Gaming Disorder Among Children and Adolescents

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1 Background

Research examining problematic video game playing dates back to the early 1980s when the first reports started appearing concerning adolescents being 'obsessed' with or 'addicted' to the playing of arcade video games such as *Space Invaders* [1]. The playing of video games (i.e., 'gaming') has evolved during this time from playing video games in amusement arcades in the 1980s to playing video games on dedicated gaming consoles and personal computers in the 1990s, to playing video games online in the 2000s [1]. More recently, technology has advanced so that gaming can be engaged from almost anywhere through smartphones and Wi-Fi-enabled mobile handheld devices, as well as in virtual reality [2]. Historically, gaming has traditionally been an activity predominantly engaged in by children and adolescents, but gaming has now become a popular activity among adults [1]. However, children and adolescents, appear to be a vulnerable group when it comes to experiencing the negative consequences of gaming excessively which can adversely affect their educational performance, mental health, and/or personal relationships [1]. Consequently, this has become an important issue of concern for many different stakeholder groups (e.g., parents, teachers, treatment providers, healthcare practitioners, policymakers, government bodies, and the gaming industry).

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Despite the many positives of gaming, a small minority of individuals appear to engage in gaming to such an extent that it disrupts and compromises many areas of their everyday lives. Therefore, problematic gaming has become a topic of increasing research interest. However, there are multiple debates about terminology, with many terms being used interchangeably in the extant literature (e.g., 'excessive', 'problematic', 'disordered', 'dependent', 'compulsive', 'addictive', and 'pathological') [1]. For the sake of consistency, the present review uses the term 'disorder(ed)', given that this is the term used in psychiatric diagnostic manuals.

This marked increase in research from many different perspectives (e.g., epidemiological, clinical, developmental, neurobiological, etc.), led the American Psychiatric Association (APA) to introduce 'internet gaming disorder' (IGD) as a tentative disorder in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) in 2013 [3]. The APA describes IGD as a behavioral addiction like gambling disorder, defining it as *'persistent and recurrent use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress'* (p. 795) [3]. More recently, the World Health Organization (WHO) included 'gaming disorder' (GD) as a formal diagnosis in the 11th revision of the International Classification of Diseases (ICD-11) in 2019 [4]. The criteria for both of these are shown in Table 1.

2 Current State of Knowledge

2.1 Prevalence of Gaming Disorder

In the past three decades, many studies have attempted to determine the prevalence of disordered gaming. However, given the existing various definitions, screening instruments, and/or self-selected samples used, there has been a varied number of prevalence estimates across studies. To date, three meta-analyses have been published. Fam [5] examined the prevalence estimates of IGD among adolescents in 28 studies ($N = 61,737$; 20 studies in Europe, four in Australia; two in Asia, and one in North America). There was wide variability in prevalence rates (0.5–19.9%) with a pooled prevalence rate of 4.6% of GD among adolescents (with male adolescents having higher GD prevalence rates [6.8%] than female adolescents [1.3%]). A meta-analysis by Stevens et al. [6] comprised 53 studies ($N = 226,247$; 17 coun-

Table 1 Definitions and criteria for internet gaming disorder and gaming disorder as proposed in the DSM-5-TR and ICD-11 (DSM-5-TR: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; ICD-11: International Classification of Diseases 11th Revision)

	DSM-5-TR Internet Gaming Disorder	ICD-11 Gaming Disorder
Definition	'Persistent and recurrent use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress'. (Also includes non-internet computerized games as well as internet games)'.	'The behavior pattern is of sufficient severity to result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning'.
Criteria endorsement and duration of the condition	An individual should endorse five (or more) out of nine criteria over a 12-month period.	An individual should endorse all the criteria over a 12-month period or more, although the required duration may be shortened if all diagnostic requirements are met, and symptoms are severe.

(continued)

Table 1 (continued)

	DSM-5-TR Internet Gaming Disorder	ICD-11 Gaming Disorder
Criteria	Being excessively preoccupied with gaming	Impaired control over gaming
	Having withdrawal symptoms when not gaming	Elevated priority given to gaming
	Spending more and more time gaming	Increased time spent on gaming despite problems
	Failed attempts to reduce or quit gaming	
	Losing interest in hobbies due to gaming	
	Engaging in gaming despite its adverse consequences	
	Deceiving others about gaming duration	
	Achieving a positive mood by gaming	
	Risking, jeopardizing, or losing a job or relationship because of gaming	

tries). The prevalence of GD was 3.05% but lower in high-quality studies (1.96%). Males had a higher GD prevalence rate (6.31%) than females (2.54%). The most recent meta-analysis by Kim et al. [7] comprised 61 studies (N = 227,665; 29 countries). The prevalence rate of GD was 3.3% but lower when only including data from 28 representative samples (2.4%). Males had a higher GD prevalence rate (8.5%) than females (3.5%). The study also estimated prevalence rates for six different age categories. The pooled prevalence rates were 6.6% for children and adolescents (based on five studies), 6.3% for adolescents and young adults (five studies), 3.4% for young adults (nine studies), 3.3% for adolescents (38 studies), 1.9% for all adults (six studies), and 1.3% for adolescents and adults (five studies). All three of the meta-analyses reported high heterogeneity in their reported GD prevalence rates. These were influenced by both methodological variables (e.g., screening instrument used, terminology regarding problematic gaming use, study design, type of sample surveyed, type of sampling method used) and participant variables (e.g., sample size, country/region of participants, age of participants).

2.2 Etiology of Gaming Disorder

One of the key topics in the GD field is etiology. A recent comprehensive review of the etiology of GD [8] outlined the three overarching interacting factors that are involved in the acquisition, development, and maintenance of GD. These are the: (i) individual factors (i.e., person-based characteristics such as genetic/biological predispositions, personality factors, motivations for playing, etc.), (ii) gaming-related factors (e.g., structural characteristics of the video games themselves, the medium in which the video games are played), and (iii) environmental factors (i.e., the situational characteristics such as peer, family, and cultural influences in video game playing) [8].

2.3 Individual Factors

Individual factors that play a contributory role in the etiology of GD (among others) include genetic/biological predispositions, personality traits, demographic risk factors, motivations, and comorbid psychopathologies. The neural mechanisms associated with GD appear to resemble those of other addictions [9]. The cognitive-

affective alterations found in GD include impaired executive functioning, impaired emotional regulation, impaired decision-making, and impulsivity related to different functioning in prefrontal areas and the front-limbic, temporoparietal, and subcortical regions [10], as well structural changes in several brain regions including altered white-matter density and reduced grey matter volume (controlling emotional regulation, cognitive/motor control, decision-making, and behavioral inhibition). Studies have also indicated that compared to controls, those with GD show activation in the (i) orbitofrontal cortex (indicating a lower level of punishment sensitivity), and (ii) dorsolateral prefrontal cortex (associated with a higher level of craving) [11].

Many studies have explored the association between GD and the 'Big Five' personality traits. Two meta-analyses have been published [12, 13]. These have shown a very consistent positive relationship between GD and neuroticism. Given that neurotic individuals are more prone to depression, stress, and anxiety, they may use gaming as an escape because virtual worlds feel (or are perceived as) safer than their real-life personal environments. The meta-analyses also found negative associations with conscientiousness. Given that individuals with low conscientiousness are more careless, impulsive, and disorganized, the finding that they are more likely to experience GD is unsurprising. Another very consistent finding in the literature is the positive relationship between GD and impulsivity. One recent systematic literature review reported a positive relationship between impulsivity in 32 out of 33 studies [14].

As noted in the meta-analyses concerning the prevalence of GD, the literature has consistently shown that males are much more likely to experience GD than females and this also includes children and adolescents. Age also seems to be important, with adolescents and emerging adults being at higher risk of GD than other age cohorts. Various explanations have been provided in the literature from cultural perspectives (e.g., males have both a much greater affinity to, and enjoyment of, playing video games), evolutionary perspectives (e.g., males have a greater inclination towards competition, aggression), and neurobio-

logical perspectives (e.g., males demonstrating higher cue-elicited craving-related neural responses). Other factors have been examined but are less consistent and/or contradictory in findings related to increased risk of GD (e.g., ethnicity, relationship status, employment status, income, educational level, etc.) [8].

In the case of GD, comorbidity tends to be the norm rather than the exception [8]. Research has consistently found a positive association between GD and (i) depression [15], (ii) anxiety [16], (iii) ADHD (hyperactivity and inattention) [8], (iv) comorbid polysubstance use [17], (v) autism [18], and (v) risk for suicidal ideation [8]. However, given that the majority of studies examining these associations with comorbid conditions are cross-sectional, longitudinal research is needed because the directions of the associations are uncertain. However, in many, the associations may well be reciprocal.

2.4 Gaming-Related Factors

To facilitate habitual and rewarding video game playing, game design plays a role in exploiting psychological mechanisms (e.g., operant conditioning) [8]. For vulnerable and susceptible individuals (such as those who experience social anxiety or who have low self-esteem), such design features may facilitate excessive and (and among a minority of individuals) disordered gaming. GD [19]. For instance, although GD has been reported among offline gamers, it is much more prevalent among online gamers [8]. Among adolescents who are socially anxious and/or who have poor social skills, online gaming environments can help meet their social needs if they find face-to-face interactions anxiety-inducing.

The genre of video games may also contribute to GD. For instance, research has consistently found that massively multiplayer online role-playing games (MMORPGs) are most associated with GD. Other genres have been associated with GD including multiplayer online battle arena (MOBA) games, real-time strategy (RTS) games, and shooter games (both first-person and third-person [8]. These types of video game tend to be

far more immersive than other video game genres and appear to be an important factor in the maintenance of GD.

The structural characteristics of the video games themselves may also contribute to GD. Given that virtual in-game rewards can result in the release of dopamine [8], such features are critical in reinforcement and game continuance [8, 20]. The unpredictability of when a reward will occur, particularly in video games such as MMORPGs, can result in individuals playing for hours and hours in single gaming sessions. Game designers can exploit the principles of operant conditioning and players can find themselves locked into variable-ratio reinforcement schedules, which result in habitual gaming patterns. Players designing their in-game avatars can create extensions of themselves which may be psychologically rewarding and/or act as a compensatory mechanism for those with low body satisfaction to overcome their social anxiety, and thus boost their self-esteem [21]. Complimenting this, GD has been shown to increase when gamers experience their avatars as themselves (i.e., identification), their avatar's needs as their own (often prioritized to their offline needs [immersion]), their avatar being able to behave in ways that they cannot in their real lives (i.e., repression), and their avatar as the person/character they would like to have been (i.e., idealization) [19].

Research in media psychology-inspired concepts further reinforces the significance of structural game features for GD [19, 21]. These refer to the extent gamers are absorbed by (i) the virtual world, experiencing the latter as real (i.e., as if they were there [presence/telepresence]) [19] and (ii) their in-game activity, due to the gradual increase of in-game challenges, at a rate that matches the increase of the player's in-game skills. For gamers to be challenged and completely engaged with their in-game action, these challenges need to slightly exceed their current skill level. If game demands are significantly higher than players' skills, gamers become distressed and disengage. Similarly, if players' demands are significantly lower than their skills, they will experience boredom and disengage. As players keep engaging with the game, their skills concurrently increase, requiring the game developer to increase the level of game challenges at a similar pace (i.e., level-up process) to maintain sustained game content consumption and process/state ('flow') [19].

Finally, the past few years have seen the introduction of arguably 'predatory' monetization techniques by the gaming industry in the form of micro-transactions (e.g., loot boxes where players spend real money to open virtual crates or boxes to win something that might help them in the progression of the games). A number of scholars have noted the similarities between loot boxes and gambling. Given that loot boxes are available to minors, it has raised concerns that loot-box buying may be a 'gateway' to gambling [8, 22]. Based on the empirical research to date, there appears to be a consensus that loot-box buying and expenditure are indeed associated with both problematic gaming and problematic gambling among adolescents and adults [8, 23].

2.5 Environmental Factors

Excluding cultural factors (which are beyond the remit of this chapter), research has consistently shown that early life experiences (e.g., familial relationships) can be risk factors for acquiring GD. Systematic reviews examining family factors associated with GD among adolescents have consistently shown that specific factors in relationship quality (e.g., single-parent families, family/marital conflicts, poor family functioning, poor parenting styles [neglectful, authoritarian, permissive], childhood maltreatment, violent disciplining, etc.) are positively associated with GD severity [24, 25]. Other environmental factors that have been associated with adolescent GD include having difficulty in making friends and having low levels of school-related well-being [8, 26].

3 Future Research

Despite the marked increase in research examining GD in child and adolescent samples and given that the majority of studies have used cross-sectional convenience sampling, further research is needed with large-scale representative samples using longitudinal designs. Also, more cross-cultural comparisons are needed - especially between Southeast Asia and Europe given the large cultural differences in these regions and variances in how parents and policymakers view gaming in the countries within them. Further research is additionally needed from a neurobiological perspective, including whether GD may be influenced by inherited biological and/or genetic factors. There is also a dearth of data concerning clinical samples given the large reliance on community sample data. There also needs to be research into the growing area of esports (i.e., professional gaming) because playing video games professionally can take up lots of time and resources if adolescents have aspirations to have a career in gaming [27].

Research is also needed to help design a taxonomy relevant to current video games and that contributes to identifying which structural characteristics and game mechanics affect the behaviors of the players, especially because some of these characteristics may have age-sensitive effects. The impact of loot-box buying, for example, maybe more detrimental to adolescents than adults. Finally, those in the field could also collaborate with cognate areas (such as the gambling disorder field) and try to acquire datasets from gaming operators, with the goal of identifying online gaming profiles using behavioral tracking data (e.g., using tidy classification algorithms to predict GD risk, based on engagement game mechanics [presence, flow, user-avatar bond]).

4 Recommendations

- One of the limitations in the field of GD field is the lack of screening instruments specifically developed for use within child and adolescent populations. Although there are a few psychometric instruments (e.g., Gaming Addiction Scale for Adolescents [28], Videogame Addiction Scale for Children) [29] most of the screens were developed and validated with adult samples. More recent screens have relied on DSM-5 and ICD-11 criteria, which are arguably designed for adults. Therefore, bespoke age-appropriate screening instruments are vital and needed in terms of both research integrity and best clinical practices.

- As with other consumptive products that can cause problems when engaged in excessively (e.g., alcohol, gambling), there should be independent regulators in each country that oversee the video game industry, to ensure that player protection and harm minimization are dedicated core components of their commercial practices and goals.

- Unlike gambling and alcohol use which are adult-only activities, gaming is freely available to children and adolescents, therefore social responsibility initiatives for players need to be introduced in the same way that has happened in the gambling industry (e.g., limit setting, mandatory breaks, real-time personalized feedback, pop-up messaging on-screen, etc.) [30].

- Research, educational awareness (for schools, parents, teachers), prevention programs, and treatment interventions should be funded by the gaming industry.

- Governments could also oblige the gaming industry to share behavioral data for research purposes.

- Countries could introduce a levy where (say) 1% of all profits are donated to an independent body for closely monitored, legitimately, and inclusively distributed funding towards these aforementioned areas and initiatives.

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