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Internet Gaming Disorder: A Scoping Review and Future Direction

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Abstract:

Objective: The massive popularity of digital gaming in recent decades has led to an inevitable surge in the use of digital technologies. This has made the younger population more prone to gaming, and causing an exponential rise in excessive video gaming among both children and adolescents. This scoping review summarizes and determines the scope, or coverage, of the body of empirical literature on Internet Gaming Disorder (IGD); published from 2010 to 2021. It was conducted to identify and map the available empirical evidence on IGD pertaining to its: prevalence, determinants, comorbidities and health consequences.

Material and Methods: Literature searches were made in databases; including, Google Scholar, National Center for Biotechnology Information (NCBI) and PubMed to identify relevant articles published from 2010 to 2021. This was performed using preferred reporting items for systematic reviews and the meta-analyses technique (PRISMA) exclusion and inclusion criteria. Twenty-six empirical research studies are included in the present review.

Results: There have been unexplored areas related to IGD since its introduction into the International Classification of Diseases (ICD-11) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Although its harmful impact on mental health and well-being remains untouched across the world, IGD is growing rapidly and calls for substantial worldwide consideration.

Conclusion: Findings advance the understanding of IGD, identify gaps in research and propose future research directions. Research and innovations must focus on assessment, tools, prevention, intervention and treatment of IGD.

Keywords: DSM-5, ICD-11, Internet gaming disorder, mental health, PRISMA

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Introduction

Games can impact an individual's life in many ways; since ancient times playing games has been considered necessary. The popularity of digital gaming in recent years has shifted how individuals play games and how they are studied.[1-6] Most people usually play video games for the enhancement of concentration, problem-solving skills, building teamwork, simple enjoyment and many more qualities.[1,5] Video games can vary according to type (e.g., gunfire, – role-playing, and strategy), platforms (e.g., personal computer, smartphone), modes (e.g., single-player, team playing, multi-player and competing against other players), online connectivity (i.e., playing online or offline), and purposes (e.g., defeating an opponent using violence, persuasion, or furtiveness strategies).[1,5,6] Despite some studies having endorsed the beneficial effects of gaming; such as, a common, positive experience for certain gaming platforms being to relieve pressure, connect with others, satisfy shared goals, develop more social confidence, improvement in their state of mind and making friends;[1,4] most of the published literature on digital games had documented negative effects on gamers. The popularity of excessive gaming is associated with many physical, psychological and work-related issues; such as, disturbed patterns of sleep, depression and aggression, symptoms of anxiety, poor academic performance, conflicts within the family, violence, crimes and work-related problems.[1,4,7,8] The vast, worldwide growth of gaming, and the emergence of gaming sub-cultures, are significant for the emergence of problematic gaming and gaming disorders.[1,5,7] Researchers are gradually observing that many people develop a preoccupation with video games and play compulsively; to the exclusion of other interests including: family life, work, education, sleep, leisure activities, and social connections. For these people, gaming remains no longer a useful activity, but rather one that causes clinically significant impairment or distress.[3,5,7-9]

The introduction and recognition of Internet Gaming Disorder (IGD) in the DSM-5 in 2013 is a crucial phase forward and a turning point in studying the treatment and prevention of pathological video gaming and computer use.[1,9,10] Pathological gaming, which was renamed in the DSM-5 as IGD, is defined as an individual's recurrent and persistent use of the internet, leading to clinically significant impairment or distress. Nine criteria are used to identify IGD, namely: preoccupation, tolerance, withdrawal, escape, persistence, problems, deception, conflict, and displacement[11]; with five or more criteria leading to a diagnosis.[1] Despite its name, the disorder may also involve non-internet video games.[11] To diagnose gaming disorders, patterns of behavior should have created significant impairment to personal, family, social, educational, professional, or other daily life of functioning and must have been present for at least one year.[1,8,11]

In June 2018, the World Health Organization (WHO), in the 11th edition of the International Classification of Diseases and Related Health Problems (ICD-11), included gaming disorder in the chapter on substance and behavioral addiction.[12] The WHO (2018) listed the diagnostic criteria as the following: (1) an obsession with games that is difficult to control for more than 12 months; (2) when the obsession with games is higher than other interests, resulting in a reduction in daily activities; and (3) when gaming behavior continues or escalates even after acknowledging its negative impacts.[12] In addition, the ICD-11 defines this disorder as a recurrent gaming behavior pattern that includes both online and offline gaming.[8,12]

Nowadays, scoping reviews are considered as a relatively new approach as well as a valid method to present or synthesize any evidence.[13] Instead of doing systematic reviews, researchers may undertake to scope reviews to discover knowledge gaps, scope a body of literature, explain ideas, or analyze research conduct. While beneficial in and of itself, scoping studies may also serve as an effective

prelude to systematic reviews, by confirming the relevance of inclusion criteria and prospective topics.[13] As stated in many studies it has been implied that Internet Gaming Disorder has been identified in DSM-5 of Section-III as a state warranting more clinical research and experience.[1,3,9,14] IGD has emerged as a significant public health concern globally, causing mental health issues across ages and cultures.[1,5,6] IGD is now seen and taken as a serious issue; even in countries where mental health has been neither valued before, nor addressed appropriately. Adverse consequences of video gaming, evidenced in a number of empirical findings, have illustrated the emergence of considering IGD on par with other addictive behaviors and gaming-related behavior.[1,5] Adolescence is generally identified as the most vulnerable age group (age ranging between 12 and 18 years) for being most exposed to develop addictive disorders; including gaming in the digital world.[9,14] This susceptibility rises due to neurological (i.e., developing prefrontal cortex, which is accountable for decision-making and controlling impulses), developmental (i.e., resolving needs for social belonging and identity, and challenging authority), and cultural reasons (e.g., a stressful transition to secondary school, new responsibilities, and greater independence).[1] Recent development in the field warrant more clinical research, review and experience by mental and physical health experts.[3,7,9] The current state of research evidences on IGD indicates the need for scoping reviews, with respect to its prevalence, determinants, comorbidities and health consequences. Therefore, conducting scoping reviews would determine the scope or coverage of the body of empirical literature on IGD. It would be helpful in examining emerging evidence when it is still unclear what other more specific questions can be posed and could be valuably addressed by a more precise systematic review.[13] Thus, this scoping review may help in formulating policies and drawing attention to taking measures to limit the availability of games, to reduce harm and risk in addition to providing proper help to addicted gamers.

Hence this scoping review was conducted to identify and map the available empirical evidence on IGD; published from 2010 to 2021. This review aims to advance the understanding of IGD by further identifying research gaps and proposing future research directions by presenting the status-qua of IGD in terms of its prevalence, determinants, comorbidities and health consequences.

Material and Methods

The preferred reporting items for systematic reviews and meta-analysis (PRISMA) guidelines and checklist were followed for this present study (Figure 1: Procedure depicting the selection of articles).[16] PRISMA techniques help the authors ensure transparency and complete reporting of systematic reviews and meta-analyses. Authors had developed the PRISMA statement and its explanations paper to researchers in reporting a broad range of systematic reviews, to assess the benefits and risks of a variety of health conditions.[16] This present article is a scoping review on internet gaming disorder, which intends to collate the crux of the existing empirical literature pertaining to it: mainly with respect to prevalence, determinants, comorbidities and health consequences. A search on google scholar, NCBI and PubMed database was undertaken, using the keywords: 'internet gaming disorder', 'video games,' 'risk factors of IGD,' 'addictive games,' 'IGD treatment,' 'problematic involvement in online games,' 'anxiety in IGD,' 'neuroimaging studies in IGD,' 'prevalence of IGD', 'IGD in adolescents and children', 'determinants of IGD', 'comorbidities of IGD', and 'the health consequences of.

During the search process, Boolean operators (i.e., and, or, not) were used to obtain proper and relevant papers pertaining to IGD. Searches for each keyword and phrase; such as, internet gaming disorder, video games, risk factors

of IGD, health consequences of IGD etc. were conducted separately, and the conjunction 'in' was also used in the search keywords to retrieve articles presenting different related perspectives/dimension of IGD.

To select articles of relevance for the review purpose, the following inclusion criteria were used in this study: Empirical studies reporting IGD in reference to its conceptualization, screening and assessment/psychometric tools, prevalence, determinants of IGD, psychological risk factors, comorbidity/consequences, neuroimaging studies, therapies, prevention and treatment, studies that had been published in the English language with full text available; and those specifically in the context of internet gaming disorder. Additionally, articles published between the years 2010 and 2021, were only considered in the inclusion criteria of this study.

The study's exclusion criteria included: studies that were reviews, letters to the editor, case studies, qualitative investigations, studies whose entire text were not made accessible to the public, and conceptualization, screening and assessment/psychometric tools, prevalence, determinants of IGD, psychological risk factors, comorbidity/consequences, neuroimaging studies, therapies, prevention and treatment, studies that had been publishe (in the English language dealing with online internet addiction, social media addiction, and gambling addictions.

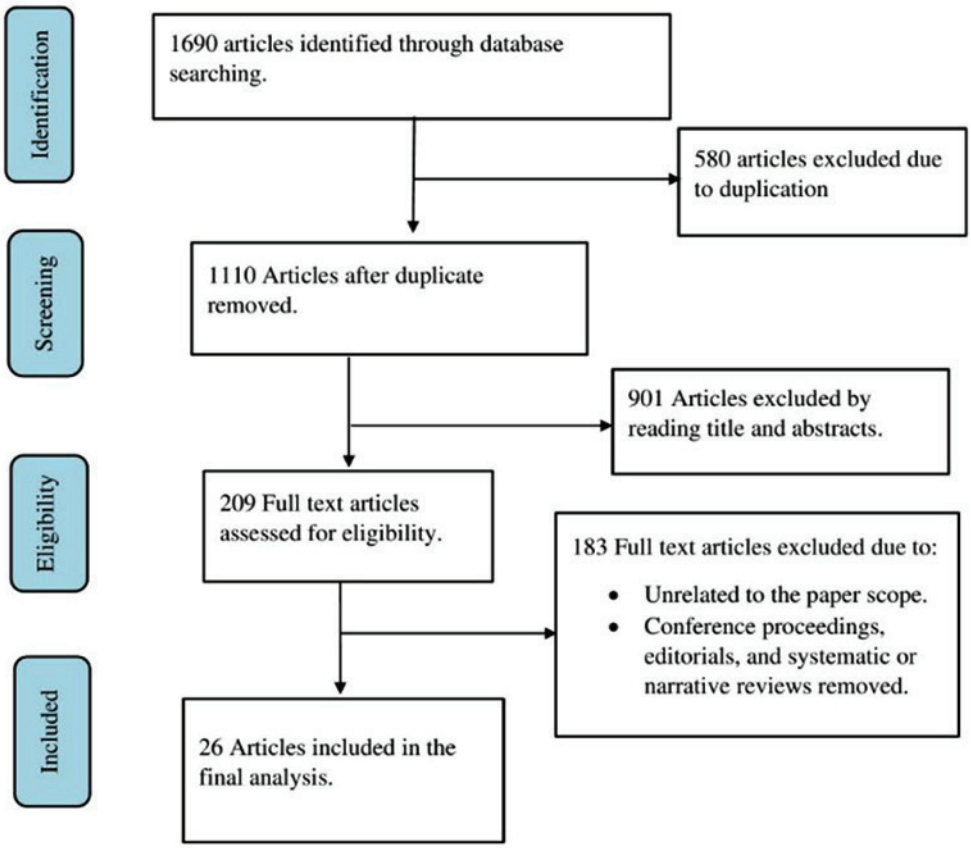

Figure 1 Flow chart of study selection for the scoping review and meta-analysis

Guided by the objective of the review and the inclusion–exclusion criteria, a literature search from several databases was conducted that yielded 1,690 articles. Following the removal of duplicates, 1,110 articles were kept for preliminary evaluation. By examining the titles and abstracts of the 1,110 publications, 901 articles were removed on the basis of the exclusion criteria. This was due to most of the 901 articles having one or two variables related to internet addiction, social media addiction and gambling addiction coupled with IGD. Two hundred and nine articles that had the word "Internet Gaming Disorder"; either in the abstract or in their title were assessed for the eligibility: 183 articles were found to be beyond the scope of the objective and inclusion criteria of this paper and were excluded from the study. The eligibility of the 209 remaining articles was assessed by examining the full text on the basis of its relevance to our study. Articles not available in full text, reviews, case studies, letters to the editors and qualitative investigations were excluded from the analysis. The remaining 26 empirical papers were incorporated into the current review (Figure 1: Procedure depicting the selection of articles). The empirical studies included in this study have a variation in sample size (ranges from 10 to 18,392) and were mostly conducted as cross-sectional, survey method, and online or web surveys (Table 1).

Results

A scoping review was carried out for summarize key concepts and findings from the chosen articles on IGD; with the intention of identifying and mapping the available empirical evidence on IGD. The available literature was segregated into different sections, accordingly, to present IGD from multiple perspectives; such as: the prevalence of IGD, determinants of IGD and comorbidities and health consequences of IGD. Table 1 summarizes the findings of these researches.

Prevalence of IGD

Prevalence studies are epidemiological measurements, providing estimates of a population affected by a given condition. Such estimates are of help in making important health-related decisions[17]: yet they bear the risk of biased assessment. Features and psychometric properties of assessment theory in conjunction with tools are thus deemed important to be considered before relying on the findings of prevalence studies.[1,10] A thorough review of the assessment tools and theory used in the selected prevalence studies of IGD found that the screening approaches to problematic gaming were inconsistent before the introduction of IGD in DSM-5 in 2013.[10,18,19] A variety of assessment tools that differed greatly in their structure, properties and purpose have been used in studies exploring IGD. Evidence shows that large variations in scientific methods and the availability of evaluation tools created hurdles in selecting the most appropriate psychometric tools for clinicians.[18,19] The Internet Gaming Disorder Scale, with a long (27-item) and short (9-item) version, is intended to measure IGD on the criteria by DSM-5. This scale's short version provides a valid and reliable assessment of IGD with high diagnostic precision, which may be used for research and assessment in male and female gamers of all ages.[10] Another scale, named: The Internet Gaming Disorder Scale short form (IGDS9-SF), was developed with the motive to assess the severity level and potential detrimental effects of online and offline gaming over a 12-month period.[15,20] The Internet Gaming Cognition Scale (IGCS) is a 24-item measure intended to evaluate maladaptive gaming cognitions that emerge from dysfunctional gaming.[14,21]

In India, the prevalence of IGD among university students, school children, youths, and adolescents has been observed to range from 3.6% to 23.0%.[2,3,23] The prevalence of IGD, differs across the world, and has been estimated, through many studies, to be between 0.3% and

17.7%.[4,6,7,10,24,25] A European study, covering seven countries, assessed the prevalence and correlation of IGD with a sample of 1,938 adolescents belonging to the age group of 14 to 17 years. The result revealed that 1.6% of adolescents had IGD, with 5.1% at risk for IGD. The study acknowledges that IGD was correlated with psychopathological symptoms; including, aggressive behavior, rule-breaking and social problems.[6,24]

Table 1 Characteristics of included studies

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Bisht et al.[2]	2021	India	Descriptive research design	91	18-24 years (college students)	Food court of the university	IGD, Depression, Gender, Types of family, Types of residence	-23.0% respondents were IGD. -Respondents having IGD reported co-morbid depression. -Depression is negative outcomes associated with IGD. -IGD and comorbidity tested. -IGD and depression needs to be explored.
Bhaskar et al.[3]	2021	India	Cross-sectional survey	802	18-30 years	Medical colleges	IGD, gender,age group, types of video games, time spend on gaming	-Prevalence of problematic gaming among medical students is 6.9%. -Playing video games associated with the physical complaints of headache, neck pain and wrist pain. -Gaming is on the rise & need for a check, research and timely remedial action. -Gaming causes clinically distress.
Wang et al.[4]	2014	Hong Kong	Cross-sectional study	503	13-19 years (Adolescents)	Secondary Schools	Problematic behaviours of video and internet gaming, Game playing, Academic performance, perceived family harmony, teacher relation, stress level, loneliness level	-15.5% identified as gaming addict. -Gaming helps some shy and socially withdrawn individuals to develop more social connections & recreation for adolescents. -GA was higher among boys. -GA was associated with having more close friends.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
								–Poor academic performance & absentees reported in children. –Gaming also associated with physical, psychological & work–related issues. –Effective educational and preventive program or strategies are needed in treatment.
Laconi et al.[6]	2017	France	Online survey	418	18 to 30 years	Social networking sites and online gaming forums and websites	Age, gender, professional status, academic level, level of IGD severity, online gaming motives, depression, self esteem	–Prevalence of IGD was 2.0%. –Digital gaming created shift in how to study it. –Games vary in types, platforms, modes, & purposes. –IGD emerged as public health concern. –Gaming motives and depressive symptoms are significant predictors of IGD scores. –Relationship between IGD, motives, games genres and psychopathological variables. –IGD persons have conflict with dear ones & smaller friend's circle.
Subramaniam et al.[7]	2016	Singapore	Web survey	1,251	13–40 years	Printed flyers on games stores, placing flyer digitally on social media platforms and gaming forums	playing time during weekdays & weekends, game genres, IGD, diagnosis psychiatric disorder, social phobia, Life satisfaction, demographic factors	–Prevalence of IGD was 17.7%. –IGD associated with sleep, depression, aggression, conflicts in family & work problems. –Significant seen in prevalence rate, worldwide growth and negative consequences. –Social anxiety and distress were higher among IGD. –Life–satisfaction lower among IGD. –More clinical investigations and innovative solutions are needed.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Lemmens et al.[10]	2015	Netherlands	Online survey	2,444	13–40 years	Online survey distributed through international market research company	IGD, Dimensions of IGD, Time spent on games, Loneliness, Life satisfaction, Self–esteem, Prosocial behaviour, Aggressive behaviour	–IGD in the DSM–5 is prominent in studying the treatment and prevention. –Psychometric properties important for prevalence studies. –Prevalence of IGD was 5.0%. –Reliable & valid scales for measuring IGD and useful for diagnosis. –Time on gaming, loneliness and aggression was positively correlated. –Negatively correlation with self–esteem, prosocial behaviour, and life satisfaction.
King & Delfabbro[14]	2016	Australia	Cross–sectional survey	824	12 years and older (Adolescents)	Multiple secondary schools	IGD sympto–matology, problematic internet gaming cognition, and psychological cognition	–Adolescence most vulnerable group in developing addictive behaviors. –Gaming cognitions were strongly associated with IGD symptomatology. –Further work in gaming populations, to understand aetiology, prevalence, and associated risk factors. –IGD cognitions helpful in developing a clinical formulation and informing treatment strategies. –Investigations and clinical research needed with IGD & cognitive factors underlying IGD.
Schivinski et al.[15]	2018	Poland	Online survey	3,377	Mean age is 20 years	Online gamers through gaming platforms	Nine IGD criteria	–Associations between levels of IGD and potential detrimental effects of gaming. –The IGDS9–SF is a suitable psychometric tool to assess IGD

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Pontes & Griffiths[20]	2015	58 different countries	Online survey	1,060	16–70 years	Online gaming platforms	IGD, gamers weekly time spent play, Social–demographic like gender, age, first time gameplay, psychoactive substaces intake etc.	–IGDS–SF9 are valid, reliable, and highly suitable for measuring IGD. –Envisaged that the IGDS–SF9 will facilitate unified research in clinical field.
Archana et al.[22]	2019	India	Cross sectional study	60	16–18 years	Clinic, National institute of mental health and neurosciences centre for well–being, and colleges	IGD, Depression, Anxiety, and Stress	–Daily usage of gaming was 10 to 14 hours. –Reported disturbances in lifestyle, sleep, eating, less involvement in offline activities and less interaction with others. –Positive relationship between IGD and depression, anxiety and stress. –IGD among youth received little attention in India & world.
Singh et al.[23]	2019	India	Internet based cross–sectional study	306	18 years and older	Among University medical students	Problematic gaming behaviours, Depressive symptoms, Socio–demographic and Internet gaming characteristics	–Estimated prevalence of 3.6%. –Multiplayer online gaming pattern, more time in gaming, and greater depressive symptoms is indicative for developing gaming disorder. –Urgent need to create awareness. –Need for effective screening and treatment strategies.
Müller et al.[24]	2015	7 European countries	Cross–sectional study	12,938	14–17 years	Representative sample	Assesses IGD prevalence and psychological correlates of IGD	Prevalence of IGD was 1.6% with 5.1% at risk for IGD. –Prevalence rates, anger, temperament vary across participating countries. –IGD is related with psychopathological symptoms.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
								–Concerning aggressive and rule–breaking behaviour and social problems are associated with IGD. –IGD is linked to adverse psychosocial issues. –Youth–specific preventative and treatment initiatives are required.
Przybylski et al.[25]	2017	United states, United Kingdom, Germany and Canada	Survey study	18,932	18 years and older	YouGov omnibus panel platforms	Label for proposed DSM–5 criteria for IGD	–0.3–1.0% qualify for a diagnosis of IGD. –Linking IGD to game engagement was strong. –Links to physical, social, and mental health outcomes were decidedly mixed.
Reyes et al.[26]	2019	Philippines	Cross–sectional study	1,026	18–40 years	Filipino gamers	IGD, Personality and socio–demographic details	–Personality traits have impact on gaming behaviours. –Positive correlation with IGD and neuroticism –While IGD was negatively correlated with conscien–tiousness, agreeableness, openness & extraversion. –Negative predictors of IGD included agreeableness and conscientiousness. –Strongest predictor among five domains are conscien–tiousness.
Feng et al.[28]	2013	Shanghai	Cross–sectional study	33	14 to 17 years old	Department of Child and Adolescent Psychiatry of Shanghai Mental Health Center	Internet gaming addiction, Cerebral resting flow, Impulsiveness, internet use per week	–Adolescents with IGA showed higher global CBF in the left inferior temporal lobe, & amygdala. –IGA is a behavioural addiction that may share similar neurobiological abnormalities with other addictive disorders.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Dong et al.[29]	2012	China	Cross–sectional study	31	University students	Through advertisements	Internet gaming addiction, White matter integrity, Fractional anisotropy	–Adolescents with IGD showed reduced volume of gray matter in regions associated with attention, motor coordination, working memory and perception. –Abnormal white matter integrity in addictive populations associated with addiction severity, treatment response and cognitive impairments. –Diminished white matter integrity demonstrated in other addictive disorders which share clinical characteristics with IGA. –Increased regional FA in individuals acts as vulnerability factor for IGA, & as a direct result of excessive internet game playing.
Yuan et al.[30]	2013	China	Cross–sectional study	36	Adolescents	Students	Cortical thickness, Gaming addiction, task performance, Anxiety and depression	–Increased cortical thickness in the left precentral cortex, precuneus, middle frontal cortex, inferior temporal and middle temporal cortices in late adolescence with IGD. –Cortical thickness of the OFC correlated with the impaired task performance during the color–word Stroop task. –Cortical thickness abnormalities of these regions may be implicated in the underlying pathophysiology of IGD.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Sioni et al.[32]	2017	United States	Web survey	394	18 to 77 years	Online gaming forums	IGD symptoms, social phobia, player–avatar identification, demographics, mental health and online usage	–Comorbidity is contributing factors for IGD. –Positive relationship between social phobia and IGD symptoms –Social phobia, avatar identification, and IGD symptoms were strongly positively related –Time spent on gaming results in dissatisfaction, disruption of daily life and work.
Wang et al.[33]	2018	Korea	Online survey	7,200	14–39 years	Pool of penelists registered for online panels at panel marketing interactive.	Internet gaming disorder, IGD use patterns and severity, anxiety symptoms, self–control, impulsivity, sociodemo–graphic and clinical variables	–Depression is a common comorbid condition among patients with IGD. –IGD with comorbid depression associated to serious psychiatric phenomenology and more psychiatric burden. –Co–administration of IGD–9 and PHQ–9 is useful in screening comorbid condition.
Hyun et al.[34]	2015	Ukraine	Cross sectional study	416	13–40 years	Online game clinic centre	Game addiction, individual factors, IQ, psycho–pathological condition, social interaction factors	–Comorbidity & IGD were tested clinically. –Individual factors, cognitive factors, psychopathological, and social interaction factors were associated with online gaming addiction. –Psychopathological conditions being the strongest risk factors for the addiction. –Individual factors, psychological factors, and social interactions were associated with the development of pure online gaming addiction. –Psychopathologies, including ADHD and depression, were the strongest factors connected with the growth of IGD.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Kaess et al.[35]	2017	Germany	Cross–sectional study	49	15–25 years	Male youth	IGD, stress and psycho–pathological distress, heart rate, basal stress levels, momentary affect and subjective stress	–IGD patients reported chronic stress & psychopathological comorbidity. –Stress sensitivity is a possible predisposing factor for IGD. –IGD patients showed an attenuated cortisol response and greater negative affect in response to acute stress. –Alterations of the stress response systems involved in development and maintenance of IGD.
Männikkö et al.[36]	2015	Finland	Cross–sectional online survey	293	13 to 24 years	Finland national registry via website	Problematic gaming behaviour, psycho–pathological symptoms, life satisfaction, social health, and physical health.	–IGD behaviour was related to psychological and health problems, namely fatigue, sleep interference, depression and anxiety symptoms. –Amount of weekly gaming, depression and a preference for online social interaction predicted increased problematic gaming symptoms. –Strong negative correlation to a variety of subjective health outcomes and IGD.
Mentzoni et al.[37]	2011	Norway	Nationwide survey	816	15–40 years	Norwegian national registry	Video game addiction, problematic game use, physical health and mental health.	–0.6% was IGD prevalence. –Age group (young) and gender (male) were both major indicators of IGD. –IGD associated with low scores on life satisfaction and increased levels of anxiety and depression. –Sleep wake cycles affects health among IGD individuals.

Table 1 (continued)

Author	Year	Study Location	Study design	Sample size	Age group	Context/ Location	Variables	Findings
Brunborg et al.[38]	2014	Norway	Survey study	1,928	13–17 years	Data from surveys	Video game use, video game addiction, depression, heavy episodic drinking, academic achievement, and conduct problems.	–IGD was related to depression, lower academic achievement, and conduct problems. –Adolescents who experience problems related to video games are likely to also experience problems in other facets of life like separations, financial insecurities. –Future research aims at establishing the temporal order of the supposed causal effects.
Festl et al.[39]	2013	Germany	Large–scale, represen–tative study using a computer–assisted telephone survey.	4,382	14 years and older	Computer and console gamers	Problematic game use, personality, gaming behaviours	–Only 0.2% met IGD criteria. In contrast, 3.7% considered problematic users, meeting at least half these conditions. –Associated with aggression, low sociability and self–efficacy and lower satisfaction with life. –Scores are associated with intensive use, as well as certain problematic aspects of individuals' personalities and social lives.
Sakuma et al.[40]	2017	Japan	Cross–sectional study	10	Mean age is 16 years	Medical and addiction centre	IGD, Internet use/gaming time, self–efficacy, participants characteristics	–Most used treating IGD is psychological therapy. –Problem recognition and self–efficacy towards positive change also improved. –Furthermore, there was a correlation between age of onset and problem recognition score. –Age of onset may be a useful predictor of IGD prognosis.

GA=gaming addiction, IGD=internet gaming disorder, IGDS9–SF=internet gaming disorder scale–short form, DSM=diagnostic and statistical manual of mental disorder, GAS=gaming addiction short scale, IGD–9= internet gaming disorder scale, PHQ–9=patient health questionnaire, ADHD=Attention deficit hyperactivity disorder, IGA=internet gaming addiction, CBF=cerebral blood flow, FA=fractional anisotropy, OFC= orbitofrontal cortex

Determinants of IGD

Multiplayer online gaming patterns, more time in gaming and greater depressive symptoms, is indicative of the developing internet gaming disorder.[23]Studies have stated that different traits, domains and disorders of personality have a substantial impact on IGD.[26,27] According to the results with Five-Factor-model traits showed a positive correlation with pathological gaming and neuroticism, while pathological gaming was negatively correlated with conscientiousness, agreeableness, openness and extraversion.[26] Further, negative predictors of IGD included agreeableness and conscientiousness, with the strongest predictor among the five domains being conscientiousness.[26] Different personality traits, with a combination of playing, are a crucial part in the attainment, progress and maintenance of pathological gaming, and there is a need for future research to understand specific personality traits that may prompt people to pathological gaming.[27]

Adolescents suffering from IGD showed relatively higher global cerebral blood flow in those areas, which are critical for learning and memory (amygdala/hippocampus), conscious urges to use drugs (insula), executive function, and inhibition.[28] Adolescents with IGD also showed a reduced volume of gray matter in regions associated with attention, motor coordination, working memory and perception.[29] These findings are consistent with research on gray matter volume in IGD.[30] However, a few studies measuring the cortical thickness in fMRI disclosed contradictory findings of increased and decreased cortical thickness in several brain regions in adolescents with IGD.[30] There are similarities on a variety of levels between different types of addiction; such as substance addiction and internet gaming addiction.[31] On a cellular level, internet addiction is demarcated by a lack of overall reward, which is displayed by reduced dopaminergic activity. On a neuronal circuitry level, gaming addiction resulted in neuroadaptation and structural alterations as a result of enhanced activity in brain areas linked to addiction for a longer time. Internet and gaming addictions appear to be restricted in their cognitive functioning in numerous domains on a behavioral level.[31] The neural associates connected to the development of internet and gaming addiction will spur more research and pave the way for the progress of addiction treatment methods.[31]

Comorbidities and health consequences of IGD

Comorbidity is the significant contributing factor for IGD.[6,32,33] Relations between comorbidity and IGD were also tested in clinical representation (i.e., IGD treatment-seekers).[2,34] For context, in a sample of 263 patients with IGD and 153 safe subjects equivalent, the study used a hierarchical logistic regression model that involved demographic variables (gender and age), cognitive factors (IQ and persevering errors), psychopathological disorders (ADHD, depression, anxiety, and impulsivity) and social experience factors (family settings, social anxiety, and impulsivity).[34] The investigators stated that all four variables were strongly correlated with IGD, with psychologic disorders identified as the most critical risk factors.[34] A common comorbidity of internet gaming disorder is depression.[2,33] The presence of comorbid depression and internet gaming disorder is linked to more significant psychiatric phenomenology, and a higher psychiatric load.[33]

A study conducted on a sample of 24 young men fulfilling the DSM-5 criteria for IGD and 25 matched controls has shown that patients with IGD reported higher everyday chronic stress as well as psychopathological comorbidity.[35] A study by Archana et al. (2019)[22] found lifestyle disturbances and a strong association of depression, anxiety, and stress with IGD among Indian adolescents. IGD models understand that people who are less secure in their skills and their role in the physical world would be at higher risk of utilizing the internet and playing video games to compensate for this.[14,21]

In this digital era, gaming has become common; however, some people are more susceptible to severe gaming-related problems. Therefore, not only the positive aspects of gaming must be investigated, but also the people and their social backgrounds to understand this tiny fraction of consumers that have created recurrent gaming habits, which contribute to adverse outcomes.[8,24,25] In contrast, the health effects of persistent gaming are relatively mild, unlike substance abuse and addiction. The most commonly noted health harms include: weight loss from restricted dietary (or weight gain due to excessive consumption), physical problems of the pain caused by poor posture and repetitive strain injuries, and reduced sleep and sleep reverse cycles leading to fatigue and lethargy.[1,3,36]

Several studies reported many negative consequences at the psychosocial and behavioral level of IGD.[1,15] Some studies reported variation in temperament; including irritability, anger and dullness in behavior.[1,24] Depression, anxiety and suicidal behavior are a few of negative outcomes associated with IGD.[1,2,7,37] Some studies reported that people with IGD had conflict with near and dear loved ones and a smaller number of real-world friends; inducing social isolation and social phobias.[1,6,24,32] Some had troubled sleep-wake cycles and sleep quality, which affects health.[1,36,37] School dropout, poor academic performance and a high rate of school absentees were reported in young children and adolescents.[1,4,38] IGD leads to major disruptions in work and productivity and increases the probability of financial insecurities, low self-efficacy, separations and divorce.[1,8,36,38,39]

The main impact on pathological users is the extreme time investment in gaming (i.e., 8-12 hours daily).[9,22] Time spent on gaming results in missing opportunities, dissatisfaction, and disruption of daily life and work; including, essential tasks (i.e., sleep, feeding, personal hygiene), real-world social contact (i.e., talking to strangers, seeing friends face-to-face, visiting family); and vital obligations (i.e., education, job, pet care, and children).[1,8,25,32,36]

Discussion

This present scoping review examines and tries to summarize empirical findings of internet gaming disorder, with respects to prevalence, determinants, comorbidities and health consequences. Playing video games is very common nowadays all over the world. Internet gaming addiction is a kind of behavioral addiction that may share similar neurobiological abnormalities with other addictive disorders.[28] There is extremely little space for outdoor physical activity, and a sedentary lifestyle predominates when playing video games. This has increased in recent decades, as playing video games and online games is a popular form of recreation for most adolescents.[4]

IGD is a dynamic condition contributing to both physical and psychological harm, with many symptoms that demand attention in treatment.[4,5,9] Co-administration of the internet gaming disorder scale (IGD-9) and patient health questionnaires (PHQ-9) are useful in screening comorbid conditions.[33] The foremost aim of treatment is to eliminate gaming behaviors, which are creating hurdles with self-care, relationships, and other life responsibilities.[1] IGD cognitions help develop a clinical formulation and informing treatment strategies.[14] The problem in this area is the absence of practical resources; including, standardized, step-by-step treatment manuals or comprehensive descriptions of the procedures and techniques employed in IGD treatment studies.[19] The most widely used approach in treating a gaming disorder is psychological therapy; including, individual and group therapy. Additionally, the age at which IGD develops itself may be a useful predictor of IGD prognosis.[40]

The causes of gaming disorder are complicated and include many biopsychosocial variables; so the medication is

relatively challenging; thus, making prevention much more critical. Youth-specific preventative and treatment initiatives are required,[24] and further work is required in diverse gaming populations, to understand etiology, prevalence, and associated risk factors.[14] Many studies suggested limiting the use of games and exploring the following measures to be taken: parents should control their children's computers through various measures; such as limiting game content and time.

Future research direction on internet gaming disorders

Much has been discussed concerning internet addiction; however, surprisingly problematic video gaming or internet gaming by the youth has received very little attention in India and globally.[2,6,22,23] However, studies from all over the world on IGD also talk about many additional issues and concerns in addition to its associated factors. As a result, a section of the population, particularly children and youths, are most exposed to hazards associated with excessive digital gaming. These statistics strongly indicate that youths are more vulnerable to IGD.[2] These perpetuating circumstances warrant and alarm both researchers and clinicians to further explore the culminating consequences and also comprehensive ways to tackle IGD.[2,3,6,22,23]

IGD is considered a situation that requires further study.[1,11] Further analysis needs to be conducted to explain whether the nine IGD symptom parameters, and the cut-off points currently being proposed are ideal or have to be reevaluated.[10] The dynamic nature of online gaming and its monetization over time has made it similar to gambling. The transition in nature of gaming systems and their interface with other tasks should be taken into account for future study. So far, many features of gaming disorders are still being debated. For example, (1) the degree to which internet gaming disorder is considered a mental illness; (2) the harmful effects of gaming disorders; (3) the relationship between IGD and other comorbid psychological disorders; (4) the gaming disorder's clinical manifestation; the etiology and how IGD develops. The nature and extent of research evidence on IGD have been covered in this scoping review. In light of the extensively drawn and included empirical findings the future researches on IGD need to focus more on: (1) its epidemiological investigation, (2) the expansion and standardization of diagnostic tools for better diagnosis and treatment; (3) the persuading factors of game behavior; (4) neurological factors and (5) treatment and prevention. At the same time, IGD is an emerging concern of all developing countries that cannot be denied, the paucity of research on it calls for an urgent requirement to investigate and study IGD as a multidimensional concept, with the varied determinants and risk factors from a whole world perspective.

Conclusion

Since the introduction of IGD in DSM-5 and ICD -11, there are still untouched areas of IGD and its harmful mental health impacts. IGD has not been given priority in many countries. Although, many prevalence studies of IGD have been conducted, most of these studies cannot demonstrate the extent of severity caused by IGD. Psychological disorders and comorbidity were significant factors contributing to IGD.[6,32] Adolescents, who were suffering from IGD, showed relatively higher global cerebral blood flow in those areas of learning and memory.[28] Nowadays, IGD is becoming an issue of major health concern in many developing countries. Many people suffering from IGD problems go untreated, with subsequent disturbances in personal, professional and social life. Every year the percentage of children and adolescents gaining access to advance digital technology is increasing at a higher pace, and children are beginning to use mobile and computers to play online games at an early age. Therefore, a large proportion of people have

the opportunity to access computers, video games and the internet, which increases the probability of addiction problems. Ultimately, the most relevant research, work on treatment, and its progress in this field is only limited to a few age groups, which needs to be expanded, to involve all age groups. Not only is there an urgent need for an appropriate and authoritative health care policy, but there is also an urgent need for awareness-raising, and the development of specialist clinics around the world to offer alternatives to remove oneself from virtual reality.

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Conflict of interest

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