

The impact of the abuse of electronic games in children and adolescents: scoping review

O impacto do abuso de jogos eletrônicos em crianças e adolescentes: revisão de escopo

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ABSTRACT

Introduction: Increasing technological development has allowed the video game industry to reach more users, predominantly younger, more vulnerable users. In this context, gaming disorder (GD) has recently been included in the New International Classification of Diseases (ICD-11). The importance of this study lies in the need to better understand the impacts of GD on children and adolescents. **Methodology:** This is a Scoping Review study, written in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. The Cochrane Library (Cochrane) database was used, where 332 bibliographic references were located, of which 9 were selected. **Results and discussion:** The study gathered evidence on the Epidemiology, Etiology, Pathophysiology, Clinical Picture, Diagnosis and Differential Diagnosis, Treatment and Prognosis of GD in adolescents and children. **Conclusion:** A worldwide prevalence of 1.96% of GD and several risk factors was identified. The diagnosis is made using DSM-5 criteria. There are also scales to guide the diagnosis, the most used being the IGDS9-SF. The main impacts were: anxiety, depression, aggressiveness, impulsivity, low self-esteem, anguish, emotional instability, isolation, mood changes, sleep and eating. The treatment of choice is psychotherapy, although psychoactive medications can be used for anxiety and ADHD.

Keywords: gaming disorder, abusive use of electronic games, childs, teenagers.

RESUMO

Introdução: O crescente desenvolvimento tecnológico permitiu que a indústria de videogames alcançasse mais usuários, predominantemente usuários mais jovens e mais vulneráveis. Neste contexto, o distúrbio do jogo (GD) foi recentemente incluído na Nova Classificação Internacional de Doenças (CID-11). A importância deste estudo reside na necessidade de compreender melhor os impactos do GD em crianças e adolescentes. **Metodologia:** Este é um estudo de Scoping Review, escrito de acordo com a extensão Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (Lista de verificação PRISMA-ScR). Foi utilizada a base de dados da Biblioteca Cochrane (Cochrane), onde foram localizadas 332 referências bibliográficas, das quais 9 foram selecionadas. **Resultados e discussão:** O estudo reuniu evidências sobre Epidemiologia, Etiologia, Fisiopatologia, Quadro Clínico, Diagnóstico e Diagnóstico Diferencial, Tratamento e Prognóstico da DG em adolescentes e crianças. **Conclusão:** Foi identificada uma prevalência mundial de 1,96% de DG e vários fatores de risco. O diagnóstico é feito pelos critérios do DSM-5. Existem também escalas para orientar o diagnóstico, sendo a mais utilizada a IGDS9-SF. Os principais impactos foram: ansiedade, depressão, agressividade, impulsividade, baixa autoestima, angústia, instabilidade emocional, isolamento, alterações de humor, sono e alimentação. O tratamento de escolha é a psicoterapia, embora medicamentos psicoativos possam ser usados para ansiedade e TDAH.

Palavras-chave: transtorno de jogos, uso abusivo de jogos eletrônicos, crianças, adolescentes.

1 INTRODUCTION

Technological development and increasing expansion of digital reach have allowed the video game industry to become one of the largest in monetary terms and with more users, predominantly in younger age groups, making this one of children's favorite leisure activities. The latest generation of video games has very attractive aspects such as stimulating visual and auditory effects and fast event frequencies that encourage continuous use. It also has a series of factors that make it an engaging and rewarding activity, such as social recognition from other players, satisfaction of being part of a group, development of intimate relationships with others in an imaginary game world, which is easier than communication face-to-face and have greater opportunity for control and active involvement. Furthermore, it is the target of the search for pleasurable and relaxing sensations and escapism from feelings such as boredom, loneliness and everyday problems. These factors encourage the abusive use of electronic games, especially in younger age groups, who are more vulnerable, and have been reported as potentially problematic and/or addictive (YILMAZ, GRIFFITHS AND KAN, 2017) (ARAUJO AND JUNIOR, 2021).

In this vein, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) of the American Psychiatric Association describes internet gaming disorder as a behavioral addiction disorder that causes significant impairment or distress in various aspects of a person's life. For diagnosis, the DSM-5 lists 9 criteria of which it requires 5 or more criteria experienced within 1 year. The condition can include gaming on the internet or on any other electronic device (computers, tablets, cell phones, consoles), although most people who develop clinically significant gaming problems play primarily online. However, until its publication in 2013, the DSM-5 recognized internet gaming disorder in the section on conditions recommended for future research. It is worth mentioning that there was already neurological research showing similarities in brain changes between electronic games and addictive substances (AMERICAN PSYCHIATRIC ASSOCIATION, 2018). According to Paulus *et al.* (2018), Gaming Disorder (GD) should be understood as a threatening disorder with a complex psychosocial background.

Based on this, and new research, the latest international classification of diseases (ICD-11) included the abusive use of electronic games, called gaming disorder, as a diagnosis. This addiction is analogous to addiction to psychotropic substances. Within this, it is characterized as a type of standardized behavior in relation to gaming, which can be online or offline, associated with manifestations such as not having control over the game (not knowing when to stop) and giving greater priority to the game than to gaming activities. daily life. Other manifestations include continuing the gaming activity even if it is bringing negative

consequences and progressive evolution, as the individual needs a longer amount of time to obtain the same satisfaction (ICD-11, 2022).

Until the inclusion of Internet Gaming Disorder (IGD) in DSM-5, there was a lack of consensus on the name to be given to this disorder (SANCHEZ-IGLESIAS *et al.*, 2020). And according to Yilmaz, Griffiths and Kan (2017), several terms are used as synonyms for gaming disorder, such as: excessive gaming, problematic gaming use, internet gaming disorder, compulsive gaming, pathological gaming, video game addiction, addiction to digital games, addiction to online games and addiction to internet games. The DSM calls the problem Internet Gaming Disorder (IGD) (SANCHEZ-IGLESIAS *et al.*, 2020).

In the life of a child or adolescent, these patterns of destructive behavior cause great harm, such as changes in well-being (SCOTT & PORTER-ARMSTRONG, 2013), impairment of mental health or a lower degree of self-control (SON *et al.*, 2013) (DE CASTRO AND JUNIOR, 2021). Other problems identified include deterioration of the family environment, social isolation, behavioral problems and a disorganized life (SANCHEZ-IGLESIAS *et al.*, 2020). Furthermore, the use of video games in adolescents has been associated with sleep disorders (LAM, 2014) and causes withdrawal when removed (CHAGAS BRANDÃO *et al.*, 2022).

The worldwide prevalence of GD appears to be comparable to that of obsessive-compulsive disorder and some substance-related addictions, but lower than compulsive buying and higher than gambling. According to a study that included a total of 226,247 participants in 17 different countries, the worldwide prevalence of GD was 1.96% when considering only studies that met more stringent sampling criteria (e.g., stratified random sampling). However, these estimates were associated with significant variability due to sample heterogeneity. The choice of screening tool accounted for 77% of the variance, with the Lemmens Internet gaming disorder-9, Gaming Addiction Identification Test, and Problematic Videogame Playing scales associated with the highest estimates. Adolescent samples were significant predictors of higher prevalence. GD rates were approximately 2.5:1 in favor of men compared to women (STEVENS *et al.*, 2020). The excessive use of video games and internet applications has been growing, especially during and after the COVID-19 pandemic (LINDEMBERG *et al.*, 2022). Another study determined that, among representative samples of children and adolescents, on average, 2% are affected by Internet Gaming Disorder (GD) (PAULUS *et al.*, 2018).

Analyzing the national scenario, according to data found in the randomized clinical trial carried out by the Institute of Psychology at USP, the prevalence of problematic use of video games among Brazilians with an average age of 12 to 14 years, in the year 2022, is higher than

the average raised in studies from other countries. Of the sample in this study, around 85.85% play video games and 27.17% fit the gaming disorder criteria, which was associated with the male gender, use of tobacco and alcohol, aggressors and victims of bullying, with abnormal levels of hyperactivity /inattention, social behavior problems, peer relationship problems and emotional symptoms. As the percentage of those who presented GD is higher than the world average, this study demonstrates the need for more prevention and intervention in these cases (CHAGAS BRANDÃO *et al.*, 2022).

The low number of Latin American publications related to this topic reveals the need for more quality studies (ROJAS-JARA *et al.*, 2022).

The importance of this study lies in the need to understand in greater depth the impacts of electronic game addiction on children and adolescents, as this problem has been emerging on a global level, increasingly affecting the population of young people and children. Given this, it is extremely important to develop new research, not only on therapy, but also on diagnostic criteria, prevention and early intervention so that it can then be approached in a more resolute way to improve the quality of life and development of these individuals. .

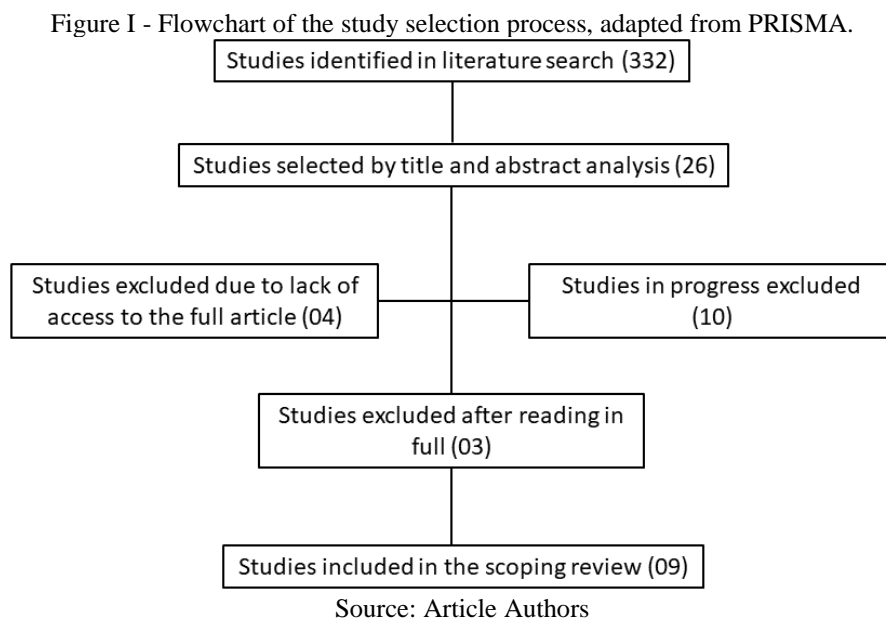
This work aims to examine and map scientific evidence on the impact of electronic game addiction on children and adolescents, current diagnostic criteria and treatments.

2 METHOD

This Scoping Review is registered with the OSF (Open Science Framework), which can be accessed at the following link: <https://osf.io/8unjs/>.

This is a Scoping Review study, according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist. This method makes it possible to map the main concepts, clarify areas of research and identify gaps in knowledge. To construct the research question, the Context, Concept and Population (CoCoPop) strategy was used for a scoping review. The following were defined: P- children and adolescents; C- electronic games and C- abusive use, as long as it considered abusive use of electronic games. Studies that addressed addiction to games, without addressing electronic games, were excluded. Based on these definitions, the guiding question was established "What is the scientific evidence on the impact of addiction to electronic games on children and adolescents?". In this sense, the bibliographic survey was carried out from September to October 2022, using the search strategy "((game or video game) AND (children or teenager or young people) AND (addiction or disorder or gaming disorder))" in The Cochrane Library (Cochrane) database. Initially, the words contained in the titles, abstracts and

descriptors were analyzed. In the first approach, we entered the keywords and found 332 bibliographical references; after reading the abstracts, we selected 26 articles published in the established period that dealt with addiction to electronic games in individuals aged between 6 and 22 years. In the next stage, nine articles were selected by reading them in full. The selected studies that answered the guiding question of this review were read in full and their references were analyzed in search of additional studies (**Figure I**). Along with the descriptors, the terms: AND and OR to make up the search keys to be used for searching the databases. The studies found included randomized or semi-randomized clinical trials in English published or made available on the platform in the last 5 years (2018 to 2022). Based on the outlined objective, a data extraction tool was created jointly by six reviewers to determine which variables to extract. The reviewers independently mapped the data, discussed the results and continually updated the data extraction tool interactively. Data was collected on the date of publication of the article, authors, title, level of evidence, information on the concept, etiology, clinical picture, current therapies and complications of addiction to electronic games in children and adolescents.



3 RESULTS AND DISCUSSION

Of the 332 studies found, after reading the titles and abstracts of the articles, 26 were selected because they met the inclusion criteria. Of those selected, 4 were excluded because they were not freely available in full and 10 because they were still in progress. The remaining 9 studies were analyzed and included in the study. In this review, the final sample totaled 9 selected studies. The process of searching for and selecting the studies in this review is shown

in the flowchart (Figure 1), in accordance with JBI recommendations, according to a checklist adapted from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). In accordance with the guidelines, the results were described narratively and in tables.

The nine studies included in this review were published and/or made available between 2018 and 2022. Of these, 8 were randomized clinical trials and 1 was a cross-sectional study. The studies on the subject covered studies with a quantitative, qualitative or qualitative-quantitative approach, and with similar objects of study on the conceptualization of gaming disorder and possible management. Table 1 shows the main impacts faced by children and adolescents addicted to electronic games.

3.1 EPIDEMIOLOGY AND RISK FACTORS

One survey estimated that up to 91% of children and teenagers between the ages of 2 and 17 play video games (NPD Group, 2011). According to a study by Stevens *et al.* (2020) which included a total of 226,247 participants in 17 different countries, the worldwide prevalence of gaming disorder (GD) was 1.96%.

International evidence on GD in adolescents comes from different latitudes of the world, with studies from Asia (58.3%), Europe (31.3%), Oceania (8.3%) and North America (2.1%) . However, this review found no documentation on GD for adolescents in Latin America (ROJAS-JARA *et al.*, 2022).

Gaming disorder rates were approximately 2.5:1 in favor of men compared to women (STEVENS *et al.*, 2020). This data is in line with another study that shows that male players were 2.183 times more likely to develop GD than women (SEVERO, 2020). Just like the study by (FERREIRA *et al.*, 2021) in which boys showed more GD and higher scores on the GAS scale (Gaming Addiction Scale). According to (ROJAS-JARA *et al.*, 2022) they are the ones who spend more hours - daily and weekly - playing than those without this disorder (ROJAS-JARA *et al.*, 2022).

The proportion of time spent playing online was a significant predictor of GD, reinforcing the idea that online interaction increases the risk of addictive behavior (FERREIRA *et al.*, 2021). In a randomized clinical trial carried out by Sanchez-Iglesias *et al.* (2020), a higher IGDS9-SF score was associated with more days of play per week and a greater number of hours of play per week. One study also found supporting evidence for the association between increased time spent gaming and increased likelihood of developing GD. More specifically,

participants who reported playing ≥ 20 hours per week were 13.5 times more likely to experience GD compared to those who reported playing ≤ 1 hour per week (SEVERO, 2020).

Furthermore, evidence shows that adolescents with GD have important relational problems with their families and/or peer groups and avoid them through virtual interactions with games (ROJAS-JARA *et al.*, 2022). “Harsh and rejecting relationships within a family can encourage more gambling; just as problem gambling harms relationships.” (NIELSEN *et al.*, 2021).

According to the self-determination model, when individuals' needs for autonomy, competence and relationships are not met in real life (by their parents), they will seek to fulfill these needs in their virtual life in games (RYAN AND DECI, 2000). Thus, video games and their virtuality are described as a safeguard for adolescent suffering or as an alternative to real contexts (e.g., home, school, etc.) that can be seen as aversive (ROJAS-JARA *et al.*, 2022).

At the same time, a place that maintains a permissive family culture, in which “technically it would be satisfying the children's needs” in the use of video games until adolescence in environments with high availability of electronic devices, facilitates early contact with video games having a greater propensity gaming disorder (ROJAS-JARA *et al.*, 2022).

Evidence indicates several risk factors in relation to GD in adolescents, such as male gender, low emotional control, difficulties in basic social skills, low self-esteem, impulsivity, drug use and the presence of disorders such as ADHD, anxiety, and depression. Other risk factors found were family conflicts, low communication with the family and poor parental supervision. Furthermore, playing with strangers, multiplayer video games, games with different modalities and functions, and freely accessible games have also been identified as risk factors for the development of GD. Protective factors against this disorder were also found, such as academic commitment and maintaining real social relationships (ROJAS-JARA *et al.*, 2022).

According to Ferreira *et al.* (2021) the most significant predictor of GD was the presence of mental disorders. It's unclear whether gambling is a risk factor for developing other mental illnesses or a coping strategy for dealing with them.

Furthermore, role-playing and battleground games are evidenced as more addictive because of their accessibility, visibility, and time spent on them. This makes players in these sports more likely to have higher scores on the mental disorders scale due to low self-control, requiring more attention to preventing mental disorders in these groups. (ROJAS-JARA *et al.*, 2022; FERREIRA *et al.*, 2021; SON *et al.*, 2013). Another study recommended the continuation

of multidisciplinary research, with the incorporation of different professional focuses and the use of quantitative and qualitative methodologies, in order to elucidate the clinical implications of RPG games (SCOTT & PORTER-ARMSTRONG, 2013).

3.2 ETIOLOGY

Electronic games are currently great companions for most children and adolescents around the world, a habit that may or may not be harmful to the individual's health and development. The problem begins when the game takes up a large part of the person's time, interfering with their social, family and school life, and even causing harm, this habit is still maintained and often becomes progressive (NIELSEN *et al.*, 2021).

A study on the causes and psychosocial consequences of GD in adolescents indicates that signs of poor psychosocial well-being, such as decreased social competence, increased loneliness and low self-esteem, generally lead to an increase in GD six months later. The study also found a relationship between loneliness and gaming disorder, indicating that loneliness is both a cause and a consequence. Psychosocial causes and consequences were similar for both sexes, although adolescent boys were much more likely to show signs of GD than girls. Thus, it has been suggested that these psychosocially vulnerable players are particularly susceptible to pathological involvement in games (LEMMENS *et al.*, 2011).

3.3 PATHOPHYSIOLOGY

At a cerebral level, the studies consulted agree that GD causes an increase or decrease in the activation of different areas of the brain, and that this has an effect on the onset and evolution of this disease. Thus, elements that we describe as typical of GD in adolescents (impulsivity, emotional regulation problems and predilection for a virtual self to replace the real self) would have a cerebral correlate linked, on the one hand, to a subconscious - activation of the prefrontal lobe, the superior and inferior frontal gyrus and the anterior cingulate cortex and, on the other hand, for an overactivation of the occipital lobe, the cerebellum and the post- and pre-central gyrus (ROJAS-JARA *et al.*, 2022).

Studies using neuroimaging have found similarities in abnormal brain structures and functions between individuals addicted to substances and adolescents with GD, which interfere with the process of understanding, reasoning, memory and learning. These changes may reflect a compensatory mechanism for maintaining behavioral performance, as well as revealing a secondary change induced by long-term video games through a mechanism of brain plasticity,

which is more susceptible in this age group as they are still in the development phase. (DU *et al.*, 2017)

Through research that characterized brain activity among adolescents, it was observed through functional magnetic resonance analysis that individuals who had GD showed decreased brain activity in response to images that represented parental affection, more specifically in the caudate gyrus, middle temporal gyrus and occipital lobe. However, there was an increase in activity in the middle frontal and inferior parietal lobes in response to online game scenes. (HAN *et al.*, 2012)

3.4 CLINICAL CONDITION

Evidence indicates that teenagers with gaming disorder have a significant level of anxiety, depression, aggression, impulsivity, low self-esteem, isolation and distressing personality traits. On an emotional level, affective instability, mood changes and the appearance of anxious-depressive states were found. At a cognitive level, children with GD are at risk of developmental delays (KISELEV, 2020). Ruminant thinking about the game and an attachment to the virtual identity over the real one were observed, which generates relevant conflicts in the cognitive self-concept (ROJAS-JARA *et al.*, 2022). Evidence shows that the “digital environment” can harm visuospatial functions (KISELEV, 2020). At a behavioral level, research has identified an influence on fewer hours of sleep, quality and eating times, and distancing from real social interactions, generating progressive isolation (ROJAS-JARA *et al.*, 2022), worse memory, attention and cognitive and academic skills among school-age children (FRACHAKH *et al.*, 2020). A relationship was also found between high scores on the IGDS9-SF and worsening health in adolescents and young adults (SANCHEZ-IGLESIAS *et al.*, 2020). Furthermore, associations have been described between GD and increased depressive symptoms, worse sleep quality, and increased time spent playing games. In this study, the majority of participants at risk for GD presented severe symptoms of depression (SEVERO, 2020).

A study on the negative consequences of video games showed that addiction related to them is associated with cases of depression, decreased academic performance and personal conduct problems, but is not associated with excessive alcohol consumption. However, the amount of time spent playing games is insignificant in determining these cases (BRUNBORG, *et al.*, 2014). Meanwhile for Frachakh *et al.* (2020), the results found come from the fact that more time spent playing video games means less time to carry out academic activities, as well as fewer hours of sleep in general, which makes children less alert and more susceptible to

cognitive errors. In addition, they state that parents with a higher level of education raise their children in a similar educational way, improving their cognitive and academic skills. Given that systematic reviews have provided evidence that violent exposure to video games is positively associated with aggression, increased aggressive behavior; increased aggressive cognitions; increased aggressive affect, increased desensitization and decreased empathy; and increased physiological arousal (CALVERT *et al.*, 2017). A recent study revealed that more than 30% of elementary school students play violent video games weekly (DeCAMP, 2017).

According to a study carried out by Lam (2014), the epidemiological evidence on the relationship between Internet gaming addiction and sleep problems is not strong. The reason for the lack of evidence may be due to the lack of well-designed studies on the specific issue of Internet gaming addiction and sleep problems. A more recent study found an association between sleep problems and severity of GD (SEVERO, 2020).

3.5 DIAGNOSIS

The DSM-5 establishes 9 criteria for diagnosing gaming disorder, of which at least 5 criteria must be experienced within a 12-month period, without determining the level of severity. These nine criteria are: (1) concern about internet gaming; (2) withdrawal symptoms; (3) increased need to spend more time playing games; (4) inability to reduce playing time or unsuccessful attempts to stop playing; (5) loss of interest in other previously pleasurable activities due to gaming; (6) continue playing despite the problems caused; (7) misleading family members or others about the amount of time spent gaming; (8) use of games to alleviate negative feelings; (9) risk or impairment of loss of employment and interpersonal relationships (AMERICAN PSYCHIATRIC ASSOCIATION, 2018). The amount of time spent online or playing games is not part of the DSM-5 criteria, but is an indicator of pathological use (SZASZ-JANOCHA *et al.*, 2020).

Gaming disorder measuring instruments designed based on DSM-5 criteria come mainly from Asia and Europe. Currently, there has been progress in the description of this disorder, with the definition of new diagnostic criteria by the World Health Organization and new instruments to include it (ROJAS-JARA *et al.*, 2022). There are several diagnostic scales around the world. Among them are the GAS-7 (Gaming Addiction Scale (7-item)); VAT (Video Game Addiction Test); AICA-S (Scale for Assessment of Internet and Computer Gaming); IGD (Internet gaming disorder); IGD-9 (Lemmens IGD Scale (9-item)); CIUS (Compulsive Internet Use Scale); POGQ-SF (Problematic Online Gaming Questionnaire–Short Form); YDQ (Young Diagnostic Questionnaire); PVP (Problematic Videogame Playing Scale); GAIT (Gaming

Addiction Identification Test); CI (confidence interval); IF (standard error); GASA (Gaming Addiction Scale–Adolescent) (STEVENS *et al.*, 2020).

A study carried out the cross-cultural adaptation of the IGDS9-SF instrument, created to assess symptoms of gaming disorder according to the DSM-5 and has been the most frequently used internationally, with several psychometric validation studies and adaptation to various languages. A randomized clinical trial showed evidence for the reliability of the Spanish version of the IGDS9-SF, when applied to a group of adolescents aged 12 to 22 years of both sexes. The authors adopted a rigorous clinical approach, with endorsement of at least five of the GD criteria, responding “very often” (the highest score) on at least five IGDS9–SF items (SANCHEZ-IGLESIAS *et al.*, 2020). The Brazilian IGDS9-SF was adequately adapted to the Brazilian context and had its content validity assessed. Future research should now evaluate the psychometric properties of the Brazilian IGDS9-SF in terms of its validity and reliability using a robust quantitative methodology, in order to further corroborate the suitability of the instrument (DONADON *et al.*, 2020).

3.6 PREVENTION AND TREATMENT

Treatment is varied and the first choice is interventions based on cognitive-behavioral therapy (CBT). The article by Lindenberg *et al.* (2020) addresses the effectiveness of this type of treatment in preventing gaming disorder and unspecified Internet use disorder in adolescents. They selected 5,549 high school students at risk of gaming disorder and unspecified internet use disorder and randomized them to the PROTECT intervention group (n = 167) and the control group (n = 255). They found a significantly greater reduction in the severity of gambling disorder and unspecified internet use disorder symptoms in the PROTECT intervention group compared to the assessment-only control group. The incremental improvement among PROTECT participants compared to control participants represented a 39.8% vs 27.7% reduction in symptoms over 12 months. A reduction in procrastination was also observed (LINDENBERG *et al.*, 2022).

When we think about Cognitive-Behavioral Therapy (CBT) it was described by parents of children with gaming disorder, improvement in general psychopathological symptoms, depressive symptoms, improvement in social anxiety and school performance with CBT after 12 months of sessions. The findings are consistent, as they were previously related to the high comorbidity of abusive use of internet games with depression and anxiety disorders (SZASZ-JANOCHA *et al.*, 2020).

Another Spanish study evaluated the effects and changes in relation to GD symptoms, psychopathological symptoms and comorbidities, emotional intelligence, self-esteem, social skills, family environment, therapeutic alliance and perceptions of change, comparing standard CBT with the PIPATIC program (Programa Individualized Psychotherapeutic for Addition to Information Technology and Communication) recently developed (TORRES-RODRIGUEZ *et al.*, 2018). The goal of the PIPATIC program is to provide specialized psychotherapy for adolescents with symptoms of GD and associated comorbid disorders. Both groups showed a significant reduction in symptoms in relation to GD, but individuals in the PIPATIC group showed statistically more significant changes than the control group; the PIPATIC group demonstrated significant reductions in comorbidity symptoms reported by patients and their families.

In 2019, a randomized clinical trial attempted to show the effectiveness of GameOver Intervention (GOI), a parent-based program developed by researchers. Participants were parents of elementary school students, with 163 (77% female; Mage = 42.70) and 199 (83% female; Mage = 41.82) participating in the intervention and control conditions, respectively. Participants assessed their children's gaming time, exposure to violent video games, and gaming disorder symptoms at three time points. The results indicate an overall reduction in playing time over the three-month period. Regarding symptoms of childhood gaming disorder, there was no significant evidence that the intervention condition was better than the control condition at decreasing this intervention target. The authors conclude that the GOI may serve as a primary intervention proposal (LI *et al.*, 2019).

A study carried out in Norway evaluated the effectiveness of a guide aimed at parents of children aged 8-12 with the aim of regulating video game behavior in children, used for 4 months. However, it was noted that there was no improvement in video game problems, sleep problems and bedtime resistance, parental mediation or effectiveness of parental limits. The study suggests a longer period of time and better counseling and monitoring of parents and children (KROSSBAKKEN *et al.*, 2018).

Furthermore, the treatment program improved identity diffusion, self-devaluation, emotional intelligence, social skills, and reduced family conflict. In contrast, the control group experienced significant positive changes in anxiety, attention problems, aggressive behavior, and general problems reported by relatives. Post-treatment results demonstrated significant differences between the two groups in the number of hours per week of gaming, GD symptoms, comorbid disorders, externalizing problems, overall total problems, emotional intelligence, and family relationships; in addition to the bond between patient and therapist, those undergoing

PIPATIC treatment (compared to the control group) found the treatment more satisfactory; and the PIPATIC program demonstrated a greater reduction than CBT treatment in GD symptoms and improvement in skills (TORRES-RODRIGUEZ *et al.*, 2018).

Based on the approach to risk factors, family and environmental influences and the main problems caused by GD, a therapy called multidimensional family therapy (MDFT) was proposed, which uses as its main focus the most important aspects of a teenager's life (school, family, friends, relationships and oneself) compared to family therapy as usual (FTAU) aims at family communication and does not present treatment stages like MDFT (NIELSEN *et al.*, 2021). MDFT consists of a few steps, forging multiple therapeutic alliances, delivering targeted interventions to youth, parents, and possibly others. This includes improving family communication and relationships, strengthening competent parenting practices, and helping adolescents develop more adaptive and prosocial coping skills. The last step involves developing a relapse prevention plan and completing treatment” (NIELSEN *et al.*, 2021).

At the beginning, all adolescents had GD, after a period of 6 months the presence of these criteria dropped drastically with both therapies and after 12 months none of the patients undergoing MDFT met criteria for GD; in relation to playing time, there was no significant effect. In terms of quality of life, there was an important fact: the adolescents did not identify problems in their behavior and during monitoring this decrease became more pronounced, in relation to parents, they saw their children's behavior as a major problem and after monitoring this concern decreased (NIELSEN *et al.*, 2021).

Another research carried out with two groups of teenagers, with and without addictions to electronic games, proposed the following methodology: families were encouraged to carry out homework aimed at increasing family integration for more than 1 hour/day and 4 days/week over 3 weeks. After this period, the improvement in family relationships was associated with an increase in brain activity related to the caudate nucleus in response to stimuli of family affection, and inversely associated with changes in playing time. These factors indicate that family cohesion can be a useful intervention in the treatment of GD (HAN *et al.*, 2012).

Finally, the evidence consulted offers key elements to better understand GD in adolescents. This includes identifying the motives for gambling, conscious and unconscious, the value of family cohesion in the manifestation and treatment of GD and the importance of the therapeutic process, which can be complemented by psychoactive drugs that are indicated for impulse regulation of other disorders, such as anxiety or ADHD (ROJAS-JARA *et al.*, 2022). According to a study, targeting the duration of gaming sessions, especially online sessions, can reduce this new addiction in youth (FERREIRA *et al.*, 2021).

3.7 LIMITATIONS

The present study presented some limitations, such as the small number of randomized clinical studies, the short time to carry out the work, few studies with evidence of the impacts of gaming disorder in children when compared to adolescents and young people, no studies with children under 6 years old and impact on neurodevelopment. Despite these limitations, our findings provided relevant information on the prevalence of gaming disorder in children and adolescents in Brazil and around the world, main risk factors, pathophysiology, symptomatology and treatment, data on which can be used for cross-cultural comparisons in other research and to open new avenues of discussion on the topic.

4 CONCLUSIONS

From this study it was possible to identify a worldwide prevalence of GD of 1.96%. Among the risk factors for GD, family conflicts, little communication with the family, male sex, greater number of hours playing (> 20 hours), online games, RPG and battlefield games, permissive family culture, environments with high availability of electronic devices, individuals' needs for autonomy, competence and relationships are not met in real life (by parents), low emotional control, difficulties in basic social skills, low self-esteem, impulsivity, drug use and the presence of disorders such as ADHD, anxiety and depression, playing with strangers, multiplayer video games, games with different modalities and functions and free access games were also identified. Protective factors for GD were also found, such as school commitment and maintaining real social relationships.

The etiology of gaming disorder has been strongly associated with decreased social competence, increased loneliness, low self-esteem and psychosocial vulnerability. Regarding the pathophysiology of GD, activation of the prefrontal lobe, superior and inferior frontal gyrus and anterior cingulate cortex and overactivation of the occipital lobe, cerebellum and post- and pre-central gyrus were identified. Decreased brain activity was also found in response to images representing parental affection, more specifically in the caudate gyrus, middle temporal gyrus and occipital lobe, and increased activity in the middle frontal and inferior parietal lobes in response to online game scenes.

Regarding the clinical picture in adolescents with GD, emotional instability, mood changes and anxious-depressive states are observed. Furthermore, at a behavioral level, a decrease in cognitive and academic skills, distancing from real social interactions, progressive isolation and an increase in aggressive behavior and a decrease in empathy were identified when exposed to violent games. Research has identified cognitive changes resulting in impairment of

visuospatial functions, in addition to changes in memory and attention. There is evidence showing harm to physical health, due to problems with sleep and eating, and mental health, with emphasis on the depressive symptoms presented.

Currently, the 9 DSM-5 criteria are commonly used to diagnose GD, but today there are several more specific scales to evaluate this type of diagnosis, the most used being the IGDS9-SF. This was adapted to the Brazilian context and had its content validity assessed, but research should assess its reliability using a robust quantitative methodology, in order to further corroborate the suitability of the instrument.

Although there are pharmacological options for treating GD, the first choice is cognitive behavioral therapy (CBT)-based instructions, which are shown to efficiently reduce the severity of complications arising from this disorder. There are also individualized programs, which were relevant in reducing the symptoms of comorbidity resulting from GD, or at least, in reducing the time spent playing games. Although counseling only for parents and guardians has not been shown to be effective, the therapeutic approach in the family group achieved good results in self-perception of behavior problems, increased parental concern regarding games, in addition to improving family relationships. As previously mentioned, therapy can be complemented with medications indicated for regulating other disorders, such as anxiety or ADHD.

We hope that our findings can help clarify risk factors, determine more susceptible groups, and assist in the development of GD prevention strategies in children and adolescents.

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ANNEXES

Table 1. Description of the studies selected based on the inclusion criteria and described according to year of publication, authorship, journal/institution, title, country of study, type of publication, age range of the population studied and type of game. Also considering the topics of the Evidence Summary guided by the PRISMA protocol.

	Year	Authorship	Periodical	Title	Country	Journal	Age range	Evidence
1	2022	Lindenberg K, Kindt S, Szász-Janocha C	Randomized Clinical Trial	Effectiveness of Cognitive Behavioral Therapy-Based Intervention in Preventing Gaming Disorder and Unspecified Internet Use Disorder in Adolescents: a Cluster Randomized Clinical Trial	Germany	JAMA Network	12 to 18 years old	PROTECT intervention effectively reduced symptoms
2	2019	Li AY, Chau CL, Cheng C	Randomized Clinical Trial	Development and Validation of a Parent-Based Program for Preventing Gaming Disorder: the Game Over Intervention	Hong Kong	International Journal of Environmental Research and Public Health	Average age of children: 10.22 (1.01) intervention. 9.97(0.95) control	Game Over Intervention (GOI) for parents. Showed reduction in playing time.
3	2021	Philip Nielsen, Maxwell Christensen, Craig Henderson, Howard A Liddle, Marina Croquete-Krokar, Nicolas Favez, Henk Rigter	Randomized Clinical Trial	Multidimensional family therapy reduces problematic gaming in adolescents: A randomised controlled trial	Switzerland	Journal of Behavioral Addictions	12 to 19 years old	The trial demonstrates the effectiveness of family therapies for adolescents with IGD, in this regard MDFT proved to be superior to FTAU
4	2020	Sanchez-Iglesias I, Bernaldo-de-Quiros M, Labrador FJ, Estupina Puig FJ, Labrador M, Fernandez-Arias	Randomized Clinical Trial	Spanish Validation and Scoring of the Internet Gaming Disorder Scale - Short-Form (GDS9-SF)	Spain	Spanish journal of Psychology	12 to 22 years old	There is evidence for the reliability of the Spanish version of the GDS9-SF, when applied to a sample of 2,173 video game players, composed of children, adolescents and young adults (aged 12 to 22) of both sexes, recruited from health centers

								educational institutions in the city of Madrid.
5	2019	Torres-Rodriguez A, Griffiths MD, Carbonell X, Oberst U	Randomized Clinical Trial	Treatment efficacy of a specialized psychotherapy program for Internet Gaming Disorder	Spain	Journal of Behavioral Addictions	12 to 18 years old	PIPATIC was effective in treating GD and its comorbidities
6	2018	Krossbakken E, Torsheim T, Mentzoni RA, King DL, Bjorvatn B, Lorvik IM, Pallesen S	Randomized Clinical Trial	The effectiveness of a parental guide for prevention of problematic video gaming in children: a public health randomized controlled intervention study	Norway	Journal of behavioral addictions	8 to 12 years old	The guide was not effective in improving video game problems, sleep problems and bedtime resistance, parental mediation and limit effectiveness
7	2020	Youssef Farchakh, Chadia Haddad, Hala Sacre, Sahar Obeid, Pascale Salameh and Souheil Hallit	Cross-sectional Study	Video gaming addiction and its association with memory, attention and learning skills in Lebanese children	Lebanon	Child Adolesc Psychiatry Ment Health	9 to 13 years old	A study showed a significant association between greater video game addiction and worse: episodic memory, cognitive and academic skills and worse clinical care. Having a college-educated parent was significantly associated with better attention and better cognitive and academic skills
8	2020	Szasz-Janocha C, Vonderlin E, Lindenberg K	Randomized Clinical Trial	Treatment outcomes of a CBT-based group intervention for adolescents with Internet use disorders	Germany	Journal of Behavioral Addictions	9 to 19 years old	There was a significant reduction in symptoms after the PROTECT+ intervention program
9	2020	Kiselev S	Randomized Clinical Trial	Children with Computer GAME Addiction Benefit from Visuospatial Training	Russia	Value health regional issues.	6 years old	Visuospatial training had a positive effect on the visuospatial functions of children with addiction to

								electronic games
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Subtitle: PROTECT (Professioneller Umgang mit technischen Medien [Professional Use of Technical Media), IGD (Internet Gaming Disorder) MDFT (Multidimensional Family Therapy) FTAU (Family Therapy As Usual), GDS9-SF (Gaming Disorder Scale 9-Short Form), PIPATIC (Programa Individualizado Psicoterapéutico para la Adicción a las Tecnologías de la Información y la Comunicación - Individualized Psychotherapeutic Program for Addiction to Information and Communication Technologies) CBT (Cognitive Behavioral Therapy)

Source: Article Authors