Received: 28.11.2023
Accepted: 26.06.2024
Published: 30.04.2025

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Gaming disorder: a narrative review

Zaburzenie związanie z graniem – przegląd narracyjny

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https://doi.org/10.15557/PiPK.2024.0038

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Abstract

Video games, including online ones, constitute very popular interactive entertainment, enjoyed non-problematically by many individuals worldwide. However, uncontrolled gaming and the occurrence of its negative consequences require appropriate diagnosis. Gaming disorder manifests as uncontrolled, persistent, or recurrent behaviour with gaming taking priority, despite its negative impact on personal functioning. Excessive use of the Internet unrelated to gaming, such as excessive use of social media, viewing pornography online, and internet gambling games, is excluded from the concept of disordered gaming. The worldwide prevalence is 3%, rising to 4.6% in adolescents, affecting more males than females. The pathogenesis is heterogeneous, with various psychological contributory factors, such as fascination with an alternative world and self-concept, low self-esteem, impulsivity, dysregulation of the reward system, and escapism. Individuals with reduced dopamine-receptor function are prone to developing disordered gaming, in particular under stressful life events. Imaging studies have demonstrated changes in brain activation, such as hyperactivation of the anterior cingulate cortex, dorsolateral prefrontal cortex, posterior inferior frontal gyrus, caudate, posterior cingulate cortex, and precuneus; in contrast to hypoactivation of the anterior inferior frontal gyrus, posterior insula, and precentral and postcentral gyri. With respect to psychiatric comorbidities, such as attention deficit hyperactivity disorder or major depressive disorder, several drugs have been effective in treating gaming disorder, namely bupropion, escitalopram, fluoxetine, paroxetine, methylphenidate, and atomoxetine. The most effective psychological intervention was cognitive-behavioural therapy. There is a need to conduct further randomised, double-blind studies controlling for comorbid mental disorders and carried out on larger groups of patients.

Keywords: video games, Internet, addiction, mental disorders, dopamine

Streszczenie

Gry wideo, w tym internetowe, stanowią bardzo popularną interaktywną rozrywkę, z której bezproblemowo korzysta wiele osób na całym świecie, jednak nadmierne granie i występowanie jego niekorzystnych konsekwencji wymaga odpowiedniej diagnostyki. Zaburzenie związane z graniem objawia się niekontrolowanym, uporczywym lub nawracającym zachowaniem, w którym priorytetem jest granie, pomimo jego negatywnego wpływu na funkcjonowanie osobiste. Nadmierne korzystanie z internetu niezwiązane z grami, np. nadmierne korzystanie z mediów społecznościowych, oglądanie pornografii w internecie oraz internetowe gry hazardowe, jest wykluczone z koncepcji zaburzenia związanego z graniem. Częstość występowania zaburzenia w skali globalnej wynosi 3%, wśród młodzieży wzrasta do 4,6%; problem częściej dotyczy mężczyzn. Patogeneza zaburzenia jest złożona i uwzględnia wiele czynników psychologicznych, w tym motywację w postaci fascynacji alternatywnym światem i koncepcją siebie, niską samoocenę, impulsywność, zaburzenie systemu nagrody i eskapizm. Osoby z obniżoną aktywnością receptora dopaminowego są podatne na rozwój zaburzenia, szczególnie w stresujących wydarzeniach życiowych. Badania obrazowe wskazują na nadmierną aktywację przedniej części kory obręczy, grzbietowo-bocznej kory przedczołowej, tylnego dolnego zakrętu czołowego, jądra ogoniastego, tylnej kory obręczy i przedklinka, natomiast obniżoną – przedniego dolnego zakrętu czołowego, tylnej części wyspy oraz zakrętów przedśrodkowego i zaśrodkowego. W związku z współwystępowaniem chorób psychicznych, takich jak zespół nadpobudliwości psychoruchowej z deficytem uwagi lub ciężkie zaburzenia depresyjne, w leczeniu zaburzenia związanego z graniem skuteczność wykazywało kilka leków, wśród nich: bupropion, escitalopram, fluoksetyna, paroksetyna, metylofenidat i atomoksetyna. Najczęstszym rodzajem skutecznej

interwencji psychologicznej była terapia poznawczo-behawioralna. Istnieje potrzeba prowadzenia dalszych badań z randomizacją, podwójnym zaślepieniem i kontrolą współistniejących chorób psychicznych, przeprowadzonych na większych liczebnie grupach pacjentów.

Słowa kluczowe: gry wideo, internet, uzależnienie, zaburzenia psychiczne, dopamina

Video games, i.e. digital games or computer games, represent a common form of interactive entertainment in today's society. Since their creation in the 1950s and with the advent of personal computers, laptops, tablets, smartphones, the Internet, and other digital technologies, video games have spread, reaching a wide range of recipients, including children, adolescents, and adults. In video games, the player controls electronically generated images that appear on a video display screen. Technically, the term "video game" has evolved and now encompasses computer games played on computers, console games played on devices designed for gaming, and games for mobile phones and other mobile devices (Chen and Zhu, 2023; Nguyen and Bavelier, 2023).

GLOBAL IMPACTS OF VIDEO GAMES

In 2021, the video game industry was estimated to reach revenues of $193 billion, with 2.9 billion players, i.e. more than one out of three people encountered (Porter et al., 2022). Without a doubt, video gaming, along with the Internet, constitutes a significant component of leisure and entertainment activity (Jo et al., 2019). On the one hand, the use of digital devices is associated with benefits to users and societies, and growing evidence points out how to better use video games as tools to shape cognitive performance. For example, memory games can facilitate the development of cognitive skills, social games can support building cooperation and communication skills, and adventure games can help people confront their fears. However, their excessive use can exert negative health consequences, as with everything, too much of a good thing can lead to problems (Dale et al., 2020).

In 2013, the American Psychiatric Association introduced internet gaming disorder as a new diagnosis to be included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013). Six years later, the 11th edition of the International Classification of Diseases included a diagnosis of gaming disorder, which involves both online and offline gaming (World Health Organization, 2019). Since the stage of proposal, the concept of gaming disorder has encountered adversaries in the debate over whether problematic gaming should be considered as a new disorder (Aarseth et al., 2017). Undoubtedly, gaming is enjoyed non-problematically by millions of individuals worldwide; however, a growing body of evidence proves that problematic gaming exists and that it is an example of disordered gaming (Griffiths et al., 2017).

VIDEO GAME CATEGORIES

Classifying video games into categories, i.e. genres, is useful for systematising their multiplying and expanding diversity. Classification can be based on various game characteristics, such as interactions between the player and the game, mechanics, dynamics, scenarios, narrative structure, and Internet connection. Being familiar with categories of video games may be particularly useful for working with patients suffering from problematic gaming, because it may help, for example, with answering screening questions and understanding different motivations to play. Some types of action games were found to be the most frequently associated with disordered gaming (Na et al., 2017). As the gaming industry continuously evolves, games become more sophisticated and interactive, and may simultaneously fall under several categories, overlap, and share common features with those of other categories (Chen et al., 2018; Choi et al., 2020). A game can be played on stationary devices, such as personal computers and consoles, or on mobile devices, such as tablets, mobile consoles, smartphones, etc. Games can be played online via the Internet in real-time and offline. Regardless of game scenarios and storytelling, and with main respect to interactions between the player and the game, a simple classification of video games distinguishes four popular categories, namely simulation, action, strategy, and traditional video games. Simulation games imitate activities such as flying an aircraft, driving a car, playing football, playing basketball, etc. In action games, the player can see a virtual world from the perspective of game protagonists, in other words avatars, which represent simulated identities in games (Choi et al., 2020). Action games can be played in a first-person or third-person perspective. A subcategory of action games contains role-playing games in which the player can develop and improve their avatar, search for adventures, and explore virtual worlds. Action games also include massive multiplayer online role-playing games characterised by the opportunity to connect with other players in real-time and complete quests, battles, or explore fantasy worlds. In contrast to offline games, the scenarios of multiplayer online games never end and are continuously engaging for players. Another subcategory is the multiplayer online battle arena, in which the player is engaged in combat in cooperation with teammates against a competing team. First-person shooters and massive-multiplayer online role-playing games have been found to be the most often associated with the problem of disordered gaming (Na et al., 2017). Strategy video games require using skills in planning, sometimes directing military activity

 DOI: 10.15557/PiPK.2024.0038

Category	Feature
Simulation games	Simulate activities such as flying an aircraft, driving a car, playing football, playing basketball, etc.
Action games (including role-playing games)	Give opportunity to encounter challenges in a virtual world, sometimes played as massive multiplayer online role-playing games or multiplayer online battle arena
Strategy games	Use planning and resources for strategic purposes
Traditional games	Represent computerised versions of puzzles, board and card games

Tab. 1. Video game categories according to interactions between the player and the game

in a battle or war against computer opponents or online against other players, i.e. in real-time strategy video games where all players are engaged at the same time (Nguyen and Bavelier, 2023). Traditional games are computerised versions of classic puzzles, board games, and card games such as chess, Scrabble, etc. Some of them can be played online in real-time with real players (Choi et al., 2020) (Tab. 1).

PREVALENCE

Computer gaming is a common form of entertainment on all inhabited continents, used by one-third of the human population. It is particularly popular in countries of East Asia, such as China, Japan, and South Korea. Many millions of gamers worldwide play computer games non-problematically; however, the prevalence of disordered gaming is significant (Griffiths et al., 2017). Feng et al. (2017) reported that the average percentage of internet gaming disorder accounted for 4.7%, which is in accordance with the 4.6% pooled prevalence among adolescents revealed in the study by Fam (2018). In the latter, male adolescents were found to be affected at higher rates than females (prevalence rate: 6.8% vs. 1.3%). Regarding gaming disorder, its worldwide prevalence was estimated to be 3.05%, and this rate was reduced to 1.96% when considering only studies that met more stringent sampling criteria (e.g. stratified random sampling) (Stevens et al., 2019). However, the prevalence of internet gaming disorder among Chinese adolescent game players aged 15–25 years was 17% (Liao et al., 2020). Variability in reported prevalences likely results from differences in demographic and cultural factors, methodology, measurements, and sampling. Thus, future epidemiological research needs to apply standardised approaches to reliably diagnose gaming disorder and report more detailed and comparable information on sampling (Stevens et al., 2019).

CLINICAL FEATURES

From a clinical standpoint, gaming can be conceptualised on a continuum ranging from non-problematic occasional or even sometimes regular gaming at one end of the scale, through hazardous gaming, to disordered gaming at the other (Griffiths et al., 2017). Hazardous gaming is considered a distinct construct from disordered gaming, and its diagnostic threshold is lower than that for disordered gaming (Kewitz et al., 2023).

Diagnostic and Statistical Manual of Mental Disorders, fifth edition; American Psychiatric Association	International Classification of Diseases, eleventh edition; World Health Organization
At least 5 out of 9 criteria must be fulfilled	All criteria must be fulfilled
1. Preoccupation with Internet games 2. Withdrawal symptoms 3. Tolerance 4. Unsuccessful control 5. Loss of interests 6. Continued excessive use 7. Deceived others 8. Used to escape or relieve a negative mood 9. Jeopardised or lost a significant relationship, job, or educational or career opportunity	1. Impaired control over gaming 2. Increasing priority given to gaming 3. Continuation or escalation of gaming despite the occurrence of negative consequences
and must be associated with: • persistent or recurrent course over a period of at least 12 months (according to ICD-11 the required duration may be shortened if all diagnostic requirements are met and symptoms are severe) • resultant significant interference with personal functioning (and/or distress according to DSM-5)	

Tab. 2. Diagnostic criteria for disordered gaming online or offline

A diagnostic framework for internet gaming disorder proposed by the American Psychiatric Association in the Diagnostic and Statistical Manual of Mental Disorders; 5th edition, contains nine diagnostic criteria (American Psychiatric Association, 2013). Excessive use of the Internet not involving playing games, e.g. excessive use of social media, viewing pornography online, and internet gambling games, is excluded from the definition of disordered gaming. Despite its name, internet gaming disorder may also involve offline computer games. At least five criteria must be met over a period of at least 12 months to diagnose internet gaming disorder (Tab. 2).

Preoccupation refers to the state of being engrossed with Internet gaming, which becomes the dominant activity in daily life. Withdrawal symptoms include irritability, anxiety, or sadness that follow the abrupt discontinuation of gaming. Tolerance refers to the need to spend increasing amounts of time gaming. Withdrawal and tolerance represent responses that occur during the process of adapting neurons when addictive behaviour is continued. The fourth criterion – loss of control – indicates unsuccessful attempts to control the gaming behaviour. The next criterion is loss of interests in previous hobbies and entertainment as a consequence of gaming. The sixth criterion is the continued, uncontrolled, excessive use of gaming despite awareness of resultant psychosocial problems. The seventh criterion is deceiving family members or others as a consequence of gaming. The eight criterion is using Internet games to escape or relieve a negative mood, such as feelings of helplessness, guilt, or anxiety. The final criterion is jeopardising or losing a significant relationship, job, or educational or career opportunity as

DOI: 10.15557/PiPK.2024.0038

a result of Internet gaming. The concept of internet gaming disorder emphasises similarities to substance addictions, including aspects of tolerance, withdrawal, repeated unsuccessful attempts to control or quit gaming, and impairment in normal functioning of the players (American Psychiatric Association, 2013).

A diagnostic approach proposed by the ICD-11 comprises three criteria, all of which must be met within a period of at least 12 months to diagnose gaming disorder. However, the required duration may be shortened if all diagnostic requirements are fulfilled and symptoms are severe. A pattern of gaming behaviour can be recurrent or persistent, either online or offline. Contrary to DSM-5, biological aspects such as withdrawal and tolerance has been excluded from the ICD-11 criteria. In accordance with DSM-5 the concept of gaming disorder arises from recognised interference or, in extreme cases, impairment of functioning in personal, family, social, educational, or occupational areas. The first criterion is impaired control over gaming, regarding onset, frequency, intensity, duration, termination, and context, which is analogous to the fourth criterion of DSM-5. The second criterion is an increasing priority given to gaming, to the extent that gaming takes precedence over other life interests and daily activities, which is similar to the first criterion of DSM-5. The third criterion is the continuation or escalation of gaming despite negative consequences, which corresponds to the sixth criterion of DSM-5 (World Health Organization, 2019).

Both internet gaming disorder and gaming disorder share some core features, namely preoccupation/priority assigned to gaming behaviour, loss of control, continued excessive gaming, duration, and resultant negative consequences. An example of the clinical expression of disordered gaming can be regular Internet game use >4 hours/day or >30 hours/week, along with the fulfilment of all diagnostic requirements (Nam et al., 2017). In particular, the occurrence of negative consequences of excessive video gaming, such as significant impairment in personal, family, social, educational, or occupational functioning, requires a diagnostic process to confirm or exclude disordered gaming.

PSYCHOLOGICAL FACTORS IN DISORDERED GAMING

From a psychological standpoint, the pathogenetic mechanisms involved in disordered gaming are heterogenous, and various contributory factors have been proposed, including personality traits, motivations, low self-esteem, impulsivity, dysregulation of the reward system, and escapism. While no consistent personality types are specifically linked to gaming disorder, the study by Liao et al. (2020) found that neuroticism and conscientiousness were associated with internet gaming disorder in Chinese adolescents aged 15–25 years. The study also revealed associations with motives for playing, such as sensation seeking, maintaining, coping, and having one or two long-term game partners (Liao et al., 2020).

In a recent study by Chen and Zhu (2023), not all gaming motivations were found to be risky for developing internet gaming disorder. Such motivations as "enjoying being in the gaming world", signifying fascination with an alternative world and alternative self-concept, were linked with internet gaming disorder. Thus, gaming may serve as an avenue through which adolescents can reduce the discrepancy between their ideal and actual selves, primarily through strong identification with their game avatars (Chen and Zhu, 2023). This corroborates the concept of low self-esteem, where gaming stimulates the experience of power and autonomy, and facilitate escape from real-life problems (Paulus et al., 2018). Another risky motivation in gaming was found to be "preoccupation". In contrast, "daily entertainment", "I am good at it", and "improvement of ability and mindset" were identified as protective motivations. This suggests that the appropriate use of leisure games in adolescents for maintaining positive mental health can be helpful in the prevention of problematic gaming (Chen and Zhu, 2023). Another psychological factor implicated in disordered gaming is impulsivity. It can be defined as the inclination to make quick, impulsive, and unrestrained decisions and actions, regardless of negative consequences (Zhu et al., 2023). One form of impulsivity is linked to the temporal discounting of reward, while the other involves motor or response disinhibition. In line with this, disordered gaming is associated with intuitive decisions rather than deliberative ones, which may explain why gaming is continued despite its negative consequences (Zhu et al., 2023). Another psychological factor in disordered gaming is dysregulation of the reward system, in which a central component is reward-seeking. A cognitive-behavioural model of disordered gaming was proposed by Dong and Potenza (2014). According to this model, motivational drives linked to reward-seeking contribute to internet gaming disorder, and diminished executive function/cognitive control over these motivational drives plays a role in the decision-making that leads to persistent engagement in gaming behaviour. In this manner, gaming behaviour may be perceived as rewarding through feelings of being in control and immediate achievement (Dong and Potenza, 2014). Taking part in gaming to modify negative feelings or relieve stress could be a normal coping behaviour, for example, when someone uses gaming to alleviate stress from daily problems, which, in turn, improves daily functioning. In contrast, when gaming becomes the exclusive or predominant strategy to cope with negative feelings, and when an individual is unable to adopt other strategies, becoming over-reliant on gaming for such purposes, avoiding and escapism can be implicated in the problem (Lee et al., 2017). Avoidant coping refers to handling a problem by attempting to push away the cognitive, emotional, and behavioural aspects of a stressor (Kim et al., 2022). In this context, escapism is closely related to avoidant coping and involving avoiding real-life problems by engaging in online activities. In particular, massive multiplayer online role-playing games provide an opportunity to escape from reality into a digital world (Kim et al., 2022).

NEUROBIOLOGY OF DISORDERED GAMING

Despite progress in research on disordered gaming, the neurobiological mechanisms underlying its pathogenesis remain not fully understood. In an early study by Park et al. (2010), Internet game overusers had increased glucose metabolism in the right middle orbitofrontal gyrus, left caudate nucleus, and right insula. In contrast, they had decreased metabolism in the bilateral postcentral gyrus, left precentral gyrus, and bilateral occipital regions. Gray matter volume in the bilateral anterior cingulate cortex, precuneus, supplementary motor area, superior parietal cortex, left dorsal lateral prefrontal cortex, left insula, and bilateral cerebellum was found to be decreased in patients with internet gaming disorder (Wang et al., 2015). In another study, grey matter density was decreased in the bilateral inferior frontal gyrus, left cingulate gyrus, insula, right precuneus, and right hippocampus (Lin et al., 2015). Compared with recreational game users, patients with internet gaming disorder exhibited decreased cortical thickness in the left lateral orbitofrontal cortex, inferior parietal lobule, bilateral cuneus, precentral gyrus, and right middle temporal gyrus, along with reduced cortical volume in the left superior temporal gyrus and right supramarginal gyrus (Wang et al., 2018). A meta-analysis of functional magnetic resonance imaging studies conducted on patients with internet gaming disorder confirmed hyperactivation of the anterior cingulate cortex, dorsolateral prefrontal cortex, posterior inferior frontal gyrus, caudate, posterior cingulate cortex, and precuneus. In contrast, hypoactivation was observed in the anterior inferior frontal gyrus, posterior insula, and precentral and postcentral gyri (Yao et al., 2017). In addition, Han et al. (2018) found lower resting-state static functional connectivity between the dorsolateral prefrontal cortex and the left Rolandic operculum in patients with internet gaming disorder. A recent study by Hou et al. (2023) revealed significant reductions in synaptic density in the right pregenual anterior cingulate cortex, bilateral putamen, and right Rolandic operculum. However, it is not fully elucidated whether the lower synaptic density represents a cause or a consequence of internet gaming disorder. Further longitudinal investigations measuring synaptic density after a period of gaming abstinence could help determine whether synaptic density increases after gaming withdrawal (Hou et al., 2023).

On the molecular level, deficits related to dopamine transmission are suggested to represent a major factor in the development of gaming disorder. A study by Kim et al. (2011) conducted on individuals with Internet addiction revealed reduced levels of dopamine D_2 receptor availability in subdivisions of the striatum, including the bilateral dorsal caudate and right putamen. Similarly, Tian et al. (2014) confirmed a low level of D_2 receptors in the striatum, which was also associated with decreased glucose metabolism in the orbitofrontal cortex. In a recent study, Kim et al. (2022) investigated the interaction effects of dopamine receptor D_2 (DRD2) polymorphisms [*C957T* (rs6277) and *Taq1* (rs1800497)] and interpersonal stress on problematic gaming, as well as the mediating effect of avoidant coping. When experiencing interpersonal stressors, individuals with both the *C957T* T allele and the *Taq1* A1 allele showed more elevated problematic gaming scores than non-carriers. In addition, the interaction effect of the combined DRD2 polymorphisms and interpersonal stress was significantly mediated by avoidant coping. The T allele of *DRD2 C957T* has been associated with a decreased mRNA translation efficiency of the dopamine receptor D_2, resulting in its impaired function, whereas the A1 allele of *DRD2 Taq1* is likely to affect D_2 receptor availability by decreasing the density of dopamine receptors (Kim et al., 2022). It is suggested that individuals with reduced dopamine-receptor function are more sensitive to stressful situations and tend to cope with stress through gaming, which provides stimulation and pleasure. However, internet gaming disorder likely results from a complex interaction of various receptors and neurotransmitters, as Tian et al. (2014), found that low levels of dopamine D_2 receptors in the striatum significantly correlated with decreased serotonin 5-HT 2A receptors in both the right and left temporal cortices.

PHARMACOTHERAPY

A recent systematic review by Sá et al. (2023) focused on the pharmacotherapy of internet gaming disorder and identified 912 articles; however, only 12 studies were finally included, and only four of them had a low risk of bias. Some studies enrolled patients with internet gaming disorder and other psychiatric comorbidities, such as attention deficit hyperactivity disorder or major depressive disorder. Several drugs were used, namely bupropion, escitalopram, fluoxetine, paroxetine, methylphenidate, and atomoxetine. The included articles reported improvement in terms of reduced symptoms of internet gaming disorder from pre- to post-treatment with pharmacotherapy (Sá et al., 2023). The most widely used instrument to measure the severity of gaming-related symptoms was the Internet Addiction Scale, proposed by Young (1998), with subsequent modifications. The scale measures the Internet use, including both gaming and other Internet-related activities, such as checking email or forming new relationships with other online users. The questionnaire consists of 20 statements and assesses compulsivity, escapism, dependency, problems related to personal, occupational, and social functioning resulting from Internet use. Each item is rated on a five-point scale ranging from 0 to 5. Total scores that range from 0 to30 points are considered to reflect a normal level of Internet usage; scores of 31 to 49 indicate the presence of a mild level of Internet addiction; scores of 50 to 79 reflect the presence of a moderate level; and scores of 80 to 100 indicate severe dependence. Regarding pharmacotherapy from a chronological perspective, an early study by Han et al.

DOI: 10.15557/PiPK.2024.0038

(2009) involving children diagnosed with attention deficit hyperactivity disorder and Internet video game addiction demonstrated that eight weeks of treatment with methylphenidate caused a reduction in scores on the Internet Addiction Scale. Another study conducted on 11 patients with Internet video game addiction revealed that six weeks period of bupropion treatment resulted in clinical improvement, expressed as decreased craving for Internet video game play and a reduction in the total time spent on gaming (Han et al., 2010). Han and Renshaw (2012) studied patients with excessive online game play, defined as more than four hours per day/30 hours per week, and major depressive disorder, who were randomly assigned to a group treated with bupropion or placebo. All participants also attended weekly education sessions regarding healthy Internet use and the adverse consequences of excessive video gaming. After the 12-week treatment period, the Internet Addiction Scale scores and the mean time spent on online game playing in the bupropion group were reduced compared to the placebo group. At the four-week post-treatment follow-up, the severity of online gaming addiction in the bupropion group remained unchanged (Han and Renshaw, 2012). Kim et al. (2012) evaluated the efficacy of bupropion in combination with cognitive behavioural therapy in the treatment of problematic online gaming in adolescents with comorbid major depressive disorder. The definition of problematic online game playing for this study was defined as spending more than four hours per day/30 h per week on gaming, a score of more than 50 on the Internet Addiction Scale, and maladaptive behaviours or distress due to problematic online game playing. The scores were reduced in patients receiving both cognitive behavioural therapy and bupropion as compared to those in the bupropion group. During the four-week post-treatment follow-up, there were no changes in the severity of online gaming addiction and the total gaming time (Kim et al., 2012). In an open trial and controlled study by Song et al. (2016), both bupropion and escitalopram were effective, as assessed with the Internet Addiction Scale in the six weeks of follow-up, and bupropion was more effective than escitalopram. In a single-blind, randomised controlled trial by Park et al. (2016), the effectiveness of atomoxetine and methylphenidate was assessed in adolescents with attention deficit hyperactivity disorder and internet gaming disorder. After three months of treatment, both groups showed clinical improvement, with no differences between the two drugs (Park et al., 2016). Nam et al. (2017) compared the effectiveness of bupropion and escitalopram in patients with major depressive disorder and problematic Internet gaming, defined as excessive Internet gaming of more than four hours per day or 30 hours per week, the Young Internet Addiction Scale scores over 50, and maladaptive and disruptive behaviour in general life due to excessive Internet gaming. After 12 weeks, both drugs showed clinical improvement, and no significant difference was observed between them (Nam et al., 2017). Kim et al. (2017) studied the efficacy of escitalopram, fluoxetine and paroxetine in the treatment of patients with internet gaming disorder and comorbid depressive or anxiety symptoms. After six months of treatment, the patients demonstrated a significant decrease in their Internet Addiction Test scores; however, no separate analysis for each drug was performed (Kim et al., 2017). Park et al. (2017) confirmed the effectiveness of escitalopram, fluoxetine, and paroxetine in patients with internet gaming disorder and depressive or anxiety symptoms, expressed as a decrease in the Internet Addiction Test scores after six months of treatment. Similar to the previous report, Park et al. (2017) did not perform a separate analysis for each of these drugs either.

PSYCHOLOGICAL INTERVENTION

Danielsen et al. (2023), in their recent systematic review, included 38 reports focused on treatments for gaming disorder, including psychological interventions. The comparison groups were mostly a no-treatment group or participants on a waiting list. The most frequent type of psychological intervention was cognitive-behavioural therapy. Other types of management included pharmacological, prevention programmes, school-based prevention programmes, and physical exercise. The highest significant effect size was associated with psychotherapy (Danielsen et al., 2023). A former meta-analysis by Stevens et al. (2019) focused on cognitive-behavioural therapy and included 12 articles evaluating its short-term and long-term effectiveness in patients with internet gaming disorder, in relation to four key outcomes: symptomatology, anxiety symptoms, depression symptoms, and time spent on gaming. The programme length varied, with six studies providing an eight-session cognitive-behavioural therapy program, and four providing a 12-session program. The results indicated that cognitive behavioural therapy was effective in reducing symptoms of internet gaming disorder and depression, and moderately effective at reducing anxiety; however, there was insufficient evidence, i.e. inadequate power, to determine whether cognitive-behavioural therapy was capable of reducing time spent on gaming (Stevens et al., 2019). Kim et al. (2012) used a group cognitive-behavioural therapy programme for individuals with online game addiction. The therapy consisted of eight sessions, lasting 1.5–2 hours, once a week, provided by a multidisciplinary treatment team including a psychiatrist, nurse, psychologist, and social worker. The first session comprised establishing ground rules, assessment of online game use, discussing the adverse effects of online game addiction in terms of academic, occupational, and economic performance, and addressing the consequences of online game addiction effecting body and mind. The second session focused on disputing false beliefs through defining beliefs mediating the relationship between activating events and gaming, analysing the evidence for identified false beliefs, and developing alternative beliefs through promoting a reduction of online game playing. The third session focused on problem definition and formulation with defining

 DOI: 10.15557/PiPK.2024.0038

online game addiction risk factors as a problem, and developing alternative solutions through managing excessive online game play risks. The fourth session focused on managing the risks of excessive online gaming and evaluating selected solutions to manage online game play. The fifth session was devoted to communication skill training through managing problems in social relationships. The sixth session addressed self-control skills training, including handling peer pressure, online game craving, negative and positive emotions. The seventh session was a family therapy session involving discussions with family members concerning intra-familial conflicts and resolutions. The eighth session consisted of future planning, including relapse prevention and re-learning how to enjoy life without online gaming (Kim et al., 2012).

CONCLUSIONS

Video games constitute a form of entertainment enjoyed non-problematically by many individuals worldwide. However, uncontrolled gaming and the resultant negative consequences of excessive video gaming, such as significant impairment in personal, family, social, educational, or occupational life, or distress, require appropriate diagnosis. Gaming disorder manifests as uncontrolled, persistent, or recurrent behaviour with priority given to gaming, despite its negative interference with personal functioning. Certain types of action games were found to be the most frequently associated with disordered gaming, in particular first-person shooter and massive-multiplayer online role-playing games. Excessive use of the Internet not involving playing games, such as excessive use of social media, viewing pornography online, or Internet gambling, is excluded from the concept of disordered gaming. The worldwide prevalence of disordered gaming is 3%, rising to 4.6% in adolescents, with males more often affected than females. Numerous psychological and neurobiological factors play a role in the pathogenesis of gaming disorder, though not all of them are fully elucidated. From a psychological standpoint, the cause of disordered gaming is heterogeneous, and various contributory factors can be involved, including motivations such as fascination with an alternative world and self-concept, low self-esteem, impulsivity, dysregulation of reward system, and escapism. Individuals with reduced dopamine-receptor function are particularly prone to developing disordered gaming, in particular under stressful life events, when maladaptive coping with stress through gaming provides relief and pleasure. Gaming disorder is likely linked to complex interactions between multiple receptor and neurotransmitter systems, not solely dopamine pathways. Imaging studies indicate hyperactivation of the anterior cingulate cortex, dorsolateral prefrontal cortex, posterior inferior frontal gyrus, caudate, posterior cingulate cortex, and precuneus; in contrast to hypoactivation of the anterior inferior frontal gyrus, posterior insula, and precentral and postcentral gyri. With respect to psychiatric comorbidities such as attention deficit hyperactivity disorder or major depressive disorder several drugs were effective in gaming disorder, namely bupropion, escitalopram, fluoxetine, paroxetine, methylphenidate, and atomoxetine. Future studies, particularly double-blind randomised controlled trials with adequate sample sizes, controlling for psychiatric comorbidities, are needed. The most frequent type of effective psychological intervention was cognitive-behavioural therapy. There is also a need to assess whether cognitive behavioural therapy may have differential effects on specific manifestations of disordered gaming.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organisations which might negatively affect the content of this publication and/or claim authorship rights to this publication.

Author contribution

Original concept of study; collection, recording and/or compilation of data; analysis and interpretation of data; writing of manuscript; critical review of manuscript; final approval of manuscript: AB, JB.

References

Aarseth E, Bean AM, Boonen H et al.: Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal. J Behav Addict 2017; 6: 267–270.

American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders. 5th ed., DSM-5, 2013.

Chen KH, Oliffe JL, Kelly MT: Internet Gaming Disorder: an emergent health issue for men. Am J Mens Health 2018; 12: 1151–1159.

Chen S, Zhu S: Unravelling the intricacies between gaming motivations and internet gaming disorder symptoms in adolescents: a network analysis of 2-year healthy and deteriorating transition profiles. Child Adolesc Psychiatry Ment Health 2023; 17: 122.

Choi E, Shin SH, Ryu JK et al.: Commercial video games and cognitive functions: video game genres and modulating factors of cognitive enhancement. Behav Brain Funct 2020; 16: 2.

Dale G, Joessel A, Bavelier D et al.: A new look at the cognitive neuroscience of video game play. Ann N Y Acad Sci 2020; 1464: 192–203.

Danielsen PA, Mentzoni RA, Låg T: Treatment effects of therapeutic interventions for gaming disorder: a systematic review and meta-analysis. Addict Behav 2023; 149: 107887.

Dong G, Potenza MN: A cognitive-behavioral model of Internet gaming disorder: theoretical underpinnings and clinical implications. J Psychiatr Res 2014; 58: 7–11.

Fam JY: Prevalence of internet gaming disorder in adolescents: a meta-analysis across three decades. Scand J Psychol 2018; 59: 524–531.

Feng W, Ramo DE, Chan SR et al.: Internet gaming disorder: trends in prevalence 1998–2016. Addict Behav 2017; 75: 17–24.

Griffiths MD, Kuss DJ, Lopez-Fernandez O et al.: Problematic gaming exists and is an example of disordered gaming. J Behav Addict 2017; 6: 296–301.

Han DH, Renshaw PF: Bupropion in the treatment of problematic online game play in patients with major depressive disorder. J Psychopharmacol 2012; 26: 689–696.

Han DH, Hwang JW, Renshaw PF: Bupropion sustained release treatment decreases craving for video games and cue-induced brain activity in patients with Internet video game addiction. Exp Clin Psychopharmacol 2010; 18: 297–304.

Han DH, Lee YS, Na C et al.: The effect of methylphenidate on Internet video game play in children with attention-deficit/hyperactivity disorder. Compr Psychiatry 2009; 50: 251–256.

Han X, Wu X, Wang Y et al.: Alterations of resting-state static and dynamic functional connectivity of the dorsolateral prefrontal cortex in subjects with Internet gaming disorder. Front Hum Neurosci 2018; 12: 41.

Hou J, Xiao Q, Zhou M et al.: Lower synaptic density associated with gaming disorder: an ^{18}F-SynVesT-1 PET imaging study. Gen Psychiatr 2023; 36: e101112.

Jo YS, Bhang SY, Choi JS et al.: Clinical characteristics of diagnosis for internet gaming disorder: comparison of DSM-5 IGD and ICD-11 GD diagnosis. J Clin Med 2019; 8: 945.

Kewitz S, Leo K, Rehbein F et al.: Assessment of Hazardous Gaming in children and its dissimilarities and overlaps with Internet Gaming Disorder. Front Psychiatry 2023; 14: 1226799.

Kim SH, Baik SH, Park CS et al.: Reduced striatal dopamine D2 receptors in people with Internet addiction. Neuroreport 2011; 22: 407–411.

Kim E, Lee D, Do K et al.: Interaction effects of DRD2 genetic polymorphism and interpersonal stress on problematic gaming in college students. Genes (Basel) 2022; 13: 449.

Kim SM, Han DH, Lee YS et al.: Combined cognitive behavioral therapy and bupropion for the treatment of problematic on-line game play in adolescents with major depressive disorder. Comput Human Behav 2012; 28: 1954–1959.

Kim YJ, Lee JY, Oh S et al.: Associations between prospective symptom changes and slow-wave activity in patients with Internet gaming disorder: a resting-state EEG study. Medicine (Baltimore) 2017; 96: e6178.

Lee SY, Lee HK, Choo H: Typology of Internet gaming disorder and its clinical implications. Psychiatry Clin Neurosci 2017; 71: 479–491.

Liao Z, Huang Q, Huang S et al.: Prevalence of Internet gaming disorder and its association with personality traits and gaming characteristics among Chinese adolescent gamers. Front Psychiatry 2020; 11: 598585.

Lin X, Dong G, Wang Q et al.: Abnormal gray matter and white matter volume in 'Internet gaming addicts'. Addict Behav 2015; 40: 137–143.

Na E, Choi I, Lee TH et al.: The influence of game genre on Internet gaming disorder. J Behav Addict 2017; 6: 1–8.

Nam B, Bae S, Kim SM et al.: Comparing the effects of bupropion and escitalopram on excessive Internet game play in patients with major depressive disorder. Clin Psychopharmacol Neurosci 2017; 15: 361–368.

Nguyen A, Bavelier D: Play in video games. Neurosci Biobehav Rev 2023; 153: 105386.

Park HS, Kim SH, Bang SA et al.: Altered regional cerebral glucose metabolism in Internet game overusers: a ^{18}F-fluorodeoxyglucose positron emission tomography study. CNS Spectr 2010; 15: 159–166.

Park JH, Lee YS, Sohn JH et al.: Effectiveness of atomoxetine and methylphenidate for problematic online gaming in adolescents with attention deficit hyperactivity disorder. Hum Psychopharmacol 2016; 31: 427–432.

Park M, Kim YJ, Kim DJ et al.: Sustained dysfunctional information processing in patients with Internet gaming disorder: 6-month follow-up ERP study. Medicine (Baltimore) 2017; 96: e7995.

Paulus FW, Ohmann S, von Gontard A et al.: Internet gaming disorder in children and adolescents: a systematic review. Dev Med Child Neurol 2018; 60: 645–659.

Porter S, Harrison J, Ang A et al.: Gaming Industry Survey 2022. What's possible for the gaming industry in the next dimension? Ernst & Young LLP, 2022.

Sá RRC, Coelho S, Parmar PK et al.: A systematic review of pharmacological treatments for Internet gaming disorder. Psychiatry Investig 2023; 20: 696–706.

Song J, Park JH, Han DH et al.: Comparative study of the effects of bupropion and escitalopram on Internet gaming disorder. Psychiatry Clin Neurosci 2016; 70: 527–535.

Stevens MWR, King DL, Dorstyn D et al.: Cognitive-behavioral therapy for Internet gaming disorder: a systematic review and meta-analysis. Clin Psychol Psychother 2019; 26: 191–203.

Tian M, Chen Q, Zhang Y et al.: PET imaging reveals brain functional changes in internet gaming disorder. Eur J Nucl Med Mol Imaging 2014; 41: 1388–1397.

Wang H, Jin C, Yuan K et al.: The alteration of gray matter volume and cognitive control in adolescents with internet gaming disorder. Front Behav Neurosci 2015; 9: 64.

Wang Z, Wu L, Yuan K et al.: Cortical thickness and volume abnormalities in Internet gaming disorder: evidence from comparison of recreational Internet game users. Eur J Neurosci 2018. DOI: 10.1111/ejn.13987.

World Health Organization: International Statistical Classification of Diseases and Related Health Problems. 11th ed., ICD-11, 2019.

Yao YW, Liu L, Ma SS et al.: Functional and structural neural alterations in Internet gaming disorder: a systematic review and meta-analysis. Neurosci Biobehav Rev 2017; 83: 313–324.

Young KS: Internet addiction: the emergence of a new clinical disorder. Cyberpsychol Behav 1998; 1: 237–244.

Zhu L, Zhu Y, Li S et al.: Association of Internet gaming disorder with impulsivity: role of risk preferences. BMC Psychiatry 2023; 23: 754.