

Internet gaming disorder in children: a narrative review

Abstract

Method: This narrative review summarizes research from the years 2019-2024 on internet gaming disorder in children.

Results: This recent research suggests a prevalence rate ranging from 20% in Brazil to 62% in Saudi Arabia, although a review across multiple studies reported an average of a much lower prevalence of 5%. Correlates/comorbidities of internet gaming disorder have included anxiety, depression, ADHD and autism. Other risk factors for this disorder include being male, impulsivity, being neurotic, being narcissistic and being exposed to gaming, violent and non-supportive behavior of their parents. Negative effects include attention, cognitive and academic performance problems as well as aggressive behavior. Only one review was found on potential underlying biological mechanisms which suggested dysregulation of the brain's reward system including the prefrontal cortex, limbic system and the amygdala. Only a few papers on interventions appeared in this literature suggesting the effectiveness of cognitive behavioral therapy and methylphenidate.

Discussion: The studies in this review highlight the prevalence and severity of internet gaming disorder in children. However, they are limited by being primarily based on mixed-age child and adolescent samples as well as results that have varied by the correlates/comorbidities of the disorders.

Keywords: internet gaming disorder, depression, children

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Introduction

This narrative review is a summary of 26 papers on internet gaming disorder in children and adolescents that were derived from a search on PubMed and PsycINFO using the terms internet gaming disorder in children and the years 2019–2024. Other terms have been used for this disorder including gaming disorder, internet gaming addiction and videogame addiction. Although the term “children” was entered in this literature search, many of the research samples have included both children and adolescents. Exclusion criteria for this review included papers on proposed protocols, case studies and non-English language papers. The publications can be categorized as prevalence data, negative effects, comorbidities, other risk factors, potential underlying biological mechanisms and interventions. This review is accordingly divided into sections that correspond to those categories. Although some papers can be grouped in more than one category, 6 researchers have reported prevalence rates, 4 papers are focused on negative effects, 14 studies involve comorbidities of internet gaming disorder, 10 are focused on other risk factors, 1 on potential underlying biological mechanisms and 3 on interventions.

Definition and prevalence data

The definition for internet gaming disorder (IGD) in children is the repetitive use of internet-based games that lead to significant issues with functioning. The DSM-5 (2013) reference suggested that internet gaming disorder was most common in male adolescents who were 12-to-20 years of age and was more prevalent in Asian countries than in North America and Europe. However, gaming devices are increasingly available to younger children and increasing numbers of children worldwide are engaging in gaming and being diagnosed with internet gaming disorder. In a recent study, for example, 96% of children 8-to-10-years-old in Italy had one or more devices.¹ In

a study from the U.S., three quarters of American families were reported to own a video game console and 90% of children older than two-years-old were noted to play video games.² In this sample, youth ranging in age from 8-to-17-years old were reported to spend 1.5 to two hours per day playing video games. These youth were considered at risk for internet gaming addiction.

Risk behavior for internet gaming disorder has been reported in at least two studies. A prevalence of 8%, for example, has been noted for risk behavior in youth from South Korea.³ In this two-year longitudinal study, 3rd, 4th and 7th graders (N=2319) were reportedly engaging in more than four hours per day on internet gaming and were also diagnosed as having ADHD. This risk behavior has been labeled “hazardous gaming” by others who noted that it occurred exclusively in 35% of their sample of 8-to- 12-year-old children (N=871).⁴ In this study, 91% of children with IGD met criteria for the risk behavior of “hazardous gaming”.

The prevalence of internet gaming disorder has varied widely across countries. For example, 20% is the prevalence rate reported for Brazilian youth⁵ and 26% is the prevalence noted in a study on youth from Tunisia,⁶ while a significantly higher prevalence (62%) has been reported in a study from Saudi Arabia.⁷ The data from these studies were derived from the Game Addiction Scale (GAS-7) that has 7 items and is commonly used for diagnosing IGD. These sizeable differences are difficult to interpret. They may reflect cultural differences, or the lesser prevalence in the Tunisia study may relate to its sample size being three times the size of the Saudi Arabia sample (N=1,353 in the Tunisian sample versus 393 in the Saudi Arabia sample). The prevalence rates have tended to be lower in larger samples. For example, in a meta-analysis of 12 samples combined, the average prevalence was as low as 5% (Table 1).⁸

Table 1 Prevalence of internet gaming disorder (IGD) in children (and first authors)

Prevalence	First authors
In Italy, 96% of children 8-10-years-old have one or more devices	De Pasquale
In the U.S., 90% of children older than two-years play video games	Alanko
In South Korea, 8% are at risk for internet gaming disorder	Jeong
Hazardous gaming in 91% of 8-12-year-old children with IGD	Kewitz
In Brazil, 20% have IGD	Ferreira
In Tunisia, 26% have ICD	Amara
In Saudi Arabia, 62% have IGD	Alrahili
In a meta-analysis of 12 studies, 5% have IGD	Limone

Negative effects of internet gaming disorder in children

The negative effects of internet gaming disorder in children have included sleep disturbances, attention problems, cognitive dysfunction, inferior academic performance, and aggressive behavior. Typically, the children experienced more than one of these problems.

In the meta-analysis on 12 studies already mentioned, online gaming, which was more frequent than offline gaming, was noted to interfere with sleep and academic performance.⁸ However, as in most of the studies in this literature, internet gaming disorder was compounded and confounded by anxiety and depression symptoms.

Similar data were reported in a paper entitled “Internet and video games: Causes of behavioral disorders in children and teenagers”.⁹ In this systematic review, excessive use of video games led to **sleep disorders and poor school performance** as well as **aggressive behavior**. It was also said to hinder **social relationships** which could be related to the aggressive behavior noted.

The frequent report of poor school performance could relate to the effects of internet game addiction on **attention, cognition and learning skills**. These relationships were noted in a study from Egypt (N= 169 children 9 – 13-years-old), in which several scales were administered including the Game Addiction Scale for Children, the Children’s Memory Questionnaire, the Clinical Attention Problems Scale and the Learning, Executive and Attention Functioning Scale.¹⁰ Videogame addiction was related to cognitive and learning skills mediated by attention functioning. That attention functioning was a mediator was not surprising given that attention was a component of the outcome variable (the Learning, Executive and Attention Functioning Scale). In a similar study comparing youth with IGD (N=40) versus those without IGD (N=64), the IGD group also had attention and cognitive problems along with behavioral problems.¹¹

These problems are arbitrarily called negative effects although they could also be labeled risk factors. It is difficult to know whether these problems preceded or followed or were contemporaneous with internet gaming disorder diagnoses given that most of the studies in this literature were cross-sectional not longitudinal.

Comorbidities of internet gaming disorder in children

Several mental disorders have been notably comorbid with internet gaming disorder. These include depression, anxiety, comorbid depression and anxiety, ADHD and autism. Again, because the studies typically involved cross-sectional data, it’s not clear whether these

comorbid disorders preceded, followed or were contemporaneous with the internet gaming disorder diagnoses.

As already noted for the sample of children from Brazil (N=407 ten-18-year-old youth), 20% were diagnosed with gaming disorder.⁵ In a logistic regression model, the variables that contributed to the variance in gaming disorder were playing online, being diagnosed with a **mental disorder** and spending **more hours in non-stop gaming**.

Depression has been comorbid with internet gaming disorder in several studies. In one of the few longitudinal studies, the results are reflected in the title of the paper, “Reciprocal relationship between **depression** and internet gaming disorder in children: a 12-month follow-up of the iCURE study using cross-lagged path analysis”.¹² The results of this study on elementary school students (N=366) suggested that depression at baseline predicted severity of IGD at the 12-month follow-up assessment and IGD at baseline reciprocally predicted the level of depression at the 12-month follow-up assessment.

That reciprocal relationship was not evident in a one-year longitudinal study from China (N=1047).¹³ In that sample, time 1 IGD predicted depression at time 2, but time 1 depression did not predict IGD at time 2.¹³ Depression and shyness were reciprocally related, but shyness was not related to IGD.

The reciprocal relationship of depression and IGD¹² could be interpreted as gaming being an escape from depression and IGD might be expected to lead to depression following the isolation and potential loneliness of solo game playing. Surprisingly, isolation was not mentioned in this literature and loneliness was only mentioned in one study.¹⁴

State anxiety has also been noted to lead to video game use and addiction in children (N=162 eight-to-10-years-old) in Italy.¹ Although females had higher levels of anxiety, males spent more time on video games. The relationship between anxiety and IGD has also been noted in primary school children from China (N=667).¹⁵ In this study, a network analysis revealed not only anxiety, but also **social phobia and panic disorder** as risk factors for IGD.

The **comorbidity of depression and anxiety** has been noted in several studies on internet gaming addiction in children. In the study from Saudi Arabia (N=393 surveys), the prevalence of internet gaming disorder was 62%, while 63% were playing video games every day and 25% were gaming on average more than five hours per day.⁷ The risk factors were young age, playing games every day and multiplayer games. Higher scores on the Game Addiction Scale (GAS-7) were correlated with higher scores on inattention, **anxiety and depression**. Younger males were at greater risk.

In the Tunisian study already mentioned (N=1353 youth), 26% were problematic game users.⁶ These data were also based on the Game Addiction Scale (GAS-7). The authors also noted greater depression and anxiety symptoms as well as Facebook addiction in their sample. Surprisingly, this was the only study that referred to Facebook addiction as another form of addiction that was comorbid with internet gaming addiction.

In a systematic review on eighteen articles, gaming disorder appeared in a vulnerable group with predisposing factors including **depression, anxiety and ADHD**.¹⁶ Adolescents and males had greater scores on the Gaming Addiction Scale (GAS-7). These authors uniquely implied that comorbidities preceded gaming addiction and implicated parents as well from the studies they reviewed. This conclusion by the authors that the comorbidities preceded IGD

was surprising given that most of the findings in this literature are based on cross-sectional not longitudinal data, making it impossible to determine causality. In another review on the effects of playing video games (N= 24 studies), anxiety, depression and loneliness were noted.¹⁴ The male youth were especially vulnerable.

In a study on children and adolescents diagnosed with ADHD (N = 51) 25% had Internet gaming disorder with the use of internet occurring at age 5, smartphone use at age 6 and internet gaming at age 7.¹⁷ Although the group with Internet gaming disorder had earlier use of gaming, they were not inferior on academic performance.

In another sample of children with ADHD as compared to children without ADHD (N = 99 in each group), exposure to video games was significantly greater in the ADHD group (58% in the ADHD group versus 27% in the non-ADHD group).¹⁸ Eleven percent of the ADHD group had video game addiction as opposed to 4% in the non- ADHD group.

Internet gaming disorder has also been noted in children and adolescents with **autism spectrum disorder (ASD)**.¹⁹ In this study (N=62 boys with ASD and 31 without ASD, 4-17 years-old), boys with ASD played video games for longer times, preferred playing alone as opposed to playing in the multiplayer mode (Table 2).

Table 2 Negative effects and comorbidities of internet gaming disorder in children (and first authors)

Negative effects	First authors
Interference with sleep and academic performance	Limone, Lerida-Ayala
Attention, cognitive and learning skills affected	Ali Kappi, Tanigor
Comorbidities	
Depression	Jeong, Wang
Anxiety	DePasquale, Yang
Anxiety and depression	Alrahili, Amara
Anxiety, depression and ADHD	Han
Anxiety, depression and loneliness	Pallavicini
ADHD	Razjouyan
Autism spectrum disorder	Paulus

Risk factors for internet gaming disorder in children

Risk factors for internet gaming disorder in children have appeared in recent literature. They could be categorized as parental factors and child variables (Table 3).

Table 3 Risk factors for internet gaming disorder in children (and first authors)

Parental risk factors	First authors
Gaming	Wernicke
Phubbing	Zhou
Exposure to parental violence and low parental support	Han
Child risk factors	
Being male	DePasquale, Han, Pallavicini, Alrahili
Impulsivity	Blaxco-Fontecilla
Neuroticism	Wernicke
Narcissism	Cevik
Social phobia and panic disorder	Yang

Negative parental risk factors

Parent variables that are notable risk factors in this literature include parent gaming, phubbing, being violent and not supportive. In

a study on parental gaming behavior (N= 493), parents rated their own and their children’s behavior.²⁰ The **gaming** behavior of the parents correlated with gaming disorder in their children.

In a study entitled “ Parental phubbing and internet gaming addiction in children: mediating roles of parent – child relationships and depressive symptoms” **phubbing** (using the cell phone that interrupted interactions with the child) was said to be a risk factor for gaming disorder.²¹ In this study on Chinese children (N=1021, mean age = 10), the relationship between parental phubbing and child internet gaming addiction was mediated by parent-child conflict and child depression.

In a review of 18 articles on internet gaming addiction in children and adolescents, negative parent behaviors were risk factors.¹⁶ The predisposing parental factors included exposure to parental gaming, **violent parent behavior** and **low parental support**.

Although negative parental behaviors would be predictable risk factors for internet gaming disorder in children, just as they have been for other disorders in children, the selection of behaviors like phubbing (which was uniquely used by one author) would seem to be a “pet variable of that researcher. Those that derived from the review of 18 articles, i.e. violent parent behavior and low parental support would seemingly be more universal.

Negative child risk variables

Negative child variables have also been risk factors. These include being male, impulsive, having neurotic and narcissistic personality traits, and experiencing social phobia.

Being male has been a factor in many studies. In one study already reviewed, 8-10-year old males from Italy spent more time on video games than females.¹ In a review of 18 studies, males had higher scores on the gaming addiction scale.¹⁶ Similarly, in a review of 24 studies, internet gaming disorder was more prevalent in male youth.¹⁴

Impulsivity was a risk factor in a study on children and adolescents with ADHD.¹⁷ It’s not clear, however, whether impulsivity was related to the ADHD or IGD diagnoses in these youth.

Neuroticism (a personality trait associated with negative emotions) has also been correlated with internet gaming addiction in at least one study.²⁰ **Narcissism** as a specific neurotic personality trait has also been a risk factor in a study on gaming disorder in children.²² In this study from Istanbul (N=461 boys 9-15-years old), narcissism led to gaming disorder.

Social phobia and panic disorder were notable risk factors in a study on primary school students in China.¹⁵

Interventions for children with internet gaming disorder

Surprisingly, only three papers were found in this literature on interventions for internet gaming disorder. They include cognitive behavior therapy and methylphenidate. A review paper entitled “Effectiveness of available treatments for gaming disorders in children and adolescents: A systematic review”, 16 studies were included.²³

In this review, **cognitive behavior therapy (CBT)** or CBT- based interventions such as CBT combined with family therapy were the most used and the most effective interventions.

Two research groups have reported the effectiveness of **methylphenidate** for children and adolescents with gaming disorders. In both studies IGD and ADHD were comorbid. In one study (N=

62) methylphenidate was given for eight weeks.²⁴ This protocol led to a decrease in internet usage even though the medication was primarily prescribed for ADHD. The authors suggested that internet video game playing might be a means of self-medication for children with ADHD. In a literature review on youth with IGD plus ADHD, methylphenidate and atomoxetine were equally effective in alleviating Internet gaming disorder.²⁵

Although the authors concluded that these medications were effective for IGD, these medications are routinely prescribed for ADHD and were possibly effective for the ADHD comorbidity of IGD. They would need to be assessed on IGD and ADHD separately (Table 4).

Table 4 Interventions for internet gaming disorder in children (and first authors)

Interventions	First authors
Cognitive behavioral therapy	Lampropoulou
Methylphenidate	Han, Huzwagi

Potential underlying biological mechanisms for internet gaming disorder

Surprisingly, no underlying mechanism studies were found in this literature even though gaming disorder has been considered an addiction like other disorders that have been assessed by physiological and fMRI measures in children. Only one literature review appeared in this literature that wasn't focused on underlying mechanisms but did summarize a few fMRI studies.²⁶ In that review, the authors wrote that "...adolescents with IGD more frequently exhibit decreased short and medium-range connectivity among the subcortical, frontal and parietal regions involved in attentional and affective networks in line with other behavioral addictions." According to these authors, IGD is linked to functional and structural neural changes in the frontal-striatal and frontal-cingulate regions. Frontal-striatal dysfunction is also thought to promote a compulsive use of the internet and screen devices in general. Structural brain deficits in prefrontal cortex, amygdala connectivity, dopaminergic/serotonergic system and neurobiological deficits (in self-regulation, decision-making, and dysregulation of mood) are reward systems implicated in IGD. Youth experiencing IGD versus those not experiencing IGD seem to exhibit a stronger imbalance between cognitive control including frontal- parietal areas and the affective system including subcortical and limbic structures. Lower gray matter density in the dorsal lateral prefrontal cortex has also been linked to more severe IGD symptoms, depression, impulsivity and time spent gaming.

Methodological limitations of the literature

This recent literature on internet gaming disorder in children and adolescents has several methodological limitations that relate to different definitions/diagnoses, sampling, measures, and methods across studies. These limitations are highlighted by the scarcity of meta-analyses that could not be conducted likely because of significant variability of methods and measures across studies that resulted in their failure to meet criteria for meta-analysis. Although there is a sufficient literature for meta-analyses to be conducted, the authors of the few meta-analyses suggested that those analyses were limited by small samples and the heterogeneity of the children/adolescents on age and the severity of their internet gaming disorder.

The definitions and diagnostic criteria for internet gaming disorder have varied across studies with some researchers sampling children who have symptoms of internet gaming disorder referred to

as "hazardous gaming" and others who have limited their samples to youth who have received a diagnosis of internet gaming disorder. These different levels of severity have not been compared or traced developmentally in longitudinal studies. And, in many studies IGD was confounded by correlated problems including impulsivity, narcissism and social phobia and/or comorbid disorders including anxiety, depression, ADHD and autism.

Directionality could not be determined in the studies on correlates and comorbidities given that most of the studies are cross-sectional. And researchers have not traced the longitudinal development of internet gaming symptoms or the disorder. In addition, the samples have typically been a combination of children and adolescents. This is problematic given that the symptoms and comorbidities that are unique to the children versus the adolescents could not be determined. Some of the studies on symptoms have also lacked comparison groups of children without IGD and the very few intervention studies were typically not randomized controlled trials with waitlist control groups.

Most of the studies focused on an individual IGD symptom, for example, academic performance period. When multiple IGD symptoms were reported, for example, aggression, sleep and academic performance, the relative contributions of the symptoms to the severity of the disorder were not assessed by regression analyses. The absence of research on peer influences and effects of internet use in general in this literature was also surprising given the frequency of these effects on other disorders in children and adolescents.

The single paper on the effectiveness of cognitive behavioral therapy (CBT), although it was a review of 16 studies, was surprising given that multiple papers have appeared in the literature for many other disorders in children. The only other two intervention studies focused on methylphenidate which was not compared to a behavioral intervention. Surprisingly, family therapy and alternative therapies that have been effective for reducing other childhood disorders like massage therapy,²⁷ tai chi,^{28,29} yoga,³⁰ and exercise³¹ have not appeared in this literature.

Potential underlying biological mechanisms were only described in a review of the literature primarily on fMRI research. The results reported in this review suggested several different regions of the brain involving activation as well as grey matter reduction. These mixed findings likely relate to the different age groups being sampled and the different severity of the internet gaming disorder being measured in the children and adolescents.

Conclusion

Despite these methodological limitations, this literature has highlighted the prevalence of internet gaming disorder in children and adolescents. The prevalence may have recently increased as the excessive use of social media and the internet has increased. The prevalence of IGD highlights the need for more intervention research. The studies on correlates and comorbidities have helped identify children and adolescents who need therapy and the intervention data have informed clinicians on potential treatments for those with IGD.

Further research is needed to specify the relative significance of the IGD symptoms for identifying those children and adolescents and the specific intervention techniques that are effective in reducing IGD and its correlates and comorbidities.

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Conflicts of interest

The author declare that there is no conflicts of interest.

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