavailability to play,' or attempts to 'interrupt/reduce gaming' (IGDT-10) leading to ambiguity (Karhulahti et al., 2021). The concept of craving, though recognized as a core component of addiction in various cases. While it is no longer included as a criterion in the DSM-V, it is mentioned as an additional feature in the ICD-11. Similarly, the classification of craving exhibited disparities, with studies categorizing it as either an additional criterion for IGD/GD (Zheng et al., 2022; Adamkovič et al., 2022; Yen et al., 2022; Petrovskaya, 2022) or part of withdrawal symptoms (Castro-Calvo et al., 2021; Lee et al., 2017; Adamkovic et al., 2022), contributing to uncertainty in its characterization.

Affective symptoms like anxiety (Petrovskaya, 2022; Yen et al., 2022), depression (Yen et al., 2022; Holm et al., 2021; Ryu et al., 2019), sadness (Adamkovič et al., 2022; Yuan et al., 2022), irritability (Petrovskaya, 2022; Yen et al., 2022), and stress (Karhulahti et al., 2021; Ryu et al., 2019) were positively correlated with IGD. Cognitive and physical symptoms, including self-neglect (Adamkovič et al., 2022), somatic complaints, thinking and attention problems (Müller et al., 2015), and sleep issues (Holm et al., 2021), were also observed among players with problematic gaming behaviour.

Seven studies focused on short-term rather than long-term withdrawal durations (Yen et al., 2022; Zheng et al., 2022; King et al., 2018; Evans et al., 2018; Kaptis et al., 2016; King et al., 2016). In this short-term abstinence participants refrain from specific behaviours for periods ranging from a few days (e.g. 3,5 days to 7 days). During different phases of abstinence revealed stronger post-gaming cravings and withdrawal symptom in the short term, with longer abstinence periods correlating with decreased craving and withdrawal symptoms (Yen et al., 2022; King et al., 2018; Kaptis et al., 2016). Furthermore, in our mini-Meta analysis, a significant disparity in craving prevalence was observed between non-IGD and IGD players, with the latter exhibiting higher craving levels (est. effect size = 1.23).

Qualitative descriptions highlighted various factors influencing gaming craving experiences, such as social connections, teamwork, pandemic-related stressors, and low socialization in real life (Petrovskaya, 2022). Both internal triggers (like boredom and stress) and external triggers (such as connectivity to games) contributed to the intensity of cravings (Evans et al., 2018; King et al., 2017).

Despite providing valuable insights, the systematic review acknowledges several limitations, including publication biases, heterogeneity in sample composition, and variability in chosen withdrawal symptoms among researchers made meta-analyses inclusion challenging, potentially impacting result reliability. The review also acknowledges the lack of detailed analysis of participant feedback from qualitative studies and potential discrepancies in search strings used for literature retrieval. Overall, the review calls for standardized terminology, comprehensive evaluation of craving and withdrawal symptoms dynamics, and further research to address the identified.

5 CONCLUSIONS

This review supports adding craving as a diagnostic criterion for IGD/GD, highlighting its clinical value in diagnosing gaming disorder. Emphasizing craving reduction may alleviate withdrawal severity. However, further longitudinal and qualitative research is needed to explore the phenomenology and better comprehend the nature of craving and withdrawal in gaming disorder. Bridging empirical investigation and clinical application requires collaborative studies involving psychologists, psychiatrists, and scientists, with IGD/GD players interviews can bolster this integration. Investigating prevalent withdrawal symptoms in gaming disorder offers comprehensive insights and treatment strategies. Regarding craving, assessing its frequency pre-, during, and post-abstinence is crucial.

Declaration of interest: The author declares no competing interests.

Supplementary materials: All supplementary materials are available at: <https://osf.io/hu3x4/>. PRISMA checklist is available at: <https://osf.io/xrkea>.

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