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Identifying individuals in need of help for their uncontrolled gaming: A narrative review of concerns and comments regarding gaming disorder diagnostic criteria

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REVIEW ARTICLE



ABSTRACT

Objective: In 2013, the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) included the diagnostic criteria of Internet gaming disorder (IGD). Then, in 2019, the 11th Revision of the International Classification of Diseases (ICD-11) categorized gaming disorder (GD) as an addictive disorder. This review aimed to review the raised concerns, debate, and research of IGD or GD criteria and provide suggestions to resolve them. **Methods:** A narrative review was conducted, and PubMed was searched for articles mentioning concerns and research on the DSM-5 criteria for IGD, ICD-11 criteria for GD, or criteria for other synonyms, such as problematic gaming or gaming addiction. A total of 107 articles were identified. **Results:** Concerns were organized into three categories: conceptual framework, moral panic, and diagnostic validity. Most argumentations supported the proposition that GD and other substance use disorders have similar presentations. A clear definition of GD and adequate public education could prevent rather than exacerbate moral panic. Several researchers reported concerns regarding the nosology, diagnostic validity, and wording of each criterion. However, the threshold, five of the nine criteria with impaired function, demonstrated adequate validity in interview studies. **Conclusion:** The current findings support the addiction framework, functional impairment, and validity of the GD criteria. However, further prospective, experimental, and clinical studies validating these findings are warranted. Moreover, an integrative review or debate conference could contribute to the organization of the available results and concept development. Aggregating adequate scientific information could allay or resolve concerns related to the diagnosis of GD.

KEYWORDS

DSM-5, ICD-11, Internet Gaming Disorder, Gaming Disorder, validity, criteria

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INTRODUCTION

Video gaming has become one of the most popular recreational activities, with approximately 2.5 billion people playing games worldwide (WePC, 2019). Healthy gaming may have important benefits for education, training, and skills development (Cade & Gates, 2017). However, the powerful motivational pull of gaming might cause some vulnerable individuals to lose control over their gaming behavior. Although the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) does not include Internet gaming disorder (IGD) as an official diagnosis, it suggests diagnostic criteria for IGD in Section III (Emerging measures and models) and recommends further evaluation (American Psychiatric Association [APA], 2013; Griffiths, King, & Demetrovics, 2014), based on the available scientific evidence and the potential for excessive gaming to have major negative effects on mental health (Petry et al., 2014b).

In 2019, the International Classification of Diseases, 11th Revision (ICD-11) classified gaming disorder (GD) as an addictive disorder (World Health Organization [WHO], 2019). Scholars have raised several concerns regarding the appropriateness and validity of these diagnostic criteria (Aarseth et al., 2017). However, reliable diagnostic criteria are required to explore the mental symptoms of GD and enable the development of effective treatment plans for individuals who require professional help (King et al., 2018; King et al., 2019; Kuss, Griffiths, & Pontes, 2017a). The present review organizes the various concerns, recommendations, and findings regarding diagnostic criteria to help mental health professionals understand the conflicting perspectives on this topic. Furthermore, suggestions are provided for future studies to resolve or allay the concerns and provide a more rigorous assessment of patients.

BACKGROUND

The diagnostic criteria of IGD in the DSM-5

IGD in DSM-5 can be characterized by persistent gaming that leads to clinically significant impairment or distress as indicated by the presence of at least five of the nine criteria in a 12-month period. The nine criteria are 1) preoccupation, 2) withdrawal, 3) tolerance, 4) unsuccessful attempts to control, 5) loss of interest in previous forms of entertainment, 6) continued excessive gaming despite psychological problems, 7) engaging in deceptive behavior, 8) escape by using gaming, and 9) jeopardizing or losing a significant relationship, job, or educational or career opportunity because of gaming.

Several studies have evaluated the DSM criteria to determine their validity (Király et al., 2017; Ko et al., 2014; Ko, Lin, Lin, & Yen, 2019; Koo, Han, Park, & Kwon, 2017; Müller, Beutel, Dreier, & Wölfling, 2019). These studies have supported the validity of most criteria and the cut-off point in DSM-5 (i.e., five of nine criteria) in identifying individuals with IGD. However, extensive concerns regarding the DSM-5 criteria have also been raised in the literature.

The ICD-11 diagnostic criteria for GD and hazardous gaming

ICD-11 included GD as an addictive disorder in 2019 (WHO, 2019). The GD criteria apply to both online and offline gaming because of the similarities in addictions to online and offline games (Kuss et al., 2017a). The DSM-5 IGD criteria could also be applied to offline games (APA, 2013; Petry et al., 2014a). However, the term “Internet gaming disorder” may cause confusion (Király, Griffiths, & Demetrovics, 2015) and prevent the application of the criteria to offline games.

The diagnostic criteria of GD in the ICD-11

The criteria GD are as follows: 1) impaired control over gaming, 2) increased priority given to gaming to the extent that gaming tasks take precedence over other activities, and 3) continued gaming despite negative consequences and the behaviour pattern resulting in marked impairment to function over a period longer than 12 months.

The diagnostic criteria of hazardous gaming

Hazardous gaming is evident by a pattern of gaming that increases the risk of harmful physical or mental health consequences but has not yet reached the level to be diagnosed with GD.

Aims

Griffiths et al. (2016) have expressed the need for a consensus on the DSM-5 IGD criteria. Furthermore, Kuss et al. (2017a) reviewed concerns expressed regarding the DSM-5 IGD criteria. They proposed some possible means by which to resolve these concerns. However, other scholars have raised further concerns regarding those proposals (van Rooij et al., 2018). These proposals and concerns warrant further research to achieve clarity and resolution. The present narrative review aimed to collect, summarize, and discuss the various concerns, debate, and research on these diagnostic criteria, using a dimensional approach, to help mental health professionals and scholars organize reasonable solutions to these problems. In this review, the terms “Internet gaming disorder” and “gaming disorder” will be used. For consistency reasons, the latter (GD) will be used to represent all the other synonyms (e.g., problematic gaming or gaming addiction) as well, since that is the term with the strongest consensus among scholars at the moment.

METHODS

The PubMed database was searched for articles mentioning concerns, debate or research on the criteria for GD, including the DSM-5 criteria for IGD and the ICD-11 criteria for GD. The following search algorithm was used: “gaming” in “title” AND “criteria,” “concerns,” “debate,” or “consensus” in the “abstract/title.” PubMed was selected



because it contains over 30 million citations for biomedical literature from MEDLINE, life science journals, and online books. Furthermore, the majority of consequential articles are filed in PubMed. In total, 150 articles in PubMed were identified in the period from 2011 to March 2019. Of these, 121 were IGD or GD related. Concerns, debate or research regarding these diagnosing criteria were discussed in 86 of the articles. After the content of these 86 articles (denoted using * in the reference list) was evaluated, another 21 articles (denoted using # in the reference list) that mentioned concerns regarding the IGD or GD criteria but were not recruited in search strategy in PubMed were identified from the citations of the 86 articles. The concerns and results presented in the 107 articles were then summarized and organized into three categories. Furthermore, suggestions

are presented regarding the types of studies that would be necessary to address the concerns.

RESULTS

Three major dimensions of concern

Reviewing of the 107 articles revealed that most of the concerns relate to three critical problems: (i) whether GD is an addictive disorder, (ii) the possible public impact of considering GD a mental disorder, and (iii) whether the GD criteria are suitable to identify individuals with problematic gaming that requires further intervention. Therefore, we classified these concerns into three categories: conceptual framework, moral panic, and diagnostic validity (see [Tables 1–3](#))

Table 1. Concerns regarding the conceptual framework of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) Internet gaming disorder (IGD) and the International Classification of Diseases, 11th Revision (ICD-11) gaming disorder (GD) criteria

The issues	Is the addiction framework correct for GD?	
	Concerns	Related references
Concerns regarding the addiction model	Is formalizing an addictive disorder based on the available information beneficial? Addiction-based conceptualization of IGD is constraining because it interferes with the development and testing of alternative conceptual frameworks for problematic gaming. Criteria derived from substance use disorders or gambling disorder might neglect the potentially unique features of IGD. Gaming can be a maladaptive way of coping or manifestation of an underlying psychopathology.	van Rooij et al. (2018) Kardefelt-Winther (2014), Krossbakken, Pallesen, Molde, Mentzoni, and Finseras (2017), Starcevic (2017), van Rooij et al. (2018)
Other alternative features underlining problematic gaming.	Alternative features highlighting problematic gaming may include the following: overvaluation of gaming rewards, activities, and identities; maladaptive and inflexible rules of gaming behavior; excessive reliance on gaming to meet self-esteem needs; gaming as a method of gaining social acceptance. Lack of a well-defined object of addiction. The causal relationships between gaming and life problems have not been confirmed.	King and Delfabbro (2014a) Quandt (2017)
Secondary disorder deriving from other psychopathologies.	The comorbidity: Problematic gaming has been frequently and consistently associated with various psychopathologies.	Kuss et al. (2017a), Starcevic (2017), van Rooij et al. (2018)
The course of the disorder	Addictive disorders are generally chronic and progressive if not treated. Recent studies revealed that the natural course of excessive gaming is often transient or episodic, thus suggesting its low temporal stability.	Konkolj Thege et al. (2015), Starcevic (2017)



Table 2. Concerns regarding the moral panic effect of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) Internet gaming disorder (IGD) and the International Classification of Diseases, 11th Revision (ICD-11) gaming disorder (GD) criteria and definitions

Topics	Diagnosis of gaming disorder may result in a moral panic regarding gaming behavior in general.	
	Concerns	Related references
Premature diagnoses could cause a moral panic that would limit healthy gaming behaviors.	First, moral panic is particularly concerning when addressing the harms caused by video gaming. Moral panic could result in the medical community applying premature diagnoses and treatment of abundant false-positive cases, especially among children and adolescents. Second, research may remain focused on a confirmatory approach, rather than on exploration of the boundaries between normal and pathological gaming. Third, most healthy gamers may be negatively affected.	Markey and Ferguson (2017), van Rooij et al. (2018), Kardefelt-Winther (2014), Aarseth et al. (2017)
	Gaming behavior differs from substance abuse behaviors. It is one of the most popular hobbies among children and adolescents worldwide and has numerous healthy and positive outcomes.	Granic, Lobel, & Engels (2014)
	However, only gaming disorder has been proposed for ICD-11 inclusion, with no formal or transparent review of the evidence quality for any of the various addictions.	van Rooij et al. (2018)
Is IGD a real problem?	If no patients are identified, a formal disorder category may not be required. Feelings of distress caused by gaming were reported by only 0.3%–1% of the sample subjects.	van Rooij et al. (2018) Przybylski, Weinstein, and Murayama (2017)
	The social and political effects of declaring that a social behavior is a disease are a cause for concern.	Quandt (2017)

1. Conceptual framework of GD

Many scholars have claimed that excessive gaming that causes negative consequences is not necessarily indicative of an addictive disorder (see Table 1). Classification of problematic gaming as an addictive disorder might thus interfere with the development of alternative conceptual frameworks (Starcevic, 2017; van Rooij & Kardefelt-Winther, 2017). For example, gaming could be a coping strategy for stress (Canale et al., 2019) or secondary to another psychiatric disorder. King & Delfabbro (2014a) and van Rooij et al. (2018) reported that the underlying cause or alternative cognitive features of problematic gaming behavior, such as coping behavior or overvaluation, should be explored before GD is defined as an addictive disorder.

However, Kuss, Griffiths, and Pontes (2017b) reported that GD is “a maladaptive coping behavior fits perfectly well within an addiction framework.” Numerous studies have

supported that mechanisms of addictive behavior can be observed in GD, including attention bias (van Holst et al., 2012), risky decision-making (Bailey, West, & Kuffel, 2013), alteration in executive control (Dong, Liu, Zheng, Du, & Potenza, 2019), rewarding alteration (Duvan, Müller, Beutel, & Wölfling, 2015), emotional regulation (Yen et al., 2017), and stress vulnerability (Kaess et al., 2017; S. Yu, Mao, & Wu, 2018). Two reviews have suggested possible underlying factors, such as cognitive control, emotional regulation, decision-making, and environmental factors, that contribute to GD development and maintenance (Dong & Potenza, 2014; Kuss, Pontes, & Griffiths, 2018), in the same manner that they contribute to substance use disorders. Furthermore, studies have demonstrated similarities in comorbidities, such as attention deficit hyperactivity disorder (Percy, McEvoy, & Roberts, 2017; Yen, Liu et al., 2017), depression (Liu et al., 2018; Martín-Fernández et al., 2016), anxiety disorder (González-Bueso et al., 2018; Wang et al., 2017),

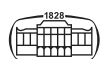


Table 3. Concerns regarding the diagnostic validity of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) Internet gaming disorder (IGD) and the International Classification of Diseases, 11th Revision (ICD-11) gaming disorder (GD) criteria and definitions

Topics	Validity of the diagnostic criteria to identify individuals with GD.	
	Concerns	Related references
Diagnostic validity	<p>Further research may indicate that the diagnostic threshold fails to differentiate nondependent from dependent use and that certain criteria do not increase diagnostic accuracy.</p> <p>Data regarding measures for IGD on predictive validity and interrater reliability is inadequate.</p> <p>IGD risks pathologizing normal behaviors if numerous symptoms that do not indicate pathology are included.</p> <p>Content validity, construct validity, and face validity should be tested.</p> <p>The polythetic, nonhierarchical DSM-5 diagnostic criteria for IGD renders the concept of IGD unacceptably heterogeneous.</p> <p>Intensity and frequency measures are required to represent the pathological threshold of each IGD and GD criteria.</p>	<p>Dowling (2014)</p> <p>King, Haagsma, Delfabbro, Gradisar, and Griffiths (2013) (Markey & Ferguson, 2017) {Kardefelt-Winther, 2015 #158}</p> <p>Starcevic (2017)</p> <p>Ko and Yen (2014)</p>
<i>Validity of each criterion</i>		
Preoccupation	<p>Preoccupation with gaming or feeling upset when an individual cannot participate to the desired extent are not necessarily indicators of pathology.</p> <p>The cognitive factors related to preoccupation must be clarified.</p> <p>“Distracted by thoughts on gaming which hinder concentration on work or other important tasks” may be more accurate than “thinking or planning when not playing”.</p> <p>Preoccupation should not be assessed on time alone but also on the cognitive content. “Perceiving gaming as central to their lives” or “whether they could imagine their lives without gaming” could be considered.</p> <p>Worse diagnostic accuracy compared with the other IGD criteria.</p>	<p>Kardefelt-Winther (2014)</p> <p>King and Delfabbro (2014b)</p> <p>Ko and Yen (2014)</p> <p>Griffiths et al. (2016)</p> <p>Király et al. (2017)</p>
Loss of control	<p>A desire or intention to stop playing is required.</p> <p>Cultural bias, rational choice, and age should be considered.</p>	<p>Griffiths et al. (2016)</p> <p>Griffiths et al. (2016)</p>
Gaming despite negative consequences	<p>Are the negative consequences short-term or long-term?</p>	<p>Griffiths et al. (2016)</p>
Withdrawal	<p>The response to an immediate disruption of gaming or prolonged refrainment from gaming (≥ 2 weeks) may not be withdrawal symptoms.</p> <p>“Over a period of up to 2 days” and “relieved by the ability to play” could be used in evaluating the withdrawal symptoms.</p> <p>Current evidence on Internet gaming withdrawal is very underdeveloped.</p> <p>Although current evidence is very underdeveloped, the most consistently reported emotional and behavioral withdrawal symptoms were irritability and restlessness, not physical withdrawal symptoms.</p>	<p>Ko and Yen (2014)</p> <p>Griffiths et al. (2016)</p> <p>Kaptsis, King, Delfabbro, and Gradisar, (2016)</p> <p>Kaptsis, King, Delfabbro, and Gradisar (2016)</p>
Tolerance	<p>Tolerance could be described as “diminished levels of gaming satisfaction because of prolonged gaming activity”.</p>	<p>Griffiths et al. (2016), Ko and Yen (2014)</p>

(continued)



Table 3. Continued

Topics	Validity of the diagnostic criteria to identify individuals with GD.	
	Concerns	Related references
	Problematic gamers appear to be driven by a need for higher-quality, rarer, more valuable, more novel, or more difficult-to-obtain rewards.	King and Delfabbro (2016)
	Individuals with IGD may have very different and tolerance-unrelated reasons for spending more time gaming.	Billieux, Schimmenti, Khazaal, Maurage, and Heeren (2015)
	The increase in time or upgradation of equipment does not necessarily reflect a pathology.	Griffiths et al. (2016)
	This criterion excludes gamers that may have played a considerable amount of time over a long period but have not increased their playing time.	Krossbakken et al. (2017)
Deception	This criterion has a considerably lower diagnostic accuracy compared with the other IGD criteria.	Ko et al. (2014)
Escape	This criterion has a considerably lower diagnostic accuracy compared with the other IGD criteria.	(Király et al., 2017; Király, Griffiths, & Demetrovics, 2015; Ko & Yen, 2014) {Rehbein, 2015 #227}
	Low specificity: Nonaddicted gamers also play to escape problems in their lives. Gamers are not necessarily aware that the purpose of their gaming is to escape problems.	Griffiths et al. (2016)
Loss of interest	Numerous gamers view escaping and losing time as a positive feature of gaming rather than a negative one.	Wood & Griffiths (2007)
	Giving up other activities for gaming may reflect a normal development process. It may also reflect an association with depression.	Griffiths et al. (2016)
Risk or Lose relationships and opportunities	Highly engaged nondisordered players have also endorsed this criterion.	Griffiths et al. (2016)
	Problems caused by gaming should be a requirement criterion.	Griffiths et al. (2016), Ko (2014)
	Including functional impairment and distress to the wording of each criterion would enable differentiation between the engaged and addicted gamers using the same scale. “Leading to clinically significant impairment or distress” could be included in the wording.	Krossbakken et al. (2017)
General concern	The field lacks basic theory, definitions, and properly validated and standardized assessment tools.	Van Rooij and Kardefelt-Winther (2017)

and associated factors, such as impulsivity (Bailey et al., 2013; Ko et al., 2017; Rho et al., 2017; Ryu et al., 2018; Y. Wang et al., 2017), between GD and other substance use disorders. Brain imaging studies (e.g., Ko et al., 2013; Tian et al., 2014) and reviews for gaming problems in child and adolescents (Kuss & Griffiths, 2012) also support these similarities, which may support the idea that GD and addictive disorders have a common manifestation or underlying mechanism (Young & Brand, 2017).

Clinical and prospective studies are necessary to investigate the mechanisms of addiction (Subramaniam, 2014). However, the IGD and GD criteria in the DSM-5 and ICD-11 respectively are indispensable for participant recruitment for these studies (Lee, Choo, & Lee, 2017; Petry, Rehbein, Ko, & O'Brien, 2015; Saunders et al., 2017).

2. Moral panic

Various levels of concern were expressed in articles regarding GD inclusion in diagnostic manuals causing over-pathologizing of normal gaming behaviors (Aarseth et al., 2017; Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Van Rooij & Kardefelt-Winther, 2017). Przybylski (2014) demonstrated a consistent, but not robust, association between gaming and children's adjustment. A small proportion of the general population (0.3%–1.0%) fulfills the IGD criteria (Przybylski, Weinstein, & Murayama, 2017). Furthermore, a clear link between IGD and psychological, social, or physical health problems has not been corroborated (Markey & Ferguson, 2017). Therefore, Carbonell (2017) reported concerns regarding the existence of



functional impairment in IGD. However, significant gaming-related problems, physical harm, emotional distress, and functional impairment in varied dimensions were revealed in several interview-based or epidemiological studies (King, Delfabbro, & Griffiths, 2013; Ko et al., 2019; Lehenbauer-Baum et al., 2015; Müller et al., 2015; Rasmussen et al., 2015; Rikkers, Lawrence, Hafekost, & Zubrick, 2016; Stubblefield et al., 2017; Subramaniam et al., 2016; Wong & Lam, 2016). IGD prevalence ranges from 0.96 to 5.9% in survey studies on the basis of DSM-5 criteria (Bouna-Pyrrou, Mühle, Kornhuber, & Lenz, 2015; Chiu, Pan, & Lin, 2018; Demetrovics et al., 2012; Evren et al., 2018; Lemmens, Valkenburg, & Gentile, 2015; Pontes, Király, Demetrovics, & Griffiths, 2014; Rehbein, Kliem, Baier, Möhle, & Petry, 2015a; Subramaniam et al., 2016; Vadlin, Åslund, Rehn, & Nilsson, 2015; H.; Yu & Cho, 2016). The meta-analysis reported an overall IGD prevalence of 3.1% or 4.6%, depending on the measurement and population (Fam, 2018; Ferguson, Coulson, & Barnett, 2011). Furthermore, the false-negative rate of self-reported questionnaire evaluation is relatively high (44%) (Jeong et al., 2018). Individuals with GD may resist participating in voluntary surveys (Yao, Potenza, & Zhang, 2017), which may cause the underestimation of GD prevalence.

Another concern is that the GD criteria could exacerbate the moral panic related to gaming (Quandt, 2017; van Rooij et al., 2018). Basing criteria on substance use disorders may cause inappropriate diagnoses of GD. Furthermore, the proposed threshold fails to differentiate between highly engaged gamers and problematic or disordered users (Deleuze et al., 2017; Dowling, 2014; Kardefelt-Winther, 2014; Starcevic, 2017), particularly in adults (Carbonell, 2017). However, compared with alcohol use disorders (2 of 9 criteria) or gambling disorders (4 of 9 criteria), the threshold for the diagnosis of IGD in the DSM-5 (5 of 9 criteria) is relatively high (APA, 2013). Furthermore, studies have suggested that the cut-off point accurately identifies adults or adolescents with IGD (Ko et al., 2014; Koo et al., 2017).

Both the DSM-5 and ICD-11 criteria for IGD and GD respectively defined dyscontrol of gaming using typical addictive symptoms and negative consequences. They did not conclude that all types of gaming were problematic (APA, 2013; WHO, 2019). Identifying a clear line between GD and healthy engagement in gaming is difficult without a clear definition, such as that provided in the DSM-5 or ICD-11 (Ko, 2014). Furthermore, unwillingness to recognize the addictive potential of gaming may lead the affected individuals to a higher health risk (Lee et al., 2017), which should be addressed using effective treatments, such as cognitive behavior therapy, mindfulness, or family-based interventions (Kim & Noh, 2019; Li et al., 2017; Zajac, Ginley, Chang, & Petry, 2017). Billieux et al. (2017) reported that terms commonly used by the public without clear definitions (such as “addiction”) may contribute more to a moral panic than a clear definition. Király and Demetrovics (2017) indicated that providing easily understandable public education regarding the definitions of IGD and GD

(particularly the distress threshold) may help prevent moral panic and misinterpretation.

3. The validity of the criteria for distinguishing patients with GD from healthy gamers

Extensive concerns have been raised regarding the majority of the DSM-5 criteria for IGD, all of which are listed in Table 3. These concerns can be classified into four categories.

The first category is related to the nosology of the criteria. Because gaming does not induce pharmacological effects, the withdrawal symptoms vary in presentation, onset, and duration, and they are thus difficult to define (Ko, 2014). King, Haagsma, Delfabbro, Gradisar, & Griffiths (2013) indicated that withdrawal is a major element of the definition of GD in screening instruments. Most gamers assessed by Ko et al. (2014) declared that they could not abstain from gaming for several days. A study demonstrated that 88% of individuals with GD experienced withdrawal symptoms within 3 days after stopping gaming (Ko et al., 2019). However, a prospective study determined that individuals with GD experienced the largest decline in withdrawal symptomatology within the first 24 hours of abstinence (Kaptsis, King, Delfabbro, & Gradisar, 2016a). Furthermore, the emotional reaction to not playing games and the symptoms occurring because of withdrawal, such as irritability and restlessness, were often confused (Kaptsis, King, Delfabbro, & Gradisar, 2016b).

The second category is related to the criteria not having the capacity to differentiate gamers with GD from highly engaged but healthy gamers (Kardefelt-Winther, 2015). Several criteria, such as preoccupation (Kardefelt-Winther, 2014), escape (Rehbein et al., 2015a), or loss of interest (Griffiths et al., 2016), reportedly manifest among both individuals with GD and healthy engaged gamers. Ko et al. (2014) further argued that the escape and deception criteria had relatively low diagnostic accuracy, as demonstrated by psychometric assessment studies (Király et al., 2017; Schivinski, Brzozowska-Woś, Buchanan, Griffiths, & Pontes, 2018). However, escape is the most significant motivational predictor of GD with clinical utility (Billieux et al., 2011; Griffiths et al., 2016; Király et al., 2015; Kuss, Louws, & Wiers, 2012; Martín-Fernández et al., 2016). Furthermore, loss of interest is critical for identifying individuals with GD, and it reflected the severity of GD in questionnaire studies (Lee et al., 2017; Rehbein et al., 2015a). Therefore, concerns and empirical study results for individual criteria were inconsistent.

Another key problem is the threshold of frequency and intensity level of each criterion, such as the number of times an individual loses control in 1 week and the consequences (Ko, 2014; Ko et al., 2019; Ko & Yen, 2014). The DSM-5 set “leading to clinically significant impairment or distress” as the threshold for the overall diagnosis (APA, 2013). Kardefelt-Winther et al. (2017) suggested that distress should be repetition persisting over a significant period of time, and functionally impairing. Krossbakken, Pallesen, Molde, Mentzoni, and Finseras (2017) and van Rooij,



Schoenmakers, and van de Mheen (2017) suggested that if functional impairment and distress were included in all the criteria, engaged and addictive gamers could be separated. Therefore, several scholars have suggested that problems resulting from gaming and functional impairment should be a required criterion to prevent GD overdiagnosis (Griffiths et al., 2016; King & Delfabbro, 2018; Ko, 2014; van Rooij et al., 2017). Furthermore, a threshold may attenuate the false-positive rates of each criterion by establishing consensus regarding severity and frequency (Ko, 2014).

The third concern is related to the wording of the criteria. The most common concern is related to determining tolerance based on time (Billieux et al., 2015; Griffiths et al., 2016; Ko & Yen, 2014; Krossbakken et al., 2017). Chronic cases spent a large amount of time gaming and could not further prolong gaming time (Ko, 2014). Several scholars have suggested that diminished levels of gaming satisfaction because of prolonged gaming activity can represent tolerance (Griffiths et al., 2016; King & Delfabbro, 2016; Ko & Yen, 2014). A study reported that tolerance was critical in identifying individuals with GD (Rehbein, Kliem, Baier, Mößle, & Petry, 2015b), whereas another determined that it was not a valid criterion (Lee et al., 2017), depending on the interpretation of tolerance.

Kardefelt-Winther (2014) argued that preoccupation is not necessarily an indicator of pathology. King and Delfabbro suggested that cognitive factors related to preoccupation must be clarified (King & Delfabbro, 2014b) and Griffiths et al. (2016) suggested assessing preoccupation based on their “perception of gaming as central to their lives” or “whether they could imagine their lives without gaming,” whereas Ko and Yen (2014) evaluated preoccupation based on “distraction caused by thoughts of gaming when they must concentrate on work or other important tasks” to reflect a functional disturbance. Furthermore, Király et al. (2017) demonstrated the relatively low diagnostic accuracy of preoccupation in a survey study. Therefore, varied methods have been suggested to evaluate the concept of preoccupation, which may affect performance in diagnosing GD.

The fourth concern related the definition of excluding criteria, to prevent inappropriate recruitment of subjects with behaviors similar to GD caused by other psychological conditions. Ko et al. (2009) proposed excluding criteria to distinguish patients that are “better accounted for by psychotic disorder, bipolar I disorder, or other impulse control disorders.” These criteria would prevent the diagnosis of GD because of over-engagement in gaming secondary to a delusion or under a manic state. The DSM-5 criteria excluded gambling behaviors and viewing of sexual Internet content (APA, 2013) because these behaviors may be more accurately accounted for by gambling disorder or sexual motivation, respectively.

Kardefelt-Winther et al. (2017) suggested excluding criteria that are more accurately explained by an underlying disorder, a willful choice, or a coping strategy. These proposals remind clinicians to emphasize the reasons or factors underlying GD. However, Griffiths (2017) argued that few

individuals would be diagnosed as addicts if these exclusion criteria, such as gaming as a coping strategy, were applied for substance use disorders (e.g., drinking as a coping strategy).

Carbonell (2017) raised concerns regarding the stability of diagnosis. A study demonstrated that self-identified excessive gaming tends to be relatively transient (Konkolj Thege, Woodin, Hodgins, & Williams, 2015), which may explain why a duration of 12 months was required for both DSM-5 and ICD-11 criteria for IGD and GD respectively. However, studies revealed the stability of GD criteria over 6 months and 2 years (Bouna-Pyrrou et al., 2018; Weinstein, Przybylski, & Murayama, 2017). These studies demonstrated in-conclusive results in the course of GD.

Despite these concerns, the proposed diagnostic threshold of 5 of 9 criteria, with the requirement of impaired function and distress, may effectively differentiate individuals with IGD from highly engaged but healthy gamers (Ko et al., 2014; Koo et al., 2017). The psychometric validity of the proposed threshold has been supported by various studies (Bouna-Pyrrou et al., 2018; Király et al., 2017; Sigerson, Li, Cheung, Luk, & Cheng, 2017).

Concerns regarding the ICD-11 GD criteria

Several researchers have argued that diagnosis with the ICD-11 guidelines may be premature because of inadequate scientific evidence (van Rooij et al., 2018). However, many of other clinicians and researchers support the WHO’s decision, which was based on clinical evidence and public health requirements (Higuchi et al., 2017; Rumpf et al., 2018). More advantages than disadvantages have presented regarding GD inclusion in ICD-11 (Király & Demetrovics, 2017; Shadloo et al., 2017; van den Brink, 2017). However, some concerns persist and scientific problems continue to be raised (Aarseth et al., 2017; van Rooij et al., 2018). The specific concerns are not listed in the present paper because most of the concerns raised regarding the ICD-11 GD definition are similar to those raised regarding the DSM-5 GD criteria.

The ICD developed the criteria for GD after gathering a considerable amount of evidence on DSM-5 criteria and made some critical changes. First, functional impairment and negative consequences were set as obligatory requirements (Billieux et al., 2017; Griffiths et al., 2016; Ko, 2014; Krossbakken et al., 2017). Criteria with controversial validity, such as escape or deceptive behaviors (Ko et al., 2014), or ill-defined criteria, such as tolerance and withdrawal (Billieux et al., 2015; Kaptsis et al., 2016b; Ko, 2014), were excluded. The three aforementioned basic criteria must be fulfilled for a positive GD diagnosis. Therefore, the ICD-11 definition has a high diagnostic threshold that may attenuate overdiagnosis risk. However, no threshold can entirely prevent false-positive cases without causing excessive false-negative cases; this is another critical concern (Maraz, Király, & Demetrovics, 2015).

Individuals with repeated intermittent negative consequences but without impaired function may not be diagnosed and treated as GD because functional impairment is



required for the diagnosis (Colder Carras & Kardefelt-Winther, 2018). The ICD-11 defined excessive gaming with a risk of mental or physical problems or risky behaviors as hazardous gaming, and the disorder was categorized under “problems associated with health behaviors” (WHO, 2019) which remind individuals to alter their behavior habits to improve their health. A study determined that 15.9% of highly engaged gamers fulfilled the definition of hazardous gaming presented by the ICD-11 (Ko et al., 2019). Therefore, the hazardous gaming definition could be used to identify individuals with GD risk at an earlier stage. Nevertheless, further evidence-based information regarding the harms of excessive gaming is required (King & Delfabbro, 2018).

DISCUSSION

Numerous researchers have readied concerns regarding defining GD as an addictive disorder because of its psychiatric comorbidity and heterogeneity in etiology. However, substance use disorders are modeled by various frameworks, such as the self-medication model (Koffarnus & Kaplan, 2018), decision-making model (Verdejo-Garcia, Chong, Stout, Yucel, & London, 2018), and rewarding deficit model (Cooper, Robison, & Mazei-Robison, 2017). Furthermore, empirical results support the similarities between GD and other addictive disorders. Moreover, retaining the comorbidity model to represent the coexisting psychiatric symptoms of GD could be a practical clinical approach, instead of negating the addiction framework. Nevertheless, these concerns should remind researchers and clinicians to consider multiple underlying factors that contribute to individual clinical manifestations of GD. Clinical, experimental, prospective, and neurobiological studies could provide etiological information, which is necessary to validate the addiction framework of GD.

Concerns were repeatedly expressed regarding GD criteria over-pathologizing healthy engaged gaming behaviors. The existence of functional impairment in GD was also doubted. Several scholars suggested that the diagnostic criteria could cause a moral panic regarding gaming behaviors (Aarseth et al., 2017; Kardefelt-Winther, 2014; Markey & Ferguson, 2017; van Rooij et al., 2018). However, several studies have demonstrated that the DSM-5 or ICD-11 criteria could distinguish IGD from engaged gamers and reveal functional impairments (Ko et al., 2014; Ko et al., 2019; Koo et al., 2017). Diagnostic criteria that provide a clear definition for disordered gaming could prevent over-pathologizing healthy gaming behavior. Therefore, well-designed public education is necessary to prevent the misunderstanding of criteria. Further clinical studies to demonstrate the negative consequences, functional impairment, and course of GD are required to abate concerns.

Concerns and inconclusive results have been reported for the nosology (e.g., “withdrawal”), diagnostic validity (e.g., “escape”), and wording (e.g., “tolerance”) of individual criteria for GD diagnosis. However, several diagnostic

interviewing studies support the overall discriminative validity of the DSM-5 criteria (Ko et al., 2014; Koo et al., 2017). The ICD-11 criteria for GD were improved with the inclusion of negative consequences and functional impairments as a required criterion and exclusion of inconclusive criteria. However, the clinical validity and utility warrant further investigation. The stability, threshold, neurobiological framework, discriminative performance, and predictivity of the GD criteria should be evaluated in clinical prospective studies to further improve their validity and utility.

Suggestions to resolve the concerns regarding the DSM-5 IGD and ICD-11 GD criteria

We suggest designing studies that include investigation of (i) the diagnostic validity of the GD criteria, (ii) the underlying etiological factors of GD, (iii) the negative consequences of GD, and (iv) the course and prognosis of GD. Furthermore, an integrated review or debate conference would be beneficial in resolving concerns. In the following sections, we discuss each of these suggestions in detail.

Diagnostic validity of the GD criteria

The most challenging aspect of validity studies on GD criteria is identifying the gold standard group and the optimal control group. Individuals with excessive gaming habits who demonstrate both typical addictive symptoms and chronic functional impairments could be eligible as members of the gold standard group. The clinical impression derived from diagnostic interviews performed by experienced mental health professionals based on the ICD-11 definition could be the standard for the recruitment of the gold standard group. Furthermore, recruiting nongamers as control group members may overestimate the diagnostic validity of the criteria in a clinical situation. Therefore, including regular or highly engaged gamers who do not meet the GD criteria in the control group is reasonable.

Studies have supported the validity of the DSM-5 IGD criteria in diagnostic interviewing studies (Ko et al., 2014; Koo et al., 2017; Müller et al., 2019). However, these studies displayed differences in criteria validity. Even though the same criteria were used (the DSM-5 IGD criteria), the intensity thresholds differed because they were derived from the personal judgment of the interviewers. Therefore, researchers must carefully consider the intensity and frequency thresholds (Ko, 2014; Starcevic, 2017) of each criterion to provide a standard assessment for diagnosis.

Case-control studies, particularly with clinical samples, could be used to evaluate the optimal thresholds for the criteria and definitions (e.g., the number of criteria required for the diagnosis) (Ko et al., 2019). The performance of these thresholds should then be tested among regular gamers in large-scale epidemiological studies.

Etiological mechanisms underlying GD

One of the most apt definitions of addiction is “decreased reward sensitivity and increased expectation sensitivity



conspire to overwhelm the brain's control circuit" (Volkow et al., 2010). In other words, addiction involves reward, expectation, and cognitive control circuits. Mechanism based on these circuits should be investigated in GD to assess the similarities and differences with substance use disorders. The cue-induced craving model (Weinstein, 2017) and the impaired cognitive control model (Kuss et al., 2018) of GD were the most consistent results in this area. However, these also yield inconsistent results concerning the brain regions responsible for craving reaction or cognitive control. Furthermore, the experimental design was limited. Therefore, well-designed neurocognitive experimental studies should be conducted, such as studies that use functional magnetic resonance imaging (fMRI), positron emission tomography, and electroencephalography (EEG) and enroll adequate sample sizes through diagnostic interviewing with a reasonable hypothesis (Ko, 2014). The combination of these results and information from behavioral tasks and psychological assessments would contribute to validating or rejecting the addiction framework of GD.

Furthermore, research with clinical samples of GD could investigate other candidate mechanisms, such as impulse control, stress vulnerability (Canale et al., 2019), emotion regulation, and decision-making (Ko et al., 2017). Comorbidity should be evaluated and specified in mechanism studies because of the high rate of psychiatric comorbidity among individuals with IGD (e.g., 39.1% adults with IGD have ADHD [Yen et al., 2017]) to demonstrate their role in the development of IGD. Intervention studies focusing on each specific mechanism are required to demonstrate the role of these theoretical frameworks in the development, maintenance, remission, and relapse of GD.

Studies focusing on the negative consequences of GD

Both Van Rooij and Prause (2014) and Browne et al. (2016) have suggested examining how GD harms an individual. A diagnostic interview study demonstrated that 89.9% of IGD patients fulfilled at least one functional impairment criterion (Ko et al., 2019). However, functional impairments varied based on gaming design. Games were usually designed to demand an increasing amount of time, e.g., 2–3 h per session, from users, during which a user is unable to perform other tasks. Nowadays, smartphone games are designed to attract users to touch the screen repeatedly and frequently to entice users to play and thus distract gamers from their duties and responsibilities, which may result in deficient work performance or accidents (e.g., while driving or cooking). Potenza (2018) reported that a hospitalized patient passed away because a care provider was gaming and was thus distracted from his work-related task.

The mental and physical negative consequences of GD may include sleep disturbances (Hawi, Samaha, & Griffiths, 2018; Mannikko, Billieux, & Kaariainen, 2015), obesity (Ko et al., 2019), and cardiovascular disorders (Braithwaite, Shirtcliffe, Jurevics, & Beasley, 2018). Moreover, accidents that occur as a result of overindulging in smartphone gaming (e.g., car accidents both as a driver or a pedestrian)

could present a new problem for individuals with GD or even highly engaged healthy gamers. Finally, "Loot Boxes" are randomized consumable virtual items that can be obtained by expending effort in the game or by paying real money. This system may cause severe financial problems (Zendle, Meyer, & Over, 2019). Studies to demonstrate the association between these problems and GD and prospective studies to investigate the causal relationships are necessary to understand the negative consequences of GD.

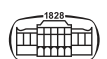
Moreover, some gaming-related problems, such as sleep disturbances or immobilization (Ko et al., 2019), result from excessive or "binge" gaming (i.e., extremely long gaming sessions) and are thus not necessarily caused by GD, which should be considered by mental health professionals and e-sport teams, companies and sponsors, who should devise strategies to protect their gamers from physical and psychological problems. These strategies could involve limiting the duration of immobility or visual exposure to the screen, encouraging or even obliging exercise, and encouraging healthy sleep habits. Furthermore, the possible negative consequences associated with "binge gaming" should also be considered when designing games, particularly for children and adolescents (Király et al., 2018).

Prospective studies examining GD course and prognosis

The most essential standard for the DSM-5 IGD criteria is its clinical utility, in terms of the assessment of clinical course and treatment response (APA, 2013). Weinstein et al. (2017) reported moderate stability of the GD criteria in a half-year follow-up study. Longer follow-up periods for individuals of GD may provide more information on the course and prognosis of GD (Petry et al., 2015). Prospective studies that provide the time course could clarify the causal relationship between GD and associated mental and physical health problems (Mihara & Higuchi, 2017; Petry et al., 2015). For example, social skills, emotional regulation deficits, attention problems, impulsivity, and self-esteem predict GD, whereas depression, anxiety, poor school performance, and emotional stress are outcomes of GD in prospective study (Ferguson & Ceranoglu, 2014; Gentile et al., 2011; Wartberg, Kriston, Zieglermeier, Lincoln, & Kammerl, 2019; Wichstrom, Stenseng, Belsky, von Soest, & Hygen, 2019). These studies have provided key information supporting the causal relationship between GD and its associated factors. However, they were based on self-reported questionnaires. Diagnostic interview studies, which prospectively investigate the relapse, remission, or exacerbation of GD and the negative consequences could clarify the separation of the stages of the disorder (Király et al., 2015; Petry et al., 2015) and the clinical utility of the GD classification.

Integrated reviews, theory proposals, and debate conferences

A holistic theoretical framework based on integrated empirical findings were lacking despite a large body of



findings on the psychological, social, and neurobiological factors of GD (Müller, 2017). The associations identified in cross-sectional studies could contribute to the meaningful hypotheses regarding the risk factors for GD and provide foundations for future confirmative research, as suggested by Kuss et al. (2017b). However, without an integrated review, the massive body of information cannot be utilized efficiently. Kuss, Pontes, and Griffiths (2018) reviewed the neurobiological correlations of GD, such as poor cognitive control and emotion regulation. Dong and Potenza (2014) proposed a cognitive behavior model of IGD, which highlighted the domains of reward-seeking, stress-reduction driving motivations, executive control, and decision-making. A systemic review claimed that deficient self-esteem, mood and reward dysregulation, problems in decision-making, and external factors could be etiological factors for GD (Paulus, Ohmann, von Gontard, & Popow, 2018). Sugaya, Shirasaka, Takahashi, and Kanda (2019) raised concerns regarding sleep disturbances, family factors, and impaired cognitive control of GD. These reviews integrated previous studies and provided an outline of the scope for etiological and prospective studies.

A unified methodology for assessment and a practical intervention should be developed as soon as possible. One practical means is to integrate available evidence-based information and clinical experience from experts in different countries over the world. Griffiths et al. (2016) argued that debate could lead to an improved theory, better methodologically designed studies, and more robust empirical evidence regarding problematic gaming and its psychosocial effects and consequences. A practical approach to advance a constructive debate in this field is the release of special issues in journals of interest where opinions can be compared and engaged with. Furthermore, international conferences, such as the International Conference on Behavioral Addictions (ICBA), could provide a platform to discuss unresolved concerns to achieve a consensus regarding resolutions. At the sixth ICBA in 2019, the WHO established a working group to lead The WHO Collaborative Project on the Development of International Screening Tools for Disorders caused by Addictive Behaviors (Carragher et al., 2019). The project aimed to develop (i) a lay-administered fully structured diagnostic interview for GD, (ii) a clinician-administered semi-structured diagnostic interview for GD, and (iii) diagnostic research criteria for GD. The working group comprises experts from across the world to integrate their knowledge and thus establish assessment tools that can be applied globally. By integrating information, experience, and the opinions of mental health professionals and scholars, we might move forward to develop a practical means to assess individuals with GD to help them and their families.

Limitations

The present study was conducted using the PubMed database alone, which may have limited the extent of articles included. Furthermore, some recommendations in the

recruited articles were based on the opinions of individual authors. Therefore, these findings must be verified in future studies.

CONCLUSION

The results of empirical studies have supported the similarities between GD and addictive disorders, despite concerns regarding the heterogeneity among GD etiologies. Neurobiological mechanisms of addiction should be evaluated using experimental studies in patients with GD. A clear definition of GD could identify individuals who require assistance without pathologizing healthy gamers. Public education is required to prevent misinterpretation of GD criteria and moral panic. Extensive concerns and inconclusive results regarding the validity or utility of individual DSM-5 IGD criteria have been reported. However, the current requirements for diagnosis are presenting five of nine criteria with functional impairment, which should differentiate individuals with GD from highly engaged but healthy gamers. Further empirical research on functional impairment, course and prognosis, and stability and predictivity of criteria are required to verify the validity and utility of the IGD and GD criteria. Considering these concerns is critical in preventing overdiagnosis, underdiagnosis, misdiagnosis, or harm to patients. In this review, we suggested assessing the addiction characteristics, negative consequences, and psychiatric comorbidities of video gaming before making a final diagnosis. Identifying and working to resolve concerns regarding the diagnostic criteria through scientific studies is the first step toward the successful treatment of GD.

Conflict of interest: ZD has been member of a WHO advisory group on the public health consequences of addictive behaviors. In this capacity he has been eligible for travel support from WHO or the host center to attend advisory group meetings but have not been remunerated for their work. ZD is the Editor-in-Chief of the Journal of Behavioral Addictions.

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