

MINI REVIEW



Understanding online gaming addiction and impulse control disorders: A mini review

Durgapada Sarkhel

Department of Biotechnology, Utkal University, Odisha, India

ABSTRACT

Online gaming addiction, characterized by compulsive engagement and impaired self-regulation, negatively affects personal, social, and academic functioning. It involves psychological mechanisms such as operant conditioning through reward systems and maladaptive emotional regulation. Neurobiologically, gaming addiction is linked to dopamine dysregulation, impairing impulse control and emotional regulation. Social factors, including virtual communities and in-game incentives, further sustain addictive behaviours. ICDs, such as pathological gambling and kleptomania, share overlapping characteristics with gaming addiction, including deficits in impulse control and reward-processing dysfunction. Both conditions involve diminished activity in brain regions such as the prefrontal cortex, exacerbating compulsive behaviours. High impulsivity is a predictor of both disorders, with individuals seeking immediate gratification despite long-term negative consequences. The review highlights that existing research lacks longitudinal studies and cross-cultural insights, limiting the understanding of addiction trajectories and the effectiveness of interventions. Emerging technologies, such as virtual and augmented reality, present additional challenges by intensifying immersion and escapism, requiring further investigation. Effective treatment strategies include cognitive-behavioral therapy (CBT) to restructure thoughts and develop healthier behaviours. Pharmacological interventions, such as selective serotonin reuptake inhibitors (SSRIs), are also used to address co-occurring conditions like anxiety and depression. Integrated approaches involving family therapy and impulse control training are essential for addressing both gaming addiction and ICDs comprehensively. Future research should focus on refining diagnostic frameworks, developing culturally relevant interventions, and exploring the interplay between gaming addiction and ICDs to enhance public health strategies.

KEYWORDS

Online gaming addiction; Impulse Control Disorders (ICDs); Dopamine dysregulation; Cognitive-Behavioral Therapy (CBT); Cross-cultural research

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Introduction

The rapid expansion of digital technologies has fuelled the popularity of online gaming, transforming it into a global entertainment medium. While casual gaming offers cognitive and social benefits, prolonged and excessive gaming can lead to behavioral disorders. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) introduced Internet Gaming Disorder (IGD) in 2013 as a condition characterized by problematic gaming behaviour. Similarly, the International Classification of Diseases (ICD-11) by the World Health Organization (WHO) recognized Gaming Disorder (GD) in 2018, broadening the focus to both online and offline gaming behaviours [1]. The clinical definitions of IGD and GD highlight the loss of control over gaming, preoccupation, and the continuation of gaming despite adverse consequences. These conditions differ from casual gaming, which does not interfere with daily functioning. The DSM-5 limits its criteria to online gaming, whereas the ICD-11 expands the definition to include offline activities as well. Both classifications emphasize the necessity of addressing this growing issue, but their distinct scopes present challenges in harmonizing research and intervention efforts [2].

Studies show that the prevalence of IGD varies widely depending on population and methodology, with rates ranging

from 1.3% to 19.9% among adolescents and young adults. A meta-analysis reported a prevalence rate of 6.2% among medical students, reflecting their heightened susceptibility due to stress and demanding schedules. Regional studies indicate further variations, with Egypt reporting a prevalence of 10.9% and Saudi Arabia 8.8%, likely influenced by local gaming cultures [3]. Despite increasing research interest, methodological inconsistencies such as differences in diagnostic criteria and assessment tools pose challenges in comparing findings across studies. The DSM-5 and ICD-11 frameworks are not entirely aligned, contributing to the variation in reported prevalence rates and complicating the development of effective public health strategies [4].

Although research into gaming addiction is expanding, the link between gaming addiction and ICDs remains underexplored. Given that both IGD and ICDs involve deficits in self-regulation and reward-processing mechanisms, investigating their shared pathways could provide valuable insights for interventions [5]. This review aims to explore the intersection between online gaming addiction and ICDs, focusing on their overlapping mechanisms and clinical implications. Addressing this relationship is essential for refining diagnostic frameworks and guiding the development of targeted therapeutic strategies.

*Correspondence: Mr. Durgapada Sarkhel, Department of Biotechnology, Utkal University, Bhubaneswar, Odisha, India, e-mail: durgapadasarkhel98@gmail.com

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Online Gaming Addiction: Definition and Mechanisms

Online gaming addiction is a behavioral disorder characterized by compulsive engagement in gaming activities, resulting in significant impairments in personal, social, or academic functioning. The development and persistence of this condition are driven by intricate interactions between psychological, neurobiological, behavioral, and social mechanisms, making it essential to explore these dimensions for effective intervention.

Psychological mechanisms

Online games incorporate reward systems that trigger immediate gratification, reinforcing frequent gaming. These rewards ranging from points and virtual achievements to character advancements activate the brain's reward pathways, encouraging players to continue gaming. This process aligns with the concept of operant conditioning, where positive reinforcement strengthens behaviour over time [6]. As players become accustomed to receiving instant rewards, they find it challenging to disengage, reinforcing the cycle of play. In addition to reward-seeking, emotional regulation plays a crucial role. Individuals often turn to gaming to manage negative emotions such as stress, anxiety, or boredom. The immersive nature of games provides temporary relief, which can create a pattern of maladaptive emotional dependence. Over time, this reliance hinders the development of healthier coping strategies, increasing the risk of addiction and emotional instability [7]. As a result, gaming shifts from a recreational activity to an emotional crutch.

Neurobiological mechanisms

From a neurobiological perspective, gaming addiction involves the dysregulation of dopamine, a neurotransmitter responsible for pleasure and reward. Studies show that gaming can release dopamine levels comparable to those observed in substance addictions, reinforcing compulsive behavior and contributing to the development of tolerance. With time, players need longer or more intense gaming sessions to experience the same satisfaction, further entrenching addictive patterns. Functional magnetic resonance imaging (fMRI) studies reveal that excessive gaming affects key brain regions responsible for executive functions. For instance, reduced activity in the prefrontal cortex responsible for impulse control and decision-making has been observed in individuals with gaming addiction. Additionally, the anterior cingulate cortex, which regulates emotions, shows diminished activity, impairing emotional regulation and reinforcing dependence on gaming as an emotional outlet [8].

Behavioral and social factors

Social interaction within gaming environments plays a significant role in sustaining addictive behavior. Multiplayer games create virtual communities where players form bonds, collaborate, or compete, fulfilling social needs. These interactions provide a sense of belonging, which can become particularly appealing for individuals experiencing social isolation in offline settings. Additionally, real-time gaming events and team-based competitions foster a fear of missing out (FOMO), further encouraging prolonged gaming. Behavioral reinforcement mechanisms embedded in games, such as loot boxes, daily login rewards, and leaderboards, contribute to addiction through intermittent reinforcement. This strategy

mirrors gambling behavior by offering unpredictable rewards, which increases engagement and makes it harder for individuals to break away from gaming sessions [9].

Impulse Control Disorders: Overview and Relevance

ICDs are psychiatric conditions marked by difficulty in resisting urges or impulses that can result in harmful outcomes. These disorders disrupt personal, social, and occupational functioning. Examples include pathological gambling, kleptomania (compulsive stealing), trichotillomania (compulsive hair-pulling), and intermittent explosive disorder (uncontrolled anger). ICDs stem from impairments in brain regions such as the prefrontal cortex, which plays a crucial role in behavioral regulation and decision-making [10]. Dysfunctions in this region reduce inhibitory control, impairing the ability to resist impulses. Alterations in dopamine pathways, involved in reward processing, further exacerbate compulsive behaviors by intensifying the desire for immediate gratification. This neurological imbalance leads individuals to act impulsively despite being aware of the negative consequences [11].

ICDs frequently co-occur with mental health conditions like anxiety, depression, and substance use disorders. For instance, individuals with trichotillomania often use hair-pulling to manage anxiety, while pathological gambling is linked to higher rates of depression. The overlap of symptoms makes diagnosis and treatment complex, as it is challenging to identify the primary disorder. Treatment typically involves cognitive-behavioral therapy (CBT) alongside pharmacological interventions to address both the impulse disorder and coexisting conditions [12]. The relationship between ICDs and online gaming addiction highlights shared neurological pathways, including deficits in impulse regulation and heightened dopamine activity. Both conditions reflect a lack of control over behaviours driven by reward-seeking tendencies, emphasizing the need for integrated treatment strategies. Recognizing these parallels is crucial for developing comprehensive interventions that address multiple compulsive behaviours and improve patient outcomes [13].

Interlink Between Online Gaming Addiction and ICDs Impulsivity as a predictor

Impulsivity plays a crucial role in the development of behavioral addictions, including online gaming addiction, and is closely associated with ICDs. Impulsive individuals are more likely to engage in behaviours that provide immediate gratification, even at the expense of long-term consequences. Studies have shown that high levels of impulsivity, characterized by difficulty delaying rewards, predict the onset and severity of gaming addiction. For example, adolescents with elevated impulsivity scores are more prone to excessive gaming due to the immediate rewards and social feedback offered by online games. Moreover, the inability to control urges leads to gaming sessions extending for hours, disrupting daily life activities. This aligns with findings in ICD-related behaviours, where impulsivity drives maladaptive actions such as pathological gambling or compulsive shopping [14].

Shared neurobiological mechanisms

Research highlights that gaming addiction and ICDs share overlapping neurobiological mechanisms, particularly

involving the brain's reward and self-control circuits. Both conditions are linked to dysfunctions in the dopaminergic system, which regulates pleasure and motivation. Impairments in the prefrontal cortex, responsible for impulse regulation and decision-making, further exacerbate compulsive behaviours observed in both online gaming addiction and ICDs. Neuroimaging studies suggest that frequent gamers and individuals with ICDs show hyperactivity in the nucleus accumbens, a key region involved in the brain's reward pathway indicating heightened sensitivity to stimuli. These findings align with substance addiction models, suggesting that both behavioral addictions and ICDs stem from similar neural deficits, particularly reduced control over rewarding impulses [15].

Behavioral correlates

Individuals with gaming addiction often exhibit behaviours such as neglecting responsibilities, prioritizing gaming over work or education, and making impulsive decisions that negatively impact their social and personal lives. Similar patterns are seen in ICDs, where individuals struggle to resist harmful urges, leading to detrimental outcomes like financial ruin or interpersonal conflict. For example, just as individuals with compulsive gambling pursue betting despite repeated losses, gamers continue playing despite negative academic performance or deteriorating social relationships. This behavioral overlap suggests that both conditions involve diminished self-control, reflecting broader deficits in executive function [16].

Case studies

Several studies illustrate the co-occurrence of gaming addiction and ICDs. One case involved a young adult with both gaming addiction and compulsive gambling tendencies, highlighting shared impulsive behaviours and neural mechanisms. Another longitudinal study identified that adolescents with ICD symptoms were more likely to develop problematic gaming habits over time, indicating a bidirectional relationship between these disorders. These cases emphasize the need for targeted interventions addressing both gaming behaviours and impulse control, as treating one aspect without the other may limit therapeutic success [17].

Mental Health Implications

Development of anxiety and depression

Excessive gaming has been linked to emotional dysregulation, impairing individuals' ability to manage emotions effectively. The compulsion to engage in gaming activates neural pathways like those observed in substance addiction, fostering psychological dependence and emotional stress. As gamers face challenges in balancing virtual achievements with real-world demands, they often experience heightened frustration and stress, increasing the risk of anxiety disorders. Depression frequently co-occurs with gaming addiction, with individuals reporting withdrawal from social life, guilt, and feelings of hopelessness. Prolonged exposure to these conditions exacerbates emotional distress, leading to significant mental health challenges that require integrated intervention approaches [18].

Impact on social relationships

The impact of gaming addiction extends beyond the individual, often disrupting personal and social relationships. Those with

gaming disorders tend to prioritize virtual interactions over real-world engagements, resulting in social isolation and diminished communication with family and friends. This social withdrawal can foster loneliness, deepening emotional instability and contributing to further detachment from meaningful relationships. In many cases, unresolved family conflicts arise as individuals struggle to manage their gaming habits, which can erode personal connections over time. Early interventions involving family counselling can play a crucial role in addressing these relational challenges and promoting healthier interpersonal dynamics [19].

Academic and occupational impacts

Gaming addiction negatively influences academic performance and workplace productivity. Students with gaming disorders often report declining grades and reduced motivation, as excessive gaming disrupts study routines and learning focus. Similarly, in the workplace, compulsive gamers struggle to maintain productivity, leading to absenteeism, missed deadlines, and poor task management. Professional environments increasingly recognize the need for supportive programs such as Employee Assistance Programs (EAPs) to address gaming-related issues. By providing counselling and mental health support, such initiatives can help mitigate the negative impacts on job performance and career development [20].

Treatment Strategies and Interventions

Psychotherapy approaches

CBT is a widely applied intervention for Internet Gaming Disorder (IGD) and other behavioral addictions. It focuses on identifying distorted thoughts associated with gaming, such as excessive attachment to virtual achievements, and restructuring them to encourage healthier behavior. Treatment often involves relapse prevention plans and teaching adaptive coping strategies. A meta-analysis highlights that CBT can reduce gaming time by approximately 50%, significantly improving psychological well-being over several months of therapy [21].

Family therapy complements individual interventions by fostering a supportive environment. It aims to rebuild communication, establish healthy boundaries, and help family members recognize behaviors that may inadvertently reinforce gaming addiction. Studies suggest that family therapy increases the success rate of recovery by improving interpersonal relationships, especially among adolescents with gaming addiction. Group therapy, which combines CBT principles with peer support, also shows promise by allowing participants to share coping strategies and develop social accountability [22].

Pharmacological interventions

Pharmacological treatments are generally reserved for severe IGD cases, particularly those involving co-occurring disorders like anxiety or depression. Selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine and escitalopram, are prescribed to stabilize mood, indirectly reducing gaming urges. Bupropion, known for its role in managing addiction through reward modulation, has been shown to curb cravings associated with gaming. In some cases, naltrexone, an opioid receptor antagonist, is used to address compulsive gaming behaviours, drawing on strategies used in substance addiction treatments. However, these interventions require careful monitoring due to

side effects, and there is limited evidence regarding long-term efficacy [23].

Digital detox programs

Digital detox programs promote behavioral change by introducing structured routines that limit gaming time and encourage offline activities. These programs involve strategies like setting gaming-free zones at home, participating in physical activities, and monitoring screen time with dedicated apps. Counselling is often integrated to identify emotional triggers and develop healthy responses. Research shows that initial participation in detox programs leads to significant improvements in social functioning and well-being, though sustaining these changes over time requires ongoing support and reinforcement [24].

Research Gaps and Future Directions

Limited longitudinal studies

While many studies on Internet Gaming Disorder and Gaming Disorder have provided valuable insights, most rely on cross-sectional designs that capture behavior at a single point in time. This approach fails to reveal how gaming addiction develops, persists, or resolves over time. Longitudinal studies are essential to track behavioral patterns across different life stages and to understand how factors such as stress, academic demands, and social changes influence addiction trajectories. Additionally, these studies could identify early predictors of gaming addiction, offering evidence-based insights into the risk of relapse and the effectiveness of interventions over the long term [25].

Lack of cultural context

Cultural factors significantly shape gaming behavior and its psychological impact, but research remains heavily focused towards high-income countries. In regions like South Korea, where online gaming is deeply embedded in youth culture, addiction rates are higher compared to Western nations, where gaming patterns may differ. This cultural variability underlines the importance of cross-cultural research to develop diagnostic tools and treatment models that are relevant across diverse contexts [26]. Without this perspective, public health interventions risk being ineffective or culturally inappropriate in non-Western settings.

Emerging technologies

The introduction of virtual reality (VR) and augmented reality (AR) games adds new dimensions to the study of gaming addiction. These immersive technologies can deepen user engagement, blurring the lines between virtual and real-world experiences. Studies suggest that the intense immersion offered by VR games could heighten escapism and reduce emotional regulation, increasing the risk of addictive behavior, especially among vulnerable populations [27]. As these technologies evolve, research must explore their long-term psychological effects and develop preventive strategies to mitigate potential harm.

Conclusions

This review highlights the shared neurobiological and behavioral mechanisms between online gaming addiction and impulse control disorders, particularly in the domains of impaired self-regulation and reward-processing dysfunction.

These overlapping characteristics suggest that individuals with gaming addiction are more prone to developing ICDs, underscoring the need for integrated research and interventions. Effective treatment strategies for gaming addiction require multi-modal approaches. Cognitive-behavioral therapy is recognized as a primary intervention, helping individuals correct cognitive distortions and build healthier behavioral patterns. Pharmacological interventions, such as selective serotonin reuptake inhibitors (SSRIs), have shown promise for managing co-occurring mental health conditions like anxiety and depression, though their direct application to gaming addiction needs further validation. Incorporating family or group therapy, which provides emotional support and enhances interpersonal relationships, further strengthens these interventions. Additionally, aligning therapeutic efforts with the management of ICDs—such as impulse control training—can offer a more holistic treatment model. Future research should focus on refining diagnostic criteria, developing evidence-based, standardized interventions, and exploring the specific interplay between ICDs and gaming addiction to enhance treatment efficacy and public health outcomes.

Disclosure statement

The author declares no potential conflicts of interest.

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