“One level more:” A narrative review on internet gaming disorder

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ABSTRACT

Due to explosive growth in technology and internet usage in the last few years, internet gaming disorder (IGD) has manifested as rapidly growing public health problem mainly affecting the teen and preteen population worldwide. It has a negative impact upon physical, psychological, social, and occupational functioning of the affected individual, often leading to severe consequences. It was only recently that it has been recognized as a separate diagnosable disorder in the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition. Not much data is available regarding the exact prevalence and the various sociodemographic, clinical, and other risk factors to identify the individuals vulnerable to develop this disorder, especially in the developing countries such as India. According to a recent report, India ranks 22nd in the list of highest revenue-generating countries from gaming-related businesses, thus highlighting the magnitude of risk faced by Indian population. The aim of this review is to provide an insight about the disorder to identify the risk factors and clinical features, to understand the effect of IGD upon the psychological and physical health with a special focus on neural changes, and to provide information on the various upcoming preventive and treatment strategies.

Keywords: Gaming addiction, internet gaming disorder, pathological gaming, prevalence, treatment

The world has changed rapidly in the past two decades. Kids and adults alike now search for the latest gaming platforms with the highest processing power chipsets and an internet plan with the fastest surfing speed. The arrival of computer and internet has changed the fundamental childhood needs very rapidly. Computer and smartphone-based games have revolutionized the world and the concept of virtual reality. The attraction of losing oneself in the realms of virtual reality that has been provided by those platforms is beyond anything. But, what happens in reality when people get busy losing themselves in the “virtual reality?” The following two case vignettes (quoted as presented by their authors) will give us an idea about that.

“Messrs. A and B were two unmarried brothers, belonging to a nuclear family of upper socioeconomic class of urban background of New Delhi, India. Mr. A is 19 years old, studying in 12th standard while Mr. B is 22 years old, studying in 2nd year of engineering in Haryana, India. The problem began when both brothers used to stay together at home and started playing online game with their virtual internet friends from different countries. The duration of online gaming progressed from 2 to 4 hours per day to 14 to 18 hours per day over the initial few months. The behavior and self-care of these brothers became so compromised and disorganized that, while playing the games, they urinated and defecated in their clothes, did not change clothes for days, did not bathe, skipped their meals, did not pick up phones, or open doors even to their parents. Their home was robbed twice of cash and costly articles in their presence, during the last 2 months while they were preoccupied in playing online games.”¹

“An 18-year-old boy had excessive use of video game for the last 2 years. Playing led to losing interest in studies as well as getting low grades in his exams. He started feeling angry and upset with other children at school. He would sit in the room alone, playing online games for long hours. He started neglecting his physical appearance and hygiene. His parents started noticing that he was losing weight and his face looked pale.”²

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academic grades. The other dysfunctions were seen in the form of decreased self-care, disturbance in biological functions, avoiding contact with others, and behavioral changes in the form of irritability whenever advised to stop accessing video game. The parents had psychiatric distress on 12-item General Health questionnaire, and family burden interview schedule indicates disturbance in leisure activities, family routine, family interaction, physical and mental health. They attributed it to helplessness to manage the user’s psychosocial dysfunctions. It also starts affecting their lifestyle in terms of decreased engagement in pleasurable activities, disturbance in sleep attributable to frequent checking of user’s activities at night, and interpersonal problems.\[7\]

**WHY PLAY GAMES? THE PRINCIPAL MOTIVES**

It was Bartle\[3\] who first formulated a hypothesis based on motivational approach, he classified the motives according to the playing styles and classified the gamers in four categories. The “achievers,” “explorers,” “socializers,” and “killers.” The achievers were those who game to attain respect of the virtual society and to gain some reward which may be a “level up” or a “new power.” Their actions are goal directed, i.e., to complete the missions of the game. The “explorers” game in search of sudden pleasures to discover new in-game structures and story. The “socializers” game to socialize, chat, and be a part of something like a team or community. Finally, comes the “killers,” also known by the slang “trolls” who use the gaming platform to bully on fellow gamers or annoy them in anyway.

Yee\[4\] made a novel attempt to categorize the motivations behind internet gaming. After testing a 40-item questionnaire, he reported three major motivational components; the first component is again subdivided into three subcomponents, which include being “in-game rank reputation” or “advancement” in the game. This includes leveling up, acquiring a new status or skill of the game character. “Mechanics” includes optimizing the game to face harder challenges. “Challenge” where the player dominates other players and earn respect of the gaming community. The second component is “social factor.” It includes chatting with fellow gamers, socializing, being part of communities, making friends, and forming teams to take on rival teams. The third component again has three subcomponents, namely, “discovery” where the players discover new items, weapons, or a new in-game world to explore, “escapism” where the gamer can escape into the virtual world forgetting about all the problems and hindrances of the real world, which leads to a subjective mood elevation, and “a coping strategy to deal with everyday problems”\[8\] and finally, “role playing” where the gamer acquires a new persona according to his/her fantasy.

Recent studies which investigated the psychological predictors of problems in gambling postulated two important predictors. According to Billieux et al., it is the “positive urgency” and “immersion” that dominate and control the behavior of a gamer. Positive urgency, which is defined as “the tendency to act rashly while in a positive mood”\[7\] makes it difficult for the gamer to avoid online gaming and let go of the euphoria. Secondly, according to them, immersion in the realms of virtual reality when faced with negative affect to avoid real-life problems is again one of the principal motivations for gamers.

**THE GENRES**

Apperley in his article titled, “Genre and game studies: Toward a critical approach to video game genres”\[8\] classified the video games in various genres. Based on the type of interaction of the player, those genres are platform, mode, and milieu. Whereas according to the type of gameplay, the video games are further classified into four major genres, those being simulation, strategy, action, and role playing. Details of these genres are shown in Table 1. However, among all these genres, it is the massively multiplayer online role-playing games (MMORPGs) that have currently gained popularity beyond anything.

**MASSIVELY MULTIPLAYER ONLINE ROLE-PLAYING GAME EXPLAINED**

Unlike others, MMORPGs have some particular characteristics. Those are: (a) Presence of a “persistent virtual world” with a huge user base. A “persistent virtual world” is a virtual world that is independent of a user’s login status; the world will exist and will be modified in the absence of a particular user by the actions of other users who are online. (b) Player has the ability to create an avatar, which he/she will be able to modify according to the needs. This includes creation of a body structure, face, attire, weapons, powers, race, clan, gender, profession, morality, and many others. (c) Advancement will be rewarded by “level up” which may be an addition of skills, powers, or unlocking of other missions. (d) Players are able to socially interact with fellow gamers through the in-game characters and can form alliances to defeat their opponents.

According to data cited from mmos.com, some of the most popular MMORPGs currently are Dungeon Fighter Online, Fantasy Westward Journey, World of Warcraft, and RuneScape.

**INTERNET ADDICTION AND INTERNET GAMING DISORDER – SAME ENTITY OR DIFFERENT?**

Internet addiction (IA) and internet gaming disorder (IGD) are not the same entity according to Griffith and Pontes.\[9\]
They pointed out that many researchers have used “the internet addiction questionnaire” or “other nonvalidated versions of the tests to diagnose and assess the severity of online gaming addiction.” According to the same report, this is possibly the reason why the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) regarded IGD and IA disorder (IAD) as the same disorder. Király et al. investigated the demographic variables and behavioral pattern among the IGD and IAD groups taking a total sample size of over 2000 adolescents. According to them, the differences between the groups are quite significant. They reported that individuals with IAD are usually males, invest a significant amount of time online doing any kind of online activities such as social networking, chatting, watching social media including gaming, whereas gaming disorder is specifically associated with gaming online. They suggested that these two entities are entirely “conceptually different behaviors.” A cross-cultural study that was conducted across two different continents taking participants from Sweden, Germany, Taiwan, and China also supported the view of Griffith and Pontes.

INTERNET GAMING DISORDER IN THE DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS FIFTH EDITION

Over the years, there had been debates whether to classify IGD as a separate entity, finally the recognition came in 2013 with the arrival of the DSM-5. It states that “Persistent and recurrent use of the internet to engage in games, often with other players, leading to clinically significant impairment or distress as indicated by five (or more) of the following in a 12-month period” is considered IGD. Those criteria being preoccupation, withdrawal, tolerance, unsuccessful attempts to control, loss of interests, continued excessive use despite psychosocial problems, deceiving, escape, and functional impairment.

PREVALENCE OF INTERNET GAMING DISORDER

The prevalence of IGD varies worldwide and is estimated to be between 0.2% and 8.5%. The severity and prevalence of IGD are found to be higher in the Asian countries than that of the West. This variable prevalence rate may be due to the use of different types of measurement instruments, different cutoffs, use of self-reporting questionnaires in most studies, and due to diversity in conceptualization. Some reviews claim that Korea reported to have the highest known prevalence, where up to 50% of the adolescents are presumed to be addicted to gaming, and IGD is reported to be a significant public health problem there and up to 24% of those diagnosed as having IA need hospitalization. However, these reviews and studies have considered IGD and IAD as the same disorder. As we have discussed before that IAD and IGD are distinct entities with some overlapping characteristics, it will not be wise to consider the prevalence of one as that of others. Table 2 summarizes the findings of some studies conducted across the world.

THE RISK FACTORS

Most of the available literature have suggested that IGD is more prevalent among males than females. Ko et al. commented that they found significant gender differences in the motives for online gaming. According to them, increasing age, poor self-esteem, and daily life

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**Table 1: The various genres of video games**

| Platform | Mode | Milieu |
|----------|------|--------|
| Nonhandheld | Handheld | Single player |
| Computers, PlayStation, Microsoft X-Box, Nintendo GameCube, etc. | PSP, Nintendo 3DS, Nvidia Shield, the wide array of smartphones, etc. | Horror, Fantasy, Fiction |

| Simulation | Strategy | Action | Role playing |
|-----------|----------|--------|-------------|
| Simulation are those games “that simulate sports, flying, and driving, and the dynamics of towns, cities, and small communities” | Strategy games refer to those which require some planning and strategy application for advancement | Games where “action” or “violence” is the main way to mission accomplishment | RPGs where the player can create and design their own avatar, players are provided with numerous options to act on during the course of the game, and their actions lead the story of the gameplay. RPGs can be played both offline and online |

**According to the type of gameplay**

| Simulation | Strategy | Action | Role playing |
|-----------|----------|--------|-------------|
| RTS | TBS | The virtual world is seen through the screen, which acts as the player’s visual field | Players have their own avatars which are visible on screen |

PSP – PlayStation Portable; RTS – Real-time strategy; TBS – Turn-based strategy; FPS – First-person shooter; TPS – Third-person shooter; RPGs – Role-playing games
satisfaction were associated with more severe online gaming addiction among males only. Muller et al. studied a sample of 12,938 children and adolescents from seven countries across Europe; they reported that “adolescents with IGD reported, being from broken home, divorced parents.” Wang et al. reported that gaming addiction has a positive association with academic performance, gender, perceived family harmony, relationship with classmates, and the number of close friends; whereas they found no association with age, grade in which subject is studying, number of family members/siblings, parental marital status, education status of parents, socioeconomic status, and ownership of gaming devices.

There are some studies that tried to evaluate if the genre of the game has anything to do with intensity of gaming addiction. Donati et al. in their study conducted in 2015, among 701 male adolescents, found that the most popular genre is action (88%) followed closely by casual (86%) and sports (84%) games. Real-time strategy (RTS) (32%) games, retro games (30%), and massively-multiplayer online (27%) were the less practiced. They also found that there is a statistically significant and positive correlation between time spent on gaming and gaming versatility (the gaming versatility score was calculated by summing the number of video game genres played). Eichenbaum et al. conducted a study in the United States of America in 2015, among 4744 university students, and reported that IGD scores elevated rapidly with time playing RTS and real person fiction games than for action games. Two years earlier to those two studies, in 2013, Lemmens et al. conducted a study to find the correlations between game genres and IGD among 2442 individuals in the Netherlands. They found a stronger correlation between online gaming and IGD than offline ones. Among the genres, they found that time spent by playing role-playing games (offline and online) and shooters correlated positively with IGD; the correlation was stronger for online play. Wang et al. reported a significant association between gaming addiction and various factors such as longer average time of gaming per week, higher frequency as well as longer period of spending money on gaming.

### PERSONALITY TRAITS

Braun et al. in their study conducted in 2015 on 2891 individuals (2421 males, 470 females) between 13 and 65 years of age applied the Big Five Inventory-SOEP and measured each of the five personality dimensions, namely, neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness among regular gamers, nongamers, and gaming addicts. They reported “a positive association between neuroticism and IGD and a negative association between extraversion, conscientiousness, and IGD” but could not find any association between openness, agreeableness, and IGD. Seven years earlier in 2008, Kim et al.’s study on 1471 individuals concluded that narcissistic personality traits, aggression, and self-control of an individual may predict the severity of gaming addiction in him/her.

### A GENE FOR GAMING!

Excessive internet gaming individuals show a higher than normal reward dependency. An increased prevalence of the DRD2 Taq1A1 and COMT alleles has been reported in these individuals. In adolescent gamers, the Taq1A1 allele was found to be associated with reward dependence than other groups.

### NEUROCHEMISTRY – DOPAMINE AGAIN!

The role of dopamine as a reward mediator has been long established. A study published in “Nature” in 1998 using C-labeled raclopride and positron emission tomography...
scans has shown that dopamine is released in human striatum while video gaming, like any goal-directed motor task. The release was highest in ventral part of striatum and positively correlated with performance level in gaming.\textsuperscript{[27]}

A study in China using 99mTc single photon emission computed tomography reported that dopamine transporter in striatum in individuals with IGD is significantly decreased compared to healthy controls. Various studies conducted on substance-addicted individuals reported similar findings and are highly suggestive of brain dopaminergic functional impairment.\textsuperscript{[28]}

**COMORBIDITIES ASSOCIATED WITH INTERNET GAMING ADDICTION**

IGD is thought to be a gradually progressive behavior, with a chronic course deteriorating over time. The pathological gaming behavior may lead to significant physical and mental health problems as reported by numerous literary evidences. Lehenbauer-Baum et al.\textsuperscript{[29]} reported that addicted gamers have a higher association with psychopathologies than controls. They found that addicts scored higher in Beck’s Depression Inventory and Social Phobia Inventory and are less agreeable, thorough, and emotionally less stable. They also reported that the intensity of anger, guilt, anxiety, and envy felt by the addicted players is more severe than controls. Achab et al.\textsuperscript{[30]} reported that addicts are severely sleep deprived and have a 3 times more odds of having diurnal sleepiness than normal gamers. Li et al.\textsuperscript{[31]} showed that pathological gaming behavior is more related to self-discrepancy, depression, and escapism. They inferred that there is a definite relationship between escapism and actual-ideal self-discrepancies which is mediated by depression. Similarly, pathological gaming and depression are interrelated which is mediated by escapism. Van Rooij et al.\textsuperscript{[32]} tried to evaluate the hypothesis that whether substance using adolescents are more prone to problematic gaming or not. Their results showed that “nicotine, alcohol, and cannabis using boys were almost twice more likely to be problematic gamers (PGs);” alcohol and cannabis using girls also showed higher propensity than controls. Yau et al.\textsuperscript{[33]} in their review reported that PGs are 2.77 times more likely to get diagnosed as having ADHD; they also reported an association of problematic gaming with mood disorder and substance use disorders (particularly those involving tobacco and “hard” drug use).\textsuperscript{[33]} In 2014, Jalink et al.\textsuperscript{[34]} published a review of 38 papers which reported injuries sustained by the use of handheld gaming devices (Nintendo, Game and Watch, Famicom, Game Boy, Virtual Boy, iQue, GameCube, and Wii). They reported cases such as epilepsy (Nintendo epilepsy), which is seizure due to rapid change of on-screen patterns, auditory hallucinations (Nintendo hallucination), tendinitis of wrist, thumb, and hand due to long hours of play (nintendinitis or nintendonitis), palmer ulcerations, enuresis, encopresis, and “motion-sensitive Wii remote-related musculoskeletal problems and various traumas.”

**ASSOCIATED BEHAVIORAL ISSUES WITH INTERNET GAMING DISORDER**

Addicted gamers experience significantly more irritability, agitation (less calmness), sadness, and often report of confusing real life with the virtual world. Van Rooij et al.\textsuperscript{[32]} found a strong association between problematic gaming and decreased psychosocial well-being and low school performance. They commented that, irrespective of gender, depressive mood, social anxiety, negative self-esteem, and loneliness prevailed in PGs. A study published in 2011\textsuperscript{[39]} on 540 adolescents in the Netherlands tried to evaluate the relationship between aggression and pathological gaming and yielded some interesting results. They reported that pathological gaming is progressive in nature and if not controlled may displace important day-to-day activities. Another important finding was that, regardless of involvement of violence in gameplay, pathological gamers self-reported increased aggressive feelings after 6 months; however, this finding was found only in males. They also commented that increase in aggressive behavior is mainly related to the time spent in playing violent games specifically, not just time spent in playing games. These data predict a possibility of physical aggression in pathological gamers in future life, which is also supported by numerous other studies.\textsuperscript{[30]}

Addicted gamers show low social participation and there is a significant negative relationship between social skills of addicted gamers and selection of home as the place of gaming.\textsuperscript{[37]} Kim et al.\textsuperscript{[39]} conducted a study on 3041 adults in Korea, which found that gamers at risk of addiction are impulsive, exhibit more aggression than healthy controls, and there is a 5 times more risk of attempted suicide in them.\textsuperscript{[39]}

**DOES EXCESSIVE GAMING CHANGE ONE’S BRAIN? WHAT DOES NEUROIMAGING STUDIES SAY?**

Recent studies have implicated numerous brain regions for the possible causation of compulsive gaming leading the conceptualization of internet gaming addiction similar to that of impulse control disorder and behavioral addiction. Abnormal activity is seen especially in the orbitofrontal cortex, striatum, nucleus accumbens, cingulate cortex, and sensory regions. These areas are implicated for “somatic representation of previous processes,” impulse control, and reward processing.\textsuperscript{[39]} Table 3 summarizes the findings as
Table 3: Inputs from neuroimaging studies performed on individuals with internet gaming disorder

| Study name          | Place of study       | Important findings                                                                                                                                                                                                 |
|---------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Park et al., 2010   | Seoul, South Korea   | 18F-fluorodeoxyglucose positron emission tomography study conducted among individuals with IGD showed “increased glucose metabolism in the right middle orbitofrontal gyrus, left caudate nucleus, and right insula, and decreased metabolism in the bilateral postcentral gyrus, left precentral gyrus, and bilateral occipital regions” when compared to controls |
| Lin et al., 2015    | Shanghai, China      | IGD group showed “significant lower gray matter density in the bilateral inferior frontal gyrus, left cingulate gyrus, insula, right precuneus, and right hippocampus” and “showed significant lower white matter density in the inferior frontal gyrus, insula, amygdala, and anterior cingulate gyrus” when compared with healthy controls |
| Jin et al., 2016    | Jiaotong, China      | This age- and gender-controlled study showed significant gray matter volume loss in “bilateral DLPFC, OFC, ACC, and the right SMA,” which the authors referred as “seeding areas.” Resting state fMRI studies were conducted to see the functional connectivity between the seeding areas and other structures. Results showed decreased functional connectivity between various cortical areas and the findings were significant for some important subcortical regions such as dorsal striatum, pallidum, thalamus, and the “seeding” areas |
| Yuan et al., 2013   | China                | This study conducted on WOW addicts who undertook a color-word Stroop test found that “cortical thicknesses of the left precentral cortex, precuneus, and lingual gyrus correlated with duration of online gaming addiction.” They also reported that the cortical thickness of the OFC correlated with the impaired task performance during the color-word Stroop task in the IGD group |
| Hong et al., 2015   | -                    | This study collected and compared the resting state fMRI data between 11 right-handed and gender-matched healthy controls with 12 right-handed male adolescents with IGD and concluded that adolescents diagnosed with IGD had “significantly reduced dorsal putamen functional connectivity with the posterior insula-parietal operculum.” In the same study, when individuals were allowed to spend more time in gaming, a significantly greater functional connectivity between the dorsal putamen and bilateral primary somatosensory cortices was noted in adolescents with IGD, whereas in contrast, controls showed significantly lower connectivity. This finding is suggested to be a possible “bio-marker” in identifying IGD |
| Ko et al., 2015     | Taiwan               | Lower gray matter density was found in adolescents who were diagnosed with IGD along with functional connectivity impairment between frontal lobe and amygdala. The data suggested a negative association between amygdala-frontal connectivity and impulsivity |
| Wang et al., 2015   | Shanghai, China      | Altered interhemispheric resting-state functional connectivity between bilateral pre-frontal lobe was implicated as a possible neuropathological mechanism of IGD |
| Ko et al., 2009     | Taiwan               | This study searched for the relationship between IGD and substance-related addictive behaviors. They recruited advanced level players of WOW with heavy online use who were selected as case after proper evaluation and controls were taken as people with<2 h internet use/day. Participants were presented with pictures from WOW followed by neutral pictures while undergoing an fMRI scan. The contrast between the BOLD signals was recorded as they presented the stimulus. The addicted group showed activation of “right OFC, right nucleus accumbens, bilateral anterior cingulate and medial frontal cortex, right DLPFC, and right caudate nucleus” in contrast to the controls. Interestingly, previous studies on substance-dependent individuals showed activation of the same structures. This study describes the possible association of those above-mentioned structures for gaming urge and craving for a particular substance, thus establishing a relationship between them |
| Ko et al., 2013     | Taiwan               | Researchers collected fMRI data from individuals with substance abuse, individuals with current IGD, and included a separate third group in their study. The third group composed of individuals who were previously diagnosed as IGD but are currently in remission. fMRI reports showed that “the IGD group had stronger activation over right DLPFC and left parahippocampus than did the remission group.” They suggested that these two areas could be “candidate markers for current addiction to online gaming” |
| Dong et al., 2012   | China                | This DTI study found “higher FA, indicating greater white matter integrity, in the thalamus and left PCC” in contrast to controls. The severity of IGD was found to be directly proportional to the FA in thalamus |

IGD – Internet gaming disorder; DLPFC – Dorsolateral prefrontal cortex; OFC – Orbitofrontal cortex; ACC – Anterior cingulate cortex; SMA – Supplementary motor area; fMRI – Functional magnetic resonance imaging; WOW – World of Warcraft; BOLD – Blood-oxygen-level dependent; DTI – Diffusion tensor imaging; FA – Fractional anisotropy; PCC – Posterior cingulate cortex

Scales for identification and assessment of internet gaming disorder

Researchers have come forward with various scales to identify and assess the severity after internet gaming addiction surfaced as a viable public health problem. Lemmens et al. in 2015 tested a long (27-item) and short (9-item) polytomous scale and a long (27-item) and a short (9-item) dichotomous scale for finding validity among 2444 Dutch adolescents and adults, aged 13–40 years. All the four scales were reported to provide satisfactory results. Vadlin et al. developed a screening tool for gaming addiction in adolescents – the Gaming Addiction Identification Test in 2012 which is a 15-item tool measured on 5-point Likert scale and reported good conducted by the recent studies conducted to identify those regions.
content validity in assessing gaming addiction. Later, they developed a parent version of the scale with the same number of items.\(^\text{[51]}\)

**PREVENTION AND TREATMENT**

Although currently many studies have suggested various preventive strategies and treatment outcomes on individuals with IA, there is a huge scarcity of literature mainly of longitudinal controlled studies on the same about internet gaming addiction. Griffiths and Meredith in their article in 2009\(^\text{[52]}\) laid down some guidelines to be followed for prevention and treatment purpose [Table 4].

**Online support forums**

A number of online support forums such as Computer Gaming Addicts Anonymous (http://egaa.info/discussion-forum/) and On-Line Gamers Anonymous (http://www.olganon.org/home) have sprung up in recent years which provide both information and internet-based treatment approach. The approach is mainly based heavily on the 12-step program of recovery (honesty and acceptance, hope, faith or trust, action and courage, integrity, willingness, humility, love, justice, perseverance, spirituality or beauty, and service) used by such groups as Alcoholics Anonymous and Gamblers Anonymous.

**Cognitive behavior therapy**

It is believed that cognitive behavior therapy (CBT) has got a role in the treatment of IGD. Identification of faulty cognition, distorted emotions, and application of proper coping skills are the ground rules for CBT. In a very recent study, King and Delfabbro (2016)\(^\text{[53]}\) tried to evaluate the cognitive psychology of internet game addicts. They found four cognitive factors that drive the behavior: “(a) beliefs about game reward value and tangibility, (b) maladaptive and inflexible rules about gaming behavior, (c) over-reliance on gaming to meet self-esteem needs, and (d) gaming as a method of gaining social acceptance.” They recommended further longitudinal studies using CBT to address these areas in the future.

**Motivational Interviewing**

A cognitive client-centered motivational approach has been suggested by some authors,\(^\text{[52]}\) the idea is to provide motivation to a person with gaming addiction, most of whom are coerced in various treatment programs. The Develop discrepancy, Avoid argumentation or confrontation over the behaviour, Roll with resistance, Express empathy, Support self-efficacy strategy is mainly applied on the area of ambivalence and resistance.

**Treatment with the self-discovery camp**

A paper published by Sakuma et al. in 2016\(^\text{[54]}\) suggested an innovative way of dealing with internet gaming addiction. They suggested deaddiction by intensive treatment in a therapeutic residential camp, which they called “Self-Discovery Camp.” The camp did not allow clients to bring any digital equipment.

**Components of therapy regimen**

- 14 sessions of CBT by psychologists
- Three medical lectures by doctors
- Eight sessions of personal counseling
- One workshop
- Outdoor activities such as cooking, walk rally, trekking, and woodworking.

**Objective of self-discovery camp**

1. To foster awareness of health, wellness, and a well-regulated life
2. To experience communication without the Internet or digital devices
3. To collaborate with others and solve problems.

College student volunteers were recruited as mentors. Participation was voluntary for everyone including the clients with IGD and the motivators who were college students majoring in education. The program reported a significant reduction of gaming behavior after only 3 months of therapy.

**Virtual reality treatment program**

Another innovative paper from Korea by Park et al.\(^\text{[55]}\) reported improvement of gaming behavior similar to that achieved by CBT, which they called virtual reality treatment program. This program consists of eight sessions, each sessions consisting of three steps preceded by a preinterview.

**Steps**

Preinterview: In this phase, the demographic information and photograph of participants were taken, their voices

| Table 4: Griffiths et al.’s recommendation for prevention of internet gaming addiction |
| --- |
| First, to find the content of the video game that is being played. If it has some objectionable contents, it need to be discussed and some rules need to be set |
| Both parents and professionals should aim at choosing games which is fun and constructive |
| Make the person understand the difference between make-believe and reality |
| Solitary game playing should be discouraged |
| Recommendations on the possible risks outlined by videogame manufacturers should be followed |
| To ensure that plenty of other activities are available to pursue for the addicted individual in their free time besides playing videogames |
were recorded, and each participant had to answer two questions: “(a) What are the most precious things in your life? (b) What is the most difficult problem caused by your excessive game play?”

1. Relaxation (5 min) - This phase was done to relax the persons by exposing to relaxing sounds and video
2. Simulation of a high-risk situation (10 min) - This phase was to induce craving in the client and was done by exposure to gaming cues from the game that he/she plays.
3. Sound-assisted cognitive reconstruction (10 min) - An aversive noise causing anxiety and annoyance to the participant was played in the most exciting high-risk situations which was paired with stimuli illustrating the aversive consequences of long-term pathological gaming (this was done by integrating participant’s photographs in aversive situations depicting long-term consequences of pathological gaming). The session ended by playing the initial recording of the participant’s answer to the question, “What are the most precious things in your life?”

The treatment protocol reported similar efficacy to that of CBT but within a short period of time.

Pharmacological treatment
Han et al.[56] studied the role of bupropion-sustained release formulation in IGD. After a 6-week trial, they concluded that there is a significant reduction in craving for internet video game play, total game play time, and cue-induced brain activity in dorsolateral prefrontal cortex. However, King and Delfabbro[57] reviewed three studies which suggested bupropion or methylphenidate for IGD and compared their efficacy to psychological treatments. They found no significant differences in terms of their efficacies.

INDIAN PERSPECTIVE

According to a web report,[58] the current consumer revenue generated by various gaming companies from India only is 469,702,000 USD which also claims that India is the 22nd highest revenue generator. This figure highly suggests that Indian population probably is in a position quite vulnerable to IGD, especially the youth population. However, a search for relevant literatures on IGD from India yielded a meager few, most of which are isolated case reports. Prevalence studies on IA are currently getting published from various corners of the country,[59] but none such has been found for IGD (to the best of our knowledge). Considering that IGD and IA have a similar approach for treatment, treatment options are available only at a few centers of our country. The National Institute of Mental Health and Neurosciences, India, has started the Services for Healthy Use of Technology Clinic, which provides help and services to those with a habitual pattern of excessive use of technology to the extent of impairment in other areas of functioning. Services include screening, cognitive reshaping, teaching of coping skills, and replacement of problematic technology use by healthy activities.

CONCLUSION

Although being recognized by the DSM-5 as a separate entity, IGD has yet not received its recognition as a viable public health problem. There have been some prevalence studies worldwide, but the actual magnitude of the disorder is yet to be revealed, especially in the developing countries such as India. Second, there is still diagnostic dilemma regarding IA and IGD, which needs to be cleared. Finally, the most important of all, researches regarding treatment options and success on this matter are still in infancy and need to pick up. Not only is there an urgent need for an effective and definitive clinical guideline of treatment, but also there is an urgent need to spread awareness and establishment of specialized clinics countrywide to provide solutions to those who are in desperate need to get out of the virtual reality.

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There are no conflicts of interest.

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