Exploring Internet gaming disorder: an updated perspective of empirical evidence (from 2016 to 2021)

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ABSTRACT

Background and aims: Since the acceptance of Internet gaming disorder (IGD) as a "disorder due to addictive behaviors", research has proliferated exponentially. The present review focuses on the conceptualization of IGD, its diagnosis and assessment, associated factors and existing prevention and treatment plans to address it.
Results and conclusions: The discrepancies between the diagnostic criteria for IGD proposed by the two central diagnostic entities, as well as the questioning of their clinical validity, have generated multiple proposals for the diagnosis and psychometric evaluation of IGD. Likewise, there have been numerous suggestions to prevent this pathology, with the involvement of governments, the gaming industry and health institutions. Finally, multiple treatment plans have been proposed, both pharmacological and psychological, although only the efficacy of cognitive behavioral therapy has been tested. It is essential, therefore, to delve deeper into this disorder by addressing the central limitations of the current literature.

1. Introduction

Internet gaming disorder (IGD) was suggested as a mental disorder in section III of the DSM-5 [1] and has been recognized as a "disorder due to addictive behaviors" by the ICD-11 [2], considering it to be a persistent and recurrent pattern of Internet gaming involvement despite the physical and psychological impairment.

However, the conceptualization of this disorder has been a matter for debate. On the one hand, some authors have considered that its inclusion in the diagnostic manuals resulted in the pathologization of some behaviors (in this case, the use of video games), which generated policies and interventions that are not essential; the proposed diagnostic criteria for IGD do not adequately distinguish between highly engaged and problematic gaming behavior, and its addictive nature has also been questioned [3–6]. On the other hand, other authors have emphasized that the diagnosis of IGD is essential, just as it is clear that others, such as anxiety or eating disorders, are essential without the fear of stigmatizing behaviors (which in that case would be worries or eating behaviors) [7].

A recent Delphi study analyzed the criteria proposed by the DSM-5 and ICD-11 to explore a possible consensus among experts about their clinical relevance and diagnostic power [8]. Some criteria (loss of control, gaming despite harm, conflict/inference due to gaming, and functional impairment) were agreed upon because of their clinical usefulness. However, there was also consensus that some DSM-5 criteria (tolerance, deception of others about gaming, and escape/regulating mood) had limited clinical relevance, suggesting its exclusion for the conceptualization and diagnosis of IGD [8].

The most affected by IGD are males (especially adolescents) presenting higher screen hours, craving and negative consequences [9,10]. More specifically, a systematic review that analyzed 53 studies with a total sample of 226,247 individuals highlighted a worldwide IGD prevalence of 3.05% [11]. In the specific case of adolescents, a prevalence of 4.6% has been described [12]. Darvesh et al. [13] found in their review that the prevalence of IGD ranged, in the general population, from 0.21 to 57.50% while in clinical populations it ranged from 3.20 to 91.00%. General population was defined as populations that were not

seeking treatment for IGD, did not have IGD at recruitment and were not undergoing treatment for IGD while clinical populations were understood as the ones who sought treatment and those who suffered from IGD at recruitment.

Similarly, Pan et al. [14] conducted a systematic review and meta-analysis of epidemiology of generalized internet addiction and IGD. The authors included 113 epidemiologic studies involving a total of 693,306 individuals, finding a prevalence of 2.47% in the case of IGD.

In view of the lack of scientific consensus regarding IGD, the present narrative review aims to shed light on the assessment, associated factors, prevention, and treatment of this diagnostic category by reviewing studies from the last 5 years. This type of review was selected in order to obtain a broad, critical, and comprehensive perspective of the current knowledge about IGD. For the selection of the studies included in this narrative review, PubMed/Medline was used to search for the term "gaming disorder" and the temporal filter of the last 5 years (September 2016-September 2021).This period was selected due to the proliferation of scientific literature in the field, mainly because of both the acceptance of the condition by ICD-11 and the pandemic period as a consequence of COVID-19.

2. IGD assessment

As highlighted by van Rooij et al. [15], the DSM-5 proposal generated an increase in the design of new psychometric scales to assess IGD. The authors identified six instruments: the 20-item Internet Gaming Disorder Test (IGD-20), a separate nine-item Internet Gaming Disorder Scale–ShortForm (IGDS9-SF), the Internet Gaming Disorder Test (IGDT-10), the Internet Gaming Disorder Scale (IGDS-9), the Clinical-Video Game Addiction Test (C-VAT 2.0) and an unconventional hybrid scale with items pertaining to Internet and online gaming. Similarly, King et al. [16] identified 29 instruments.

In parallel, Bernaldo-de-Quirós et al. [17] found 7 psychometric scales in their systematic review exploring instruments to measure IGD in adolescents and young adults: the IGD-20, the IGDS9-SF, the Problematic Online Gaming Questionnaire (POGQ), the Problematic Online Gaming Questionnaire – Short Form (POGQ-SF), the Video Game Addiction Test (VAT), the C-VAT 2.0 and the IGD scale.

Similarly, King et al. [18], in their comprehensive systematic review, identified 32 instruments to assess IGD, which were included in 320 studies, and highlighted the proliferation of psychometric tools since 2013.

New instruments for the assessment of IGD have been developed, and validations/adaptations of existing instruments have been conducted in the last 5 years (2016-2021) (included in Table 1).

Regarding the geographical origin of the new validated instruments, Asia seems to be the continent most focused on advancing the field of IGD assessment. Moreover, including both new validations and adaptations, China, Korea and Taiwan are the countries with the largest number of studies in this regard. Taking the aims of the studies into account, it seems that IGDS9-SF, IGD-20 and IGDT-10 are the instruments that arouse the greatest scientific interest, given that numerous articles have attempted to test their psychometric properties in different countries. Finally, most of these instruments are based on the criteria proposed by the DSM-5 so they share the same theoretical framework, although the number and type of items vary considerably among them. The shortest tool contains 4 items [68], while the longest is composed of 38 items [48], with the range between 7 and 11 items being the most common. Some authors have reported the need to test the rigor of the IGD diagnostic criteria in multiple populations to increase its accuracy. However, they have pointed out that the existence of multiple IGD assessment instruments greatly hinders scientific progress and that only if the scientific community reaches a consensus and uses exclusively one tool and the same cut-off points can the IGD be fully understood [72].

3. Associated factors

Several theoretical models have attempted to compile all the factors that may be associated with IGD. Among them, the model for Internet addiction [73], the theoretical model of Internet-gaming disorder [74] and the Interaction of Person-Affect-Cognition-Execution (I-PACE) model of specific Internet-use disorders [75] have had special relevance. The different models highlight the relevance of psychopathological factors, personality traits, personal attitudes, cognitive processes, decision-making style, and executive control, among others. The I-PACE model, which encompasses factors proposed by the other two frameworks, proposes: (I) predisposing variables (biopsychological constitution, psychopathological features, personality, and social cognitions, and using motives), (II) affective and cognitive responses to external or internal stimuli (coping, internet-related cognitive biases, cue-reactivity and craving, urge for mood regulation, and attentional biases) and (III) executive functions, inhibitory control and the decision to use certain applications/sites. Thus, multiple factors appear to be associated with the etiology and maintenance of IGD, although further empirical evidence is needed. Some of the factors associated with IGD are summarized below, taking into account the three main blocks considered from the biopsychosocial perspective: biological, psychological and social factors.

3.1. Neurobiological factors

Problematic gaming and IGD have been associated with neural alterations, both in functional and structural studies. More specifically, alterations have been observed in temporoparietal regions (in charge of attentional and self-concept processes), frontal areas (related to cognitive control) and frontal-limbic and subcortical regions (associated with reward processing and emotion regulation processes) [155]. In this vein, notable differences have been observed between individuals with IGD and controls, with the former showing alterations in the neuronal reward system, as well as poor response-inhibition, difficulties in decision-making processes, emotion regulation and cognitive control, poorer working memory and decreased visual and auditory functioning [156–158]. In addition, structural changes such as lower volumes of the striatum and a reduction of the gray-matter volume, as well as the white-matter density, have been described [159,160]. The systematic review by Yao et al. [161] suggests that individuals with IGD present, in comparison with controls,: (a) an hypoactivation in the anterior inferior frontal gyrus (in relation to hot-executive function), the posterior insula, somatomotor and somatosensory cortices (in relation to reward function); and (b) an hyperactivation in the caudate, anterior and posterior cingulate cortices, posterior inferior frontal gyrus, (in relation to cold-executive functions and reward).

However, it is worth noting the heterogeneity of the control groups used in these neurobiological studies, given that some use non-gamers, others non-excessive gamers, others amateur gamers, others specify that daily gaming duration was <2 h, and others do not specify the criteria for being a healthy control.

3.2. Psychological factors

3.2.1. Personality and impulsivity

In the last 5 years, the literature on the association between IGD and personality traits, as well as IGD and impulsivity [76–86] has also proliferated. Regarding personality traits, individuals with IGD show maladaptive personality traits, including high levels of negative affectivity and disinhibition [87]. Similarly, an association between IGD and personality traits such as neuroticism, conscientiousness and novelty seeking has also been described [88,89]. Granero et al. [90] have also highlighted the specific role of self-transcendence and cooperation in individuals with IGD, which would entail, among other aspects, a tendency to become immersed in the game context, losing track of time.

Table 1

Main studies in the last 5 years validating/adapting psychometric instruments and clinical interviews.

Authors	Country	Aim	Instrument	Instrument information	Sample
Yu et al. [19]	China	To examine the psychometric properties of a Chinese version of the IGD-20 Test	IGD-20 Test	20-item scale based on IGD items in DSM-5	569 Chinese middle school students and 523 university students
Kim [20]	Korea	To validate the Korean version of the IGD-20 Test.	IGD-20 Test	20-item scale based on IGD items in DSM-5	1,403 Korean online game users
Hawi et al. [21]	Arabia	To validate an Arabic version of the IGD-20 Test.	IGD-20 Test	20-item scale based on IGD items in DSM-5	375 students
Plessis et al. [22]	France	To validate the IGD-20 Test in French.	IGD-20 Test	20-item scale based on IGD items in DSM-5	166 French-speaking video game players who played an average of 21.9 h per week recruited from specialized forums.
Männikkö et al. [23]	Finland	To investigate the psychometric properties of the Finnish version of the IGDT-10	IGDT-10	10-item variant of the IGDT scale	773 Finnish vocational school students
Király et al. [24]	Hungarian, Iranian, English-speaking, French-speaking, Norwegian, Czech, and Peruvian	To test the psychometric properties, including language and gender invariance, in a large international sample of online gamers	IGDT-10	10-item scale assessing IGD as proposed in the DSM-5	7,193 participants comprising international online gamers
Király et al. [25]	Hungary	To develop and validate a brief psychometric instrument (IGDT10)	IGDT-10	10-item scale assessing IGD as proposed in the DSM-5	4,887 gamers (age range 14–64 years old)
Chiu et al. [26]	China	To validate the Chinese version of the IGDT-10	IGDT-10	10-item scale assessing IGD as proposed in the DSM-5	8,110 students from grade four to senior high who played Internet games
Wu et al. [27]	Iran	To verify the construct validity of the Persian IGDS9-SF	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	2,363 Iranian adolescents
Chen et al. [28]	China	To validate the psychometric properties of three simplified Chinese online-related addictive behavior instruments among mainland Chinese primary school students.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	1108 fourth to sixth graders
Qin et al. [29]	China	To examine the optimal cutoff score for the IGDS9-SF in a Chinese context.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	Samples from clinical settings (n = 131) and from universities (n = 3,742).
Schivinski et al. [30]	Poland	To develop the Polish version of the IGDS9-SF and scrutinize the nine IGD criteria empirically.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	3,377 gamers (mean age 20 years old)
Monacis et al. [31]	Italy	To examine the psychometric properties of the IGDS9-SF in an Italian-speaking sample	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	757 participants from Italian schools, universities and gaming halls.
Beranuy et al. [32]	Spain	To translate and adapt the IGDS9-SF to Spanish, as well as to obtain indicators relating to its validity and reliability.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	535 Vocational Training students who reported playing video games in the past 12 months
Maldonado-Murciano et al. [33]	Spain	To evaluate the psychometric properties of the Spanish version of the IGDS9-SF.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	388 online gamers
Sánchez-Iglesias et al. [34]	Spain	To assess the psychometric properties of the Spanish version of the IGDS9–SF and criterion validity by analyzing the relationships of their scores with other theoretically related variables.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	2,173 video game players between 12 and 22 years old
Severo et al. [35]	Brazil	To develop and examine the psychometric properties of the IGDS9-SF in a sample of Brazilian gamers and to find the best cut-off point	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	610 teenagers and adults
Donadon et al. [36]	Brazil	To describe the process of cross-cultural adaptation of the IGDS9-SF to the Brazilian context.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	30 gamers
Ling et al. [37]	Malaysia	To examine the psychometric properties (factor structure, reliability, and validity) of the Malay Version of the IGDS9-SF.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	137 Malaysian undergraduates
Evren et al. [38]	Turkey	To test the factor structure, reliability and validity of the IGDS9-SF.	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	1,250 participants
Kim et al. [39]	Korea	To examine the psychometric properties of K-IGDS9-SF.	K-IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	594 Korean game users
Lei et al. [40]	China	To test the psychometric properties of two versions of Chinese IGDSs: a dichotomous IGDS with yes/no type of response and a polytomous IGDS with a 0–5 Likert-type response	short IGDSs	The short IGDSs (9 items) has been developed in two forms with identical items but different response options: a dichotomous IGDS with yes/no type of response; and a polytomous IGDS with a 0–5 Likert-type response	Two population-based samples of Chinese adolescents and adults (351 for dichotomous IGDS and 378 for polytomous IGDS)

Table 1 (*continued*)

Authors	Country	Aim	Instrument	Instrument information	Sample
Sigerson et al. [41]	China	To develop a reliable and valid scale for measuring IGD in Chinese populations	C-IGDS	9-item scale assessing severity of IGD based on IGD items in DSM-5	502 Hong Kong community adults
Paschke et al. [42]	Germany	To investigate the psychometric properties of the IGDS in children and adolescents considering different age and sex groups	Short IGDS	The short IGDSs (9 items)	12- to 17-year old participants. Three independent samples: N = 762, N = 777, and N = 784
Chang et al.	Taiwan	To adjust the Taiwanese version of IGD-SF-T-L based on the DSM-5 criteria to a Likert scale model and test its psychometric property among children and adolescents with ADHD.	IGDS-SF-T-L	A modification of the Taiwanese IGD-SF criteria from a "yes" or "no" model to a 4-point Likert scale	102 children and adolescents with ADHD
van Rooij et al. [43]	Dutch	To develop and test a clinical assessment tool (C-VAT 2.0) in a clinical setting.	C-VAT 2.0	11-item test that covers the proposed DSM-5 criteria	32 clinical young participants (13–23 years old) in treatment for IGD
Lin et al. [44]	Iran	To test the psychometric properties of the Persian GAS through both classical test and modern test theories.	GAS	7-item scale	4,442 adolescents
Liu et al. [45]	China	To examine the psychometric properties of the GAS and to measure invariance among college students in China.	GAS	7-item scale	1040 full-time students from multiple colleges in China
Khazaal et al. [46]	Switzerland	To analyze the GAS in the context of item response theory (graded-response) modeling; and to investigate differential item functioning in 2 subsamples	GAS	7-item scale	2 large representative samples of Swiss men (3320 French-speaking and 2670 German-speaking)
Chen et al. [47]	China	To construct a screening tool to assess IGD symptomatology, defined by the fifth edition of the DSM-5, among Chinese gamers.	C-IGDC	27-item checklist, which is the first multidimensional, DSM-5-based IGD screening tool developed in a Chinese adult population	464 Chinese past-year gamers
Lau et al. [48]	China	To examine the psychometric properties of the IPQ-R for IGD in a general population	IPQ-R for IGD	The 38-item IPQ-R was modified to assess illness representation of IGD	1,501 Chinese community-dwelling adults
Higuchi et al. [49]	Japan	To develop a short screening test for IGD	GAMES test	9-item screening test	281 participants from the general population, aged between 10 and 29 years old.
Yang et al. [50]	China	To develop and validate a checklist for IGD symptoms of Chinese adolescents	DISCA	9 items	2144 secondary school students who reported that they had played Internet games in the past 12 months
Ko et al. [51]	Taiwan	To evaluate the best screening, diagnostic, and prevalence-estimated cutoff points of the CIAS-G for differentiating adults with IGD from regular gamers (without IGD)	CIAS-G	26-item self-report scale to assess participants' online gaming experiences	69 participants with IGD, 69 regular gamers, and 69 healthy participants
Basu et al. [52]	India	To assess IGD using a self-designed scale in conjunction with a screening questionnaire	IGAS	14 items	424 medical students
Irmak et al. [53]	Turkey	To develop a measurement tool based on reporting by family members	GDS-F	18 items that reflect nine diagnostic criteria indicated in Section III of the DSM-5.	173 adolescents from 5th grade to 12th grade, were included in the study
Kim et al. [54]	Korea	To validate the K-MOGQ and to examine the incremental validity of the K-MOGQ beyond the personality variables implicated in IGD	K-MOGQ	27 items that measure motives for online gaming	641 Korean online game users
Wu et al. [55]	China	To empirically evaluate the psychometric properties of the C-MOGQ	C-MOGQ	27 items that measure motives for online gaming	383 Chinese adult online gamers
Yu et al. [56]	China	To investigate the psychometric properties of the Chinese version of the IGCS among adolescents	C-RIGCS	24 items	755 students from junior middle schools
Hawi et al. [57]	Lebanon	To develop and validate an instrument to assess children's overall addiction to digital devices (including video gaming, social media and texting).	DASC	25-item self-report instrument that was developed based on nine diagnostic DSM-5 IGD criteria and also mapped onto Griffiths six core addiction criteria	822 participants from 4th grade to 7th grade
Sarda et al. [58]	France	To assess the reliability and factor structure of the IGD scale, and to provide the cross-validity and criterion validity of this measure.	IGD scale	9 items proposed by Petry et al. referring to their behavior during the last year	693 players
Koo et al. [59]	Korea	To develop and validate the SCI-IGD in adolescents	SCI-IGD	12 items	236 adolescents from both community and clinical settings
Sprong et al. [60]	USA	To compare the DSM-5 validated assessment criteria of the IGD-20 with the primary reinforcing behavioral functions evaluated by the VGFA-R.	IGD-20 and VGFA-R	IGD-20: 20-item scale based on IGD items in DSM-5	304 participants

Table 1 (*continued*)

Authors	Country	Aim	Instrument	Instrument information	Sample
				VGFA-R: 24-item Likert-style scale designed to assess four functions that maintain video game play	
Stavropoulos et al. [61]	Australia, The USA, and The UK	To examine the IGDS9-SF measurement invariance across gamers from Australia, the USA, and the UK	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	171 Australian gamers, 463 American gamers, and 281 British gamers
Pontes et al. [62]	The USA, India, and The UK	To examine the IGDS9-SF measurement invariance across gamers from the USA, India, and the UK	IGDS9-SF	9-item scale assessing severity of IGD based on IGD items in DSM-5	1013 gamers from the USA (n = 405), India (n = 336), and the UK (n = 272)
Yılmaz et al. [63]	Turkey	To develop a valid and reliable Video Game Addiction Scale for Children	VASC	21 items	780 children
Jo et al. [64]	Korea	To develop an IGD screening tool for adolescents to be used in various primary care settings.	IGUESS	9 items	121 adolescents recruited from a public school, community-based resources for mental health, a private counseling center, and a psychiatry clinic
Ryu et al. [65]	Korea	To examine the psychometric properties of the DIA in Korean adolescents	DIA	10 items based on the DSM-5 IGD diagnostic criteria	103 adolescents
Besser et al. [66]	Germany	To develop an optimized short screening for problematic Internet use and Internet addiction	CIUS	5 items	3,040 participants
Gmel et al. [67]	Switzerland	To develop a short form of the CIUS	CIUS short form	8 items	learning (n = 1,371) and validation samples (n = 1,550)
Schluter et al. [68]	Canada	To develop a brief self-attribution Screener for Substance and Behavioral Addictions	SSBA	4 items	6,000 adults
Leung et al. [69]	Hong Kong and Taiwan	To investigate whether the BSMAS, SABAS and IGDS-SF9 were appropriate for their use in heterogeneous subsamples from Hong Kong and Taiwan	BSMAS, SABAS, and IGDS-SF9	BSMAS: 6 items to assess social media addiction. SABAS: 6 items to assess smartphone use addiction. IGDS-SF9: 9-item scale assessing severity of IGD based on IGD items in DSM-5	University students from Hong Kong (n = 306) and Taiwan (n = 336)
Chen et al. [70]	Hong Kong and Taiwan	To examine the time invariance of the SABAS, BSMAS, and IGDS-SF9 for Chinese university students, and to evaluate the reproducibility, including relative and absolute reliabilities, of the three instruments across three months	BSMAS, SABAS, and IGDS-SF9	BSMAS: 6 items to assess social media addiction. SABAS: 6 items to assess smartphone use addiction. IGDS-SF9: 9-item scale assessing severity of IGD based on IGD items in DSM-5	640 university students (304 from Hong Kong and 336 from Taiwan)
Wang et al. [71]	34 countries	To evaluate and compare the psychometric properties of the GDT and IGDS9-SF	GDT and IGDS9-SF	GDT: 4-item scale based on the ICD-11 framework. IGDS9-SF: 9-item scale assessing severity of IGD based on IGD items in DSM-5	544 adult gamers

IGD: Internet gaming disorder; IGD-20 Test: Internet Gaming Disorder Test; DSM-5: Diagnostic and Statistical Manual of Mental Disorders- Fifth Edition; IGDT-10: Internet Gaming Disorder Test; IGDS9-SF: Internet Gaming Disorder Scale – Short Form; K-IGDS9-SF: Korean version of the Internet Gaming Disorder Scale—Short Form; IGDSs: Internet Gaming Disorder scales; C-IGDS: Chinese Internet Gaming Disorder Scale; IGDS-SF-T-L: Internet Gaming Disorder Scale with Likert Scale; ADHD: Attention-deficit/hyperactivity disorder; C-VAT 2.0: Clinical Video game Addiction Test; GAS: 7-item Gaming Addiction Scale; C-IGDC: Chinese Internet Gaming Disorder Checklist; C-IGDC: Chinese Internet Gaming Disorder Checklist; IPQ-R: Revised Illness Perception Questionnaire; GAMES test: GAMing Engagement Screener test; DISCA: DSM-5 IGD Symptoms Checklist for Adolescents; CIAS-G: Chen Internet Addiction Scale-Gaming Version; IGAS: Internet gaming addiction scale; GDS-F: Gaming Disorder Scale-Family Form; K-MOGQ: Korean version of the Motives for Online Gaming Questionnaire; C-MOGQ: Chinese version of the Motives for Online Gaming Questionnaire; C-RIGCS: Chinese version of Revised Internet gaming cognition scale; DASC: Digital Addiction Scale for Children; SCI-IGD: Structured Clinical Interview for Internet Gaming Disorder; VGFA-R: Video Game Functional Assessment-Revised; BSMAS: Bergen Social Media Addiction Scale; SABAS: Smartphone Application-Based Addiction Scale; GDT: Gaming Disorder Test; ICD-11: International Classification of Disease, Eleventh Revision; VASC: Videogame Addiction Scale for Children; IGUESS: Internet Game Use-Elicited Symptom Screen; DIA: Diagnostic Interview for Internet Addiction; CIUS: Compulsive Internet Use Scale; SSBA: Screener for Substance and Behavioural Addictions.

However, differences have been observed in individuals with IGD in terms of personality traits and dysfunctionality, establishing two clusters. The first one is characterized by greater introversion, inhibition, borderline tendency traits and lower histrionic traits in comparison to the second cluster which is characterized by less comorbidity and higher functionality [91]. In addition, when comparing individuals with IGD to those with gambling disorder, the former appear to exhibit lower novelty seeking and persistence traits [92].

Regarding impulsivity, a recent systematic review on probability discounting found that individuals with IGD had a greater tendency, compared to controls, to overestimate the potential gains associated with the consequences of their decisions, especially if these potential gains were not substantial [93]. They also showed a higher tendency to take risks in probabilistic gains. It has also been suggested that subjects with IGD present deficits in decision-making and inhibitory control, aspects that could be associated with brain alterations [94–98]. In this vein, Kräplin et al. [99] highlighted that this impulsive decision-making could be a consequence of IGD, rather than a predictor, due to altered reward learning.

3.2.2. Emotion regulation and emotional intelligence

Another aspect that has been studied in recent years is the role of

emotions in - IGD. Specifically, both emotion regulation [100–103] and emotional intelligence [104–106] have been explored. On the one hand, an association has been observed between IGD and impaired emotion regulation, which could exacerbate the negative mood symptoms of young adults with IGD [100,101]. On the other hand, emotional intelligence seems to have a protective effect on the development of IGD [105], and its different dimensions may have different roles in this disorder [104].

3.2.3. Co-occurring symptomatology/disorders

In the last 5 years, the association between IGD and other co-occurring psychopathologies has begun to be studied in depth [107–112], especially since it may increase the severity of the disorder and worsen the treatment outcome. More specifically, the association between IGD and ADHD [113–121], depression [106,122–130], suicidal ideation [131], substance use [132–134], problematic social media use [135,136], sleep problems [135,137,138], autistic traits [103,121,139], anxiety [106,130,140–142], stress [143,144], and posttraumatic stress symptoms [145] has been explored.

The high levels of comorbidity observed in the clinical populations with IGD have been questioned by experts who consider that there is not enough empirical evidence to consider IGD as a mental disorder. They claim that the high levels of comorbidity could reflect that gaming behavior is used as a coping strategy associated with underlying problems that have a different nature [146,147].

3.3. Psychosocial factors

The role of the family in the development and maintenance of problem gaming and IGD seems to be essential [148] and it has been studied from different perspectives: (i) parent status; (ii) the parent-child relationship; (iii) parental influence on gaming behavior; and (iv) family environment [149].

Regarding parental status, factors such as socioeconomic status and parental mental health have been studied, highlighting, for example, an association between IGD and parental anxiety [150]. The parent-child relationship has been the most studied factor, and it has been suggested that those individuals with IGD present greater family conflicts and a poorer family relationship [151], which have even been associated with the severity of the disorder [152]. In addition, over-protection and rejection by parents could also have a negative influence on IGD [153]. Regarding parental influence on gaming, it has been observed that IGD symptomatology may elicit ineffective Internet-specific parental responses that could exacerbate the disorder [154].

4. Policy and prevention

Before considering the proposed policy and prevention plans for IGD, it is worth considering the main harms associated with IGD. Although, compared to other addictive disorders, such as gambling disorder, IGD has relatively low economic costs associated. There is another potential harm. Some common examples associated with extreme gaming time are disturbances in basic activities (such as sleep patterns and fatigue, eating patterns and hygiene), social disturbances and isolation, and neglect of daily responsibilities, as well as physical pain due to poor posture [162].

The main IGD policies applied by the majority of Asian countries have been categorized, in a recent systematic review, into three main blocks: (a) those that limit the availability of games; (b) those that reduce risk and harm, and (c) those that aim to support gamers [163].

In order to limit the availability of games, different policies have been implemented: (i) the shutdown system, in which governments select a time slot and force game service providers to block access to online games during that period of time, for example between 10 p.m. and 6 a.m., as in the case of Thailand; (ii) the fatigue system, in which online game providers have to monitor the playtime of their consumers and discourage minors from playing for long periods of time by reducing

the experience points (XPs) needed to advance in the game associated with the playing time; (iii) parental controls that include content filters, time limits and monitoring the online activity; (iv) limiting gaming time in Internet cafés, for example between 2 p.m. and 8 p.m., as in Thailand; and (v) increasing the price of video games, although this is only a hypothetical measure suggested by the authors, which has not been implemented yet [163].

To reduce risk and harm, some gaming companies are currently implementing warning messages. However, the authors suggest that other potential measures would be to use rating systems for rating games taking into account their addictive potential, as well as to design games that are less addictive or less exploitative of gamers' time [163].

Finally, there are policies to support gamers who develop IGD, although it is not entirely clear which institutions should provide such assistance, whether they should be gaming companies, the government or private institutions [163].

King et al. [164] establish another classification of prevention strategies: (a) universal prevention; (b) selective prevention; and (c) indicated interventions.

Universal prevention may encompass: (i) educational resources that provide gamers with information on healthy levels of use, recommendations on physical activity and promotion of more adaptive activities; (ii) legislative action, such as shutdowns of online gaming services during certain time slots of the day; (iii) technological measures, such as parental controls or notifications for excessive gaming time; (iv) public awareness, such as the stipulation of national days and campaigns that encourage non-use of the Internet; and (v) behavioral measures, such as using the devices in common areas of the home or reducing the number of owned devices [164].

Selective prevention focuses on those subjects who are more vulnerable to IGD, and would consist of: (i) regular screening, for example in schools and universities, in order to identify emerging cases; (ii) mental health checks with medical practitioners to detect possible risk factors; (iii) school-based educational programs, in which healthy patterns of Internet use and gaming are taught; and (iv) workplace Internet policies, with regulations on Internet access [164].

Finally, indicated interventions would be intended for those individuals with IGD, including: (i) support and community groups; (ii) outpatient medical and mental health services; (iii) psychosocial rehabilitation, focused on socialization; and (iv) psychoeducation on strategies to minimize the harm of IGD [164].

Gentile [165] also highlights four central ways in which parents can monitor their children's gaming behavior and, consequently, prevent the development of IGD: (i) co-viewing or co-playing with children or adolescents; (ii) setting restrictions on the amount of time spent on gaming behavior; (iii) setting restrictions on content; and (iv) conducting active mediation with children where perspectives on, for example, the effects of video games are discussed.

As highlighted by Petry et al. [166], at a global level, industries that benefit from products that bring with them harmful consequences, in this case the gaming industry, present a clear conflict of interest when promoting primary, secondary and tertiary prevention strategies, making government regulations and taxation strategies essential. Moreover, the efficacy of all these regulations, as well as their possible side effects, should be systematically tested [167]. However, as Kuss [168] points out, it should be kept in mind that not all prevention policies and plans that are effective in a specific region or cultural context work in other cultures, since the degree of acceptability of these strategies is subject to cross-cultural differences.

4.1. Prevention during COVID-19 pandemic

Video games may have had a positive effect during the lock-downs resulting from the COVID-19 pandemic, as they helped to promote social distancing, socialization and stress reduction, among other factors [169]. However, for the most vulnerable individuals, this increased use

of video games may lead to the possible development of IGD. To this end, different prevention options for adolescents have been proposed during the pandemic [170]: (i) promotion by schools of avenues for interaction among students when schools are closed due to lockdowns; (ii) monitoring by parents of gaming patterns (e.g. (iii) promotion of home activities, such as table games or physical exercise at home; (iv) promotion of educational video games instead of mainstream video games; and (v) promotion by clinicians of emotional support and coping strategies to better address the pandemic.

5. IGD treatment

In addition to efforts to prevent problems associated with gaming behavior, attempts to treat IGD have been increasing worldwide, and especially in East Asia, despite the fact that there is still no complete consensus on the definition and assessment of this psychiatric entity [171]. Currently, studies of psychotherapy for IGD outnumber those involving pharmacological approaches 3 to 1 [172].

5.1. Pharmacotherapy

Zajac et al. [173], in their systematic review, found that 5 of the 13 studies focused on treatment for IGD evaluated the efficacy of pharmacotherapy. Zajac et al. [174], included 7 pharmacotherapy studies in another systematic review. The most commonly used drugs for the pharmacological approach to IGD were those psychotropic drugs that are also used to treat ADHD (methylphenidate and atomoxetine) and depressive symptomatology (bupropion and escitalopram). Although it has been suggested that these drugs may be effective in reducing the gaming time and IGD symptomatology and severity, even correlating with a reduction in impulsivity levels [175,176], more empirical evidence is needed to draw more solid conclusions.

5.2. Psychotherapy

5.2.1. Cognitive behavioral therapy

A recent systematic review found 4 studies evaluating the effect of cognitive behavioral therapy (CBT) on IGD [173]. It has been suggested that CBT has an impact on the reduction of weekly gaming hours and IGD symptomatology. King et al. [171] also found in their systematic review that CBT was the psychological intervention with the most empirical evidence. However, the authors noted that one of the central limitations of these studies was that they were ambiguous in explaining the content covered in the various treatment sessions. In addition, Zajac et al. [174] reported in their systematic review that, although the treatments employed focused on CBT principles, the specific type of CBT varied, with studies including standard CBT, and others employing craving-focused CBT, gaming-specific CBT, or CBT with mindfulness strategies.

The meta-analysis of Stevens et al. [177] included 12 studies focusing on CBT for patients with IGD, most of them conducted in Asia. The authors found a significant reduction in IGD and depressive symptomatology at post-test. However, it was not possible to determine the efficacy of CBT in reducing the time spent gaming. In addition, Han et al. [178] suggested that CBT may also have an effect in reducing anxious symptomatology comorbid to IGD, as well as impulsivity levels and social avoidance. However, although CBT appears to be a promising intervention for this disorder, more evidence is needed.

In this vein, Young & Brand [179] propose the possible use of CBT for Internet addiction (CBT-IA) for IGD. This intervention, initially developed for Internet addiction, would be used by linking different elements, such as maladaptive cognitions, to online games. The intervention consists of three stages: behavioral modification, cognitive restructuring and harm reduction.

5.2.2. Other approaches

New alternative approaches to standard CBT have emerged in recent years, possibly with the aim of reducing dropout rates, as well as making the interventions more attractive to the target of IGD patients, who are mostly adolescents [180]. According to Wendt et al. [181], these interventions for adolescents with IGD should, in addition to addressing elements of CBT (e.g., reduction of gaming times), generate a structured, adaptive and supportive therapeutic environment.

Four studies were included in the systematic review by Zajac et al. [173] analyzing other approaches to IGD. Family therapy, eclectic psychotherapy (including cognitive behavioral therapy strategies, family therapy, solution-focused therapy and motivational interviewing), the self-discovery camp for adolescents (composed of cognitive behavioral therapy sessions and personal counseling, among others) and a writing and speaking course were tested in these studies. The studies reported a decrease in gaming time and parent-reported IGD symptomatology.

Multidimensional family therapy and family therapy as usual, whose effectiveness has been previously tested in other disorders, appear to be a promising option for treating IGD in adolescents [182,183]. This intervention focuses on the role of the family in both the development and management of adolescent disorders. Kim & Noh [184] highlight that family-based interventions are effective in reducing both online game playing time and the severity of IGD.

Other manualized treatment programs have been proposed to address IGD, such as OMPRIS and PIPATIC. On the one hand, OMPRIS combines motivational interviews, elements from CBT, social counseling, media education and Internet-related addiction therapy [185]. On the other hand, PIPATIC is an intervention for adolescents between 12 and 18 years of age consisting of six modules (psychoeducational, treatment as usual, intrapersonal, interpersonal, family intervention, and development of a new lifestyle) aimed at reducing IGD symptomatology [186]. PIPATIC has been shown to be effective for both IGD and comorbid symptomatology, as well as for the improvement of family and interpersonal relationships [187]. Another example is the use of equine-assisted activities and therapies, which have been suggested to have a direct impact on the attachment of adolescents with IGD and insecure attachment issues, which would consequently reduce the severity of IGD symptomatology [188].

The therapeutic residential camp (self-discovery camp) is an intensive treatment for adolescents with IGD developed in South Korea that includes a combination of different therapies, such as CBT, psychoeducation, medical lectures, personal counseling and workshops. This intervention has shown improvements in total gaming time, as well as in problem recognition and self-efficacy towards positive change [189].

Mindfulness has also been proposed as an approach to IGD, showing reductions in maladaptive cognitions associated with gaming behavior which, in turn, appear to have an effect on reducing IGD severity and craving [190,191].

Finally, other approaches have been considered, such as transcranial direct current stimulation [192,193], high-frequency repetitive transcranial magnetic stimulation [194] or virtual reality therapy [180], although their efficacy has not yet been explored in depth.

5.3. Challenges of treatment studies

King et al. [171] highlighted, after their CONSORT evaluation, that there are still unresolved issues and limitations regarding the different treatments proposed for IGD, such as: (1) the optimal duration of the intervention; (2) the differences in efficacy between group and individual format; (3) the lack of control groups; (4) the inconsistencies regarding the assessment of treatment outcome; and (5) the lack of follow-up.

6. Limitations and future studies

The main limitation in the study of IGD is the lack of a consensual theoretical model and, consequently, the lack of diagnostic criteria and cut-off points whose validity has been tested. Therefore, future studies, especially longitudinal studies, as well as international multicenter collaborations, should deepen the clinical validity of the current classification systems and possible consensus cut-off points, as well as the selection of an adequate psychometric instrument that allows the comparison of results between studies. To remedy the lack of literature focused on this disorder, different authors have proposed the following [195–198]:

1) To explore the risk factors for the development of IGD in depth (especially genetic, social, and personality factors), and its impact on quality of life and health. Moreover, to identify possible biomarkers in order to improve detection and intervention.
2) Although there is some research on how different genres of games (from strategic simulation games to arcade games) have differing levels of addictive potential, it is essential to continue to explore the new video games that are constantly being developed and which ones include structural characteristics with greater addictive potential.
3) To carry out more studies focused on the clinical population, instead of the general population.
4) To design assessment instruments that are age and culturally appropriate in order to explore the disorder contemplating these essential factors.
5) To focus on the comorbidities of IGD in order to discover whether it is a separate entity or a symptom of other psychiatric conditions, such as ADHD, depression or anxiety.
6) To develop longitudinal studies, especially randomized controlled trials, in order to deepen the clinical course of the disorder to know, for example, whether it is a continuous or intermittent pathology, or how long it takes to develop, and to study the effectiveness of different therapeutic approaches.

7. Conclusions

Understanding the precise conceptualization of IGD has important implications for its assessment, prevention and treatment. Therefore, these findings support the need to increase the evidence focused on this disorder in order to reach a scientific consensus about the most effective theoretical model, psychometric instrument and treatment plan.

Conflicts of interest

F.F.-A. received consultancy honoraria from Novo Nordisk and editorial honoraria as EIC from Wiley. The rest of the authors declare no conflict of interest. The funders had no role in the design of the study; the collection, analyses, or interpretation of data; the writing of the manuscript, or the decision to publish the results.

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