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The concept of recovery in gaming disorder: A scoping review

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REVIEW ARTICLE



ABSTRACT

Background: Recovery from mental health and behavioral disorders is classically defined as a reduction in symptoms. More recent definitions see it as a process in which individuals improve their health, wellness and other life domains. The inclusion of gaming disorder (GD) in the 11th International Classification of Diseases in 2019 prompted growing interest in GD. However, relatively little is known about recovery from GD, and there is scant literature describing or assessing its course. **Objectives:** This scoping review was designed to explore the state of the art on recovery from GD (e.g., terminology and measures used to assess recovery, main topics in studies about recovery from GD). **Methods:** PubMed, Web of Science, and Scopus databases were searched and critically reviewed according to PRISMA guidelines. We included empirical studies in English covering individuals across all age groups who met the diagnostic criteria of GD/internet gaming disorder (IGD) according to valid scales that relate to recovery or any change, and were published before February 2022. **Results:** A total of 47 out of 966 studies met the inclusion criteria. Recovery as a concept is not explicitly mentioned in GD studies. Rather, changes in subjects' disorders are described in terms of decreases/reductions in symptom severity, or improvement/increases. These changes are primarily measured by scales that evaluate symptom reduction and/or improvement in GD and other psychopathologies. **Conclusions:** The concept of recovery is included in the GD field but is not clearly mentioned or used. Therapists and researchers should aim to promote and integrate the notion of recovery in GD.

KEYWORDS

gaming disorder, recovery, scoping review, improvement, treatment, interventions

INTRODUCTION

This scoping review was designed to systematically map the literature on recovery from gaming disorder (GD). Gaming disorder (GD) is a relatively new mental disorder. It refers to persistent gaming behavior (online as well as offline) manifested by a loss of control, gaming despite harm to the individual, and conflicts stemming from gaming and functional impairment (World Health Organization, 2019). GD, under its previous name of internet gaming disorder (IGD), was first included in 2013 in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) appendix as a condition that should be further explored (American Psychiatric Association, 2013). The International Classification of Diseases, 11th revision (World Health Organization, 2019) defined it as a “disorder due to addictive behaviors”, given the concerns related to the harm caused by excessive involvement in this behavior and its negative impact on numerous areas of functioning (Zajac, Ginley, & Chang, 2020). In line with the ICD-11, the current review uses the term GD rather than IGD. However, in Table 1, the terms used by the original researchers have been maintained.

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A recent systematic review and meta-analysis revealed that the worldwide prevalence of GD was 3.05% (or 1.96% when only considering studies applying more rigorous sampling methods), with a higher male prevalence (Stevens, Dorstyn, Delfabbro, & King, 2021). Various assessment tools have been used to evaluate GD (King et al., 2020). These include the Internet Gaming Disorder Scale Short Form (Pontes & Griffiths, 2015), the Ten-Item Internet Gaming Disorder Test (IGDT-10; Király et al., 2017), the Clinical Video Game Addiction Test (Van Rooij, Schoenmakers, & Van de Mheen, 2017), and the Chen Internet Addiction Scale-Gaming version (Ko, Chen, Wang, Tsai, & Yen, 2019). While most use a cutoff threshold of five or more IGD criteria, there is no universal or standardized assessment tool (Bickham, 2021). This disparity in instruments may make it difficult to define a gold standard for the assessment of GD (Costa & Kuss, 2019). A recent Delphi study reached a consensus that some DSM-5 criteria were not clinically relevant, lead to the over-pathologization of gamers who are highly involved in gaming, and that the ICD-11 criteria are more useful (Castro-Calvo et al., 2021).

GD is associated with male gender, younger age and lower socio-economic status (Mihara & Higuchi, 2017; Stevens et al., 2021), as well as a variety of psychiatric symptoms or mental disorders such as depression (Ryu et al., 2018), anxiety (Adams et al., 2019), stress (Taechoyotin et al., 2020) and attention-deficit hyperactivity disorder (ADHD) (Park et al., 2017). It can co-occur with other addictive behaviors such as alcohol use disorder and problematic social media use (Burleigh, Griffiths, Sumich, Stavropoulos, & Kuss, 2019). It has also been associated with increased experience of loneliness and low self-esteem (Lemmens, Valkenburg, & Peter, 2011), aggression (Kim, Namkoong, Ku, & Kim, 2008) and poor physical health (Ayenigbara, 2017).

There is a growing body of literature focusing on intervention and treatment approaches for GD (King & Delfabbro, 2014; King et al., 2017; King, Kaptis, Delfabbro, & Gradisar, 2017; Zajac et al., 2020). Treatment approaches, including pharmacotherapy, motivational interviews, and cognitive behavior therapy, are usually adapted from substance use disorder treatments (King et al., 2017; King, Kaptis, et al., 2017; Saunders et al., 2017; Stevens, King, Dorstyn, & Delfabbro, 2019; Young & Brand, 2017). However, despite the growing literature on GD, its clinical course and the trajectories of GD remain unclear. The effectiveness of treatment approaches has received scant attention, in particular whether GD should be diagnosed as chronic or intermittent (Gentile et al., 2017; Zajac et al., 2020).

Recovery traditionally represents the transition from trauma and illness to health (White, 2005). Recovery is recognized by mental health care systems worldwide as the underlying philosophy for policy and practice (Laudet & Humphreys, 2013; Williams, Almeida, & Knyahnytska, 2015). However, even though recovery is embedded within mental addiction policies and practices, there is a lack of consensus among researchers, practitioners and policy makers as to the specific parameters characterizing recovery and the most accurate instruments to measure it (Inanlou,

Bahmani, Farhoudian, & Rafiee, 2020; Slade & Hayward, 2007).

The two paradigms describing the ways in which recovery from addiction is perceived and defined are known as the 'deficit-based' and the 'strengths-based' approaches. The deficit-based paradigm is influenced by medical perspectives and targets symptom reduction or elimination (White, 2007). It assesses recovery in terms of abstinence, sobriety, and/or symptom reduction. However, studies show that for some people abstinence is not an essential aspect for overcoming addictions to substances or gambling (Eddie, Bergman, Hoffman, & Kelly, 2022; Slutske, Piasecki, Blaszczynski, & Martin, 2010), thus raising the question whether abstinence is an imperative goal for recovery, whether abstinence is a critical element to recovery and whether it relates to all kinds of substances and addictive behaviors, or is one of many ways to achieve recovery (Neale, Nettleton, & Pickering, 2011; Slutske et al., 2010; White, 2007).

The harm-reduction approach acknowledges the difficulties associated with abstinence and suggests that reducing the harm related to addiction is evidence of a form of recovery (Bartram, 2021). Thus, although this approach is presented as the opposite of abstinence, it nevertheless corresponds to the idea of deficit. By contrast, the strengths-based paradigm, which was first proposed in the mid-1990s, is gaining momentum. Influenced by mental health consumer movements, it emphasizes growth rather than a reduction in pathology, which aligns with the principles of positive psychology (Ashford et al., 2019; Krentzman, 2013). In this paradigm, recovery is viewed as a holistic process of change. It involves self-directed means, consists of efforts over time, and manifests in improvement in a range of biopsychosocial aspects of life (Ashford et al., 2019). At the operational level, recovery from addictive behaviors is measured by and associated with multiple indicators of general well-being or quality of life (Kirouac, Stein, Pearson, & Witkiewitz, 2017; Neale et al., 2016), as well as neurological markers (Dempsey et al., 2015). All these indicators are considered recovery outcomes and processes (Gavriel-Fried, Lev-El, & Kraus, 2022; Song & Hsu, 2011).

In practice, these two approaches tend to be integrated. A good example is the position taken by the UK Drug Policy Commission which describes recovery as "a process of voluntarily sustained control over substance use" which calls for abstinence, but also states that this control maximizes health, well-being and engagement in society (Commission, 2008).

Aims of this scoping review

Whereas previous systematic and scoping reviews of GD have mainly focused on current diagnostic procedures and interventions for GD (Costa & Kuss, 2019), treatment considerations (Greenfield, 2018), and treatment approaches (Stevens et al., 2019; Zajac et al., 2020), none have related to or focused on the recovery concept itself. It is paramount to clarify how the concept of recovery is implemented in the



GD field to define treatment outcomes, evaluate treatment efficacy, as well as to structure and deliver treatment systems (El-Guebaly, 2012; Kelly & White, 2010; White, 2007), and solidify a recovery agenda of GD. GD is a relatively new behavioral addiction that would benefit from greater dissemination of studies and their findings. Hence, the most appropriate review method is a scoping review: an evidence-based method to identify the types of evidence available in a specific field, assess research gaps, and disseminate the findings to policy-makers, mental-health practitioners and treatment users (Peters et al., 2020).

Thus, the goal of this scoping review was to map and summarize the state of the art on recovery from GD by implementing PRISMA guidelines (Peters et al., 2020). It responds to the following research questions: 1. What are the characteristics of empirical studies in the field of GD that deal with recovery?; 2. Which terminology is used for recovery from GD?; 3. How do researchers measure recovery from GD, and what are the main variables measured?; 4. What are the main topics covered by research on recovery from GD? 5. Has the field of GD recovery evolved over time?

METHOD

Data sources and search procedure

PubMed, Web of Science, and Scopus databases were searched up to February 2022 with no specified initial date for “gaming disorder” and “recovery”, their synonyms or related terms. Examples of these synonyms or related terms include “game addiction”, “problematic gaming”, “pathological gaming”, “excessive gaming”, “abstinence”, “remission”, and “reduction”. The exact search algorithms for each database are presented in [Supplemental Table S1](#).

These database searches yielded a total of 1,590 hits: PubMed (293 results), Web of Science (562 results), and Scopus (735 results). After duplicates across the three databases were deleted, 966 hits remained. Titles and abstracts were examined and articles comprising non-relevant content, gray literature and articles in languages other than English were excluded ($n = 781$). In the next round, full text articles were examined. Out of 185 articles, 138 were excluded based on the exclusion criteria specified in the next section. In total, 47 papers were retained and included in the analysis of this scoping review (see [Fig. 1](#) for a flowchart of the search procedure).

Study selection. The inclusion and exclusion criteria were the following: Inclusion criteria – 1) Empirical articles related to individuals in all age groups who met the diagnostic criteria for GD or IGD according to validated scales used in this field, whose findings clearly related to GD. 2) Articles that clearly related to recovery or any change (e.g., reduction/improvement in GD symptoms, gaming behaviors, and various biopsychosocial characteristics/symptoms). 3) Articles in English. 4) Articles published up to February 2022.

Exclusion – we excluded articles that 1) Did not implement the official cutoff score for GD (e.g., three DSM-5

criteria instead of five); 2) Failed to provide a clear definition of GD; 3) Studies that described a short-term laboratory trial in which the participants were unaware that they were taking part in an intervention/treatment that could have led to improvement. We excluded these articles since there was no indication of the participants’ motivation to recover/receive treatment. We also excluded articles that 4) Included participants with other addictions and or gamers at risk in the sample, that made no distinction between these groups and individuals with GD when presenting the findings; 5) Related only to problematic internet use; 6) Scoping and systematic reviews, meta-analyses, and theoretical articles; 7) Studies not written in English; 8) Full texts not available.

After removing all duplicates, the second, third and fourth authors (M.S., D.K., & D.H.) independently reviewed all the titles and abstracts in the initial search and selected them according to the eligibility criteria through ongoing discussion with the first and last authors (B.G.F. & O.K.). Then, two researchers (M.S. & D.K.) read the abstracts individually, rated them and made a comparison. Approximately 10% disagreement was found, which was resolved entirely through discussion. In addition, the first author reviewed 10% of the titles and abstracts to reinforce the search process. Full-text articles that were found to be relevant to the scoping review were downloaded and screened to determine eligibility by the two other researchers.

Data extraction and analysis

The selected studies were initially characterized as a function of their common characteristics (e.g., study method and design, sample characteristics) and according to the research questions. This process was carried out independently by two authors (M.S. & D.K.). The results were compared and any discrepancies were discussed with the first author (B.G.F.) and resolved by consensus with ongoing involvement of the other authors (Z.D., & O.K.). To determine the main topics, an inductive content analysis was conducted on the findings derived from the data (Elo & Kyngäs, 2008). This approach is suitable when no prior knowledge on a specific topic exists. The main topics as they appear in the study aims and findings for each article were coded, and then grouped into categories and sub-categories as a function of their similarities and differences. In the last stage, they were grouped into one overarching theme (internal and external factors that promote/hinder recovery), and divided into two main categories (internal factors, external factors) each of which contained sub-categories (e.g., psychological characteristics and personality traits, social characteristics). To examine question four, the articles were arranged chronologically by year of publication and classified according to the categories/sub-categories to which they related.

RESULTS

A total of 47 studies met the inclusion criteria for this scoping review. An overview of the characteristics of these articles is presented in [Table 1](#).



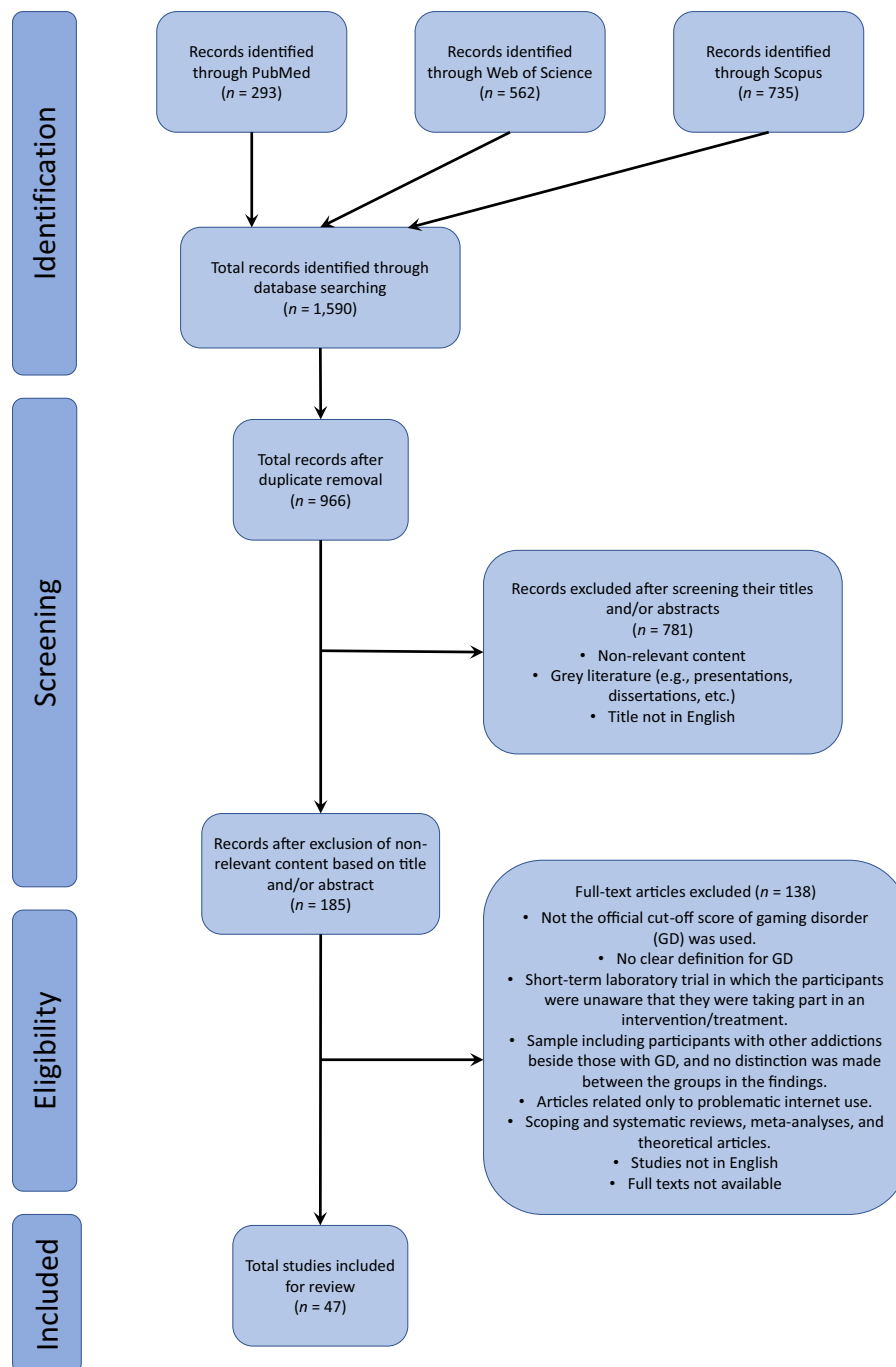


Fig. 1. PRISMA flowchart of the study selection process

Study and sample characteristics

Country. The majority of the studies were conducted in Asian countries. Most were conducted in South Korea ($n = 20$) (e.g., Han, Seo, Hwang, Kim, & Han, 2020; Jeong et al., 2020; Kim et al., 2017; Song et al., 2016) and in China ($n = 11$) (e.g., Deng et al., 2017; Dong, Wang, Zhang, Du, & Potenza, 2019; Liu et al., 2021). The remaining studies were conducted in Spain, Norway, Switzerland, Italy, Australia and USA (e.g., Cuppone et al., 2021; Martin-Fernandez et al., 2017; Nielsen et al., 2021).

Age. The majority of the studies ($n = 19$) focused on two age groups (adolescents or young adults) separately. However, a few studies included a sample comprised of adolescents and adults (e.g., Han & Renshaw, 2012; Kim et al., 2017). The mean age range of the participants in all studies was 13–26 years. In 17 studies, the participants had a mean age ranging from 13 to 18 (e.g., Lee et al., 2018; Pallesen, Lorvik, Bu, & Molde, 2015), and in 29 studies, the participants had a mean age ranging from 19 to 26 (e.g., Bae, Hong, Kim, & Han, 2018; Jeong et al., 2020). In one study, age was not reported (Liu et al., 2021).

Table 1. Characteristics of the studies included in the final scoping review ($N = 47$)

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Afriwilda & Mulawarman (2021)	Indonesia	Quantitative Experimental	One month	Evaluate a strength- based counseling intervention based on motivational interviewing in students with an online gaming addiction	$N = 32$ 65.62% males Mean age 15.84 (SD NR)	Mentioned once	Increase; improvement in psychological well- being	Increase in psychological well- being following motivational interviewing, which was more effective than counseling.
Bae et al. (2018)	South Korea	Quantitative Experimental	12 weeks	Evaluate Bupropion treatment; examine whether connections between the default mode network and the cognitive control network differed between internet-based gambling disorder (ibGD) and IGD	$N = 31$ (16 IGD) 100% males Mean age IGD (25.3 ± 5.2) ibGD (25 ± 4.9)	Not mentioned	Decrease; reduction in symptom severity; improvement in problematic behaviors	Improvement in depression (BDI), ADHD (K-ARS), and behavioral inhibitory/ activation (BIS/BAS) symptoms, and internet addiction (YIAS) scores. The functional connectivity within the default mode network and between the default mode network and cognitive control network decreased in IGD patients.
Cuppone et al. (2021)	Italy	Qualitative Case study	One year	Examine the effectiveness of a neurocircuit-based intervention, repetitive transcranial magnetic stimulation (rTMS)	$N = 2$ (One excessive on-line gamer) 100% Male Aged (21)	Mentioned once	Decrease in symptom severity; improvement in executive control	Decrease in time spent on gaming and recurrent thoughts about gaming. Improvement of emotional state, relational skills, and executive control. Resumption of friendships and leisure outdoor activities.
Deng et al. (2017)	China	Quantitative Longitudinal	Six months	Evaluate the effectiveness and detect the active ingredients of CBI in mitigation of IGD among young adults.	$N = 63$ 100% males Mean age CBI+ (21.8 ± 1.90) CBI- (22.0 ± 1.8)	Not mentioned	Decrease/reduction in craving; improvement in various domains	Decrease in the severity of IGD, craving, depressive symptoms, hours spent on gaming, and fulfillment of psychological needs in the CBI group. (continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Dong et al. (2019)*	China	Quantitative Longitudinal	One year	Identify subjective and neural factors underlying recovery by comparing data from recovered IGD and active IGD.	<i>N</i> = 29 (recovered IGD) 82.75% males Mean age Active (21.46 ± 1.83) Recovered (21.73 ± 1.91)	Mentioned 40 times	Recovery; decrease in craving; less sensitivity to gaming cues	Recovered IGD exhibited less activation in brain regions that are associated with craving, decreased brain responses to gaming cues and increased connectivity in the executive control regions.
Han et al. (2021)	South Korea	Quantitative Experimental	One year	Examine whether ADHD and IGD share similar brain functional connectivity between the frontal and subcortices.	<i>N</i> = 113 (49 IGD) 100% males Mean age ADHD (14.2 ± 1.9) ADHD + IGD (14.6 ± 1.2) Pure IGD (14.6 ± 1.2) HC (14.8 ± 2.0)	Mentioned once	Good prognosis	After one year of treatment for ADHD and IGD symptoms, the functional connectivity between the cortex and subcortex in all ADHD and IGD participants with good prognoses increased compared with those with poor prognoses.
Han et al. (2010)	South Korea	Quantitative Experimental	Six weeks	Evaluate whether Bupropion sustained release treatment, decreased craving for video games and cue- induced brain activity in patients with internet video game addiction (IAG)	<i>N</i> = 19 (11 IAG) 100% males Mean age IAG (21.5 ± 5.6 years) HC (20.3 ± 4.1)	Not mentioned	Decrease in craving; changes in brain activity	Improvement in maladaptive behaviors (e.g., school attendance). Decrease in craving, game play time, internet addiction scores (YIAS), and cue-induced brain activity in the dorsolateral prefrontal cortex.

(continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Han et al. (2012)	South Korea	Quantitative Experimental	Three weeks	Evaluate whether family therapy intervention would change patterns of brain activation in response to affection and gaming cues in adolescents with an online game addiction	$N = 30$ (15 with online game addiction) Gender NR Mean age online game addiction (14.2 ± 1.5) HC (14.0 ± 1.3)	Not mentioned	Decrease in gaming time; changes in brain activity; improved family cohesion	Decreases in internet addiction scores (YIAS), game play time and brain activation. Increases in family cohesion. Decreased activity of the caudate, middle temporal gyrus, and occipital lobe in response to affection stimulation, and increased activity of the middle frontal, inferior parietal lobes, and cerebellum in response to game stimulation.
Han and Renshaw (2012)	South Korea	Quantitative Prospective, randomized, double- blind clinical trial	12 weeks	Evaluate whether Bupropion treatment would reduce the severity of excessive online game play (EOP) as well as depressive symptoms	$N = 57$ 100% males Mean age Bupropion ($21.2 \pm$ 8.0) Placebo (19.1 ± 6.2)	Mentioned once	Decrease in symptom severity/ improvement in severity of online game addiction	Decrease in internet addiction (YIAS), depressive symptoms (BDI), and clinical (CGI-S) scores and in the mean time spent in online game playing.
Han et al. (2018)*	South Korea	Quantitative Cohort	Five years	A follow-up for patients who received professional treatment for IGD over a 5-year period	$N = 755$ 95.6% males Mean age 22.4 (± 6.1)	Mentioned 23 times	Recovery; Improved group	Recovery predictors were older age, earlier admission to the clinic, lower baseline depressive symptoms (BDI) and ADHD (K- ADHD-RS) scores and no suggestion for more treatment.

(continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Han et al. (2020)	South Korea	Quantitative Clinical trial	One month	Evaluate the effectiveness of CBT in treating impulsivity, anxiety, avoidance, and family and environmental problems in IGD patients	$N = 205$ 100% males Mean age CBT (25.9 ± 5.1) Supportive therapy (26.5 ± 5.5)	Not mentioned	Good prognosis; improvement in various psychological and environmental factors; reduction in symptom severity	Decrease in ADHD (K-ADHD) and depressive symptoms (BDI) scores, no use of medication, and higher harm avoidance scores were significant predictors of improvement in IGD. The CBT group showed a greater decrease in internet addictions (YIAS), anxiety (BAI), behavioral inhibitory/activation (BIS/BAS), and social avoidance and distress (SADS) scores compared to the supportive therapy group.
Hong et al. (2020)	South Korea	Quantitative Prospective trial	14 weeks	Evaluate the effect and neurophysiological mechanism of a physical exercise intervention (PE) combined with CBT on mood and frontal alpha asymmetry in IGD.	$N = 50$ 100% males Mean age CBT + PE (15.4 ± 2.9) CBT (15.9 ± 2.5)	Not mentioned	Decrease/reduction in symptom severity; Improvement in severity of symptoms; enhanced cognitive control	Decrease in depression (BDI), anxiety (BAI), ADHD (K-ARS), and YIAS scores. The changes in BDI and YIAS scores in the CBT + PE were significantly greater than those in the CBT-only. The increase in F4–F3 and F8–F7 frontal alpha asymmetry values were more pronounced in the CBT + PE than in the CBT-only. (continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Jeong et al. (2020)	South Korea	Quantitative Randomized, single- blind, sham- controlled trial	Six weeks	Examine the effects of transcranial direct current stimulation (tDCS) on addictive behavior and regional cerebral metabolic rate of glucose in problematic online gamers.	$N = 26$ 57.69% males Mean age Active tDCS (22.2 ± 1.7) Sham tDCS (23.2 ± 1.6)	Not mentioned	Decrease/reduction in symptom severity; changes in brain activity; improvement; increase in self control	Decrease in internet addiction (IAT), behavioral inhibition (BIS), behavioral activation (BAS-fun seeking; BAS reward responsiveness) scores, and in average weekly hours spent on gaming. Increase in brief self- control scale (BSCS) Active tDCS also showed increased regional cerebral metabolic rate of glucose in the left putamen, pallidum, and insula.
Kim, Han, Lee, Kim, & Renshaw (2012)*	South Korea	Quantitative	Four weeks	Examine whether excessive online game playing was associated with deficits in prefrontal cortical function; examine whether recovery from excessive online game playing (AEOP) would improve prefrontal cortical activation in response to working memory stimulation.	$N = 23$ (13 AEOP) Gender NR Mean age AEOP (14.5 ± 1.1) HC (14.2 ± 1.3)	Mentioned twice	Recovery, Abstinence, changes in brain activity	Recovery was associated with increased brain activity in response to complex stimulation in the dorsolateral prefrontal cortex and a decrease in the premotor cortex. Decreased severity in internet addiction scores (YIAS), decrease in game play time.

(continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Kim, Han, Lee, and Renshaw (2012)	South Korea	Quantitative Prospective trial	12 weeks	Evaluate the efficacy of CBT combined with Bupropion for the treatment of problematic online game play in adolescents with a co- morbid major depressive disorder	<i>N</i> = 65 100% males Mean age CBT-Med (16.2 ± 1.4) Med (15.9 ± 1.6)	Not mentioned	Decrease in symptom severity; increase/ improvement in life satisfaction	Decrease in internet addiction scores (YIAS), depression (BDI) and anxiety (BAI) symptoms, school problematic behavior scores, and online game play time. Increase in mean life satisfaction scores.
Kim et al. (2017)	South Korea	Quantitative Prospective longitudinal study	Six months	Identify neurophysiological markers associated with symptom changes in IGD patients. Identify factors that predict symptom improvement following outpatient treatment with pharmacotherapy	<i>N</i> = 49 (20 IGD) 100% males Mean age IGD (22.7 ± 5.4) HC (23.9 ± 4.3)	Not mentioned	Decrease/ improvement in symptom severity; changes in brain activity	Decrease in internet addiction scores (IAT), and a significant reduction in the absolute power in the delta band of the frontal region.
King, Kaptsis, et al. (2017)	Australia	Quantitative repeated-measures design	28 days	Test the efficacy of a voluntary 84-h abstinence protocol for modifying problematic internet gaming cognitions and behaviors	<i>N</i> = 24 (9 IGD) 83.33% males Mean age 24.6 (±5.1)	Not mentioned	Abstinence; clinical change; improvement in IGD symptoms and in maladaptive gaming cognitions; maintenance of adaptive levels of on-line gaming	Significant decline in IGD symptomatology (IGD criteria checklist), maladaptive gaming cognition on the Internet Gaming Cognition Scale (IGCS) and in gaming activity (hours) (continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Lee et al. (2021)*	South Korea	Quantitative Longitudinal clinical cohort study	Three years	Investigate whether ADHD comorbidity in IGD patients influences recovery, recurrence, and trajectories of IGD symptoms.	$N = 255$ 96.47% males Mean age pure-IGD (22.3 ± 6.5) ADHD-IGD (20.1 ± 5.7)	Mentioned 30 times	Recovery; Diagnosis change from IGD to non- IGD	For both groups, IGD symptoms (YAIS) improved significantly. The ADHD-IGD group showed a lower probability of recovery, a higher probability of recurrence, and a higher severity of IGD symptoms during follow-up periods than the pure-IGD group.
Lee et al. (2018)*	South Korea	Quantitative Cohort study	12 months	Identify which neuropsychological factors promote recovery from IGD	$N = 31$ 80.95% males Mean age non- improved (13.8 ± 3.0) improved (12.2 ± 2.2)	Mentioned 10 times	Recovery; good prognosis	In the improved gamers there was a decrease in internet addiction (IAT) and smartphone addiction (SAS) scores. In the non-improved gamers there was higher aggression, harm avoidance, and perceptual reasoning index scores (related to the Full-Scale Intelligent Quotient measure). (continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Li et al. (2018)	USA	Qualitative Case study	Five months	Provide support for Mindfulness-Oriented Recovery Enhancement (MORE) for video game addiction	N = 2 100% males Age (25,20)	Mentioned four times	Decrease and reduction in symptom severity; good prognosis; increase in positive coping; recovery; enhancement	Case 1 – no longer met DSM-5 criteria (no signs of video game addiction), slight increase in craving (controlled later), reduction in maladaptive cognition scores (OCS), acquired new strategies (e.g., mindful reappraisal) Case 2 - no longer met DSM-5 criteria (no signs of video game addiction), decrease in craving, reduction in maladaptive cognition scores (OCS), increased control over playing, difficulty regulating emotions.
Li and Wang (2013)	China	Quantitative Longitudinal, randomized, controlled trial	Six weeks	Evaluate the effectiveness of CBT in the treatment of online game addiction (only study 2 is relevant)	N = 28 100% males Mean age 15.52 (± 1.97)	Not mentioned	Decrease /reduction in symptom severity	Decrease in online game cognitive addiction scores and online game cognitive distortion scores.
Lim et al. (2016)	South Korea	Quantitative Longitudinal	Six months	Examine whether improvement in quality of life and cognitive functioning were associated with changes in addiction symptoms following outpatient/ treatment.	N = 84 (44 IGD) 100% males Mean age IGD (19.15 $\pm$ 5.21) HC (21.37 $\pm$ 6.30)	Mentioned once	Decrease in symptom severity; good prognosis; symptom improvement	Decrease in internet addiction scores (IAT), and a significant increase in quality-of- life psychological health scores, response inhibition, working memory, and executive functioning. (continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Liu et al. (2021)	China	Quantitative Longitudinal	Six months	Evaluate whether CBI would affect intrinsic connectivity distribution in IGD	N = 115 (74 IGD) 100% males Age NR	Mentioned twice	Decrease in symptom severity; changes in brain activity; remediated; Normalized	Decrease in gaming- cue-related craving and severity of addiction Increase in intrinsic connectivity distribution.
Liu et al. (2018)	China	Quantitative Longitudinal	NR	Evaluate how behavioral interventions influence emotional network connectivity related to depression in individuals with IGD (Only study 3 is relevant)	N = 63 100% males Mean age 18.31 (± 0.89)	Not mentioned	Decrease/reduction in symptom severity; changes in brain activity	Decrease in Internet Addiction score (CIAS) and depression scores (BDI) and in the resting state functional connectivity of the amygdala with frontal cortical regions (emotion and executive control networks).
Martín-Fernández et al. (2017)	Spain	Quantitative Transversal design	Six months	Presents profiles of adolescents with IGD according to comorbidity and analyze treatment response.	N = 59 96.6% males Mean age 14.83 (± 1.45)	Not mentioned	Decrease in symptom severity; partial abstinence; change in the patterns of maladaptive game play	Decrease in IGD symptoms (DSM-5 criteria) in externalizing and internalizing profile patients.
Nam et al. (2017)	South Korea	Quantitative Double blind prospective trial	12 weeks	Assessed whether both Bupropion and Escitalopram would be effective in reducing the severity of symptoms in patients with both major depressive disorder and IGD.	N = 30 Gender NR Mean age 23.9 (± 1.6)	Not mentioned	Decrease/reduction in symptom severity; changes in brain activity; symptom improvement	Decrease in internet addiction scores (YIAS) and depression (BDI) scores, and in functional connectivity. Decrease in impulsivity (BIS-BAS) and attentional symptom (K-ARS) scores. (continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Niedermoser et al. (2021)	Switzer- land	Qualitative Case study	Eight months	Presents the importance and the effects of treating a non- substance addiction (IGD) with cognitive behavioral therapy (CBT)	N = 1 100% Male Aged (19)	Not mentioned	Decrease in symptom severity; Improvement in control and functioning	No longer diagnosed as IGD. Major reduction in game time, depressive symptoms (Hamilton- 21) and clinically significant insomnia. Increased importance of social life, development of new hobbies and fields of interests.
Nielsen et al. (2021)	Switzer- land	Quantitative Randomized controlled trial	One year	Evaluated two family therapies: multidimensional family therapy and family therapy as usual in terms of their impact on the prevalence of IGD and IGD symptoms	N = 42 97.6% males Mean age 14.9 (± 2)	Not mentioned	Decrease/reduction in symptom severity and in gaming time; changes in perception of problem severity	Decrease in the prevalence of IGD and the number of IGD criteria. Less discrepancy in the perception of gaming problems between teens and parents. Improvement in family relationships.
Pallesen et al. (2015)	Norway	Quantitative Exploratory study	13 weeks	Evaluated the convergence of treatment response on video game addiction across several sources of information (patient, mother, and therapist)	N = 12 100% males Mean age 15.7 (± 1.3)	Not mentioned	Decrease/ improvement in symptom severity (reported by therapists and mothers)	Patients did not report significant improvement in problematic video game play whereas the mothers and therapists reported significant improvement.
Park, Kim, Kim, and Choi (2017)	South Korea	Quantitative Experimental	Six months	Identify which neurophysiological markers are associated with changes in symptoms after pharmacotherapy treatment in patients with IGD	N = 47 (18 IGD) 100% males Mean age 24.66 (± 3.80)	Not mentioned	Decrease in symptom severity; symptom improvement	Decrease in internet addiction scores (IAT) scores, although cognitive deficiencies in information processing remained.

(continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Park et al. (2016)	South Korea	Quantitative Prospective trial	One month	Examined whether virtual reality therapy would improve functional connectivity in individuals with an online gaming addiction (OGA)	$N = 36$ (24 OGA) 100% males Mean age 23.7 (± 2.93)	Not mentioned	Decrease /reduction/ improvement in symptom severity; changes in brain activity	Decrease in internet addiction scores (YIAS) scores. Increase in FC.
Park, Lee, Sohn, and Han (2016)	South Korea	Quantitative Single-blind, randomized, and controlled	Three months	Examined the effectiveness of Atomoxetine and Methylphenidate on problematic online gaming in adolescents with ADHD	$N = 86$ 100% males Mean age 17 (± 1.3)	Not mentioned	Decrease/reduction in symptom severity/improved clinical symptoms	Decrease in internet addiction scores (YIAS) and behavioral inhibition/activation (BIS-BAS) scores, and in impulsivity.
Pornnoppadol et al. (2020)	Thailand	Quantitative Quasi-experimental, prospective study	Six months	Evaluated and compared the effectiveness of psychosocial interventions for IGD including a therapeutic camp, a parent management training for game addiction and psychoeducation approach	$N = 104$ pairs (parent + child) 78.8% males Mean age 14.33 (± 1.29)	Not mentioned	Decrease in symptom severity; improvement in quality of life; alleviation of overall behavioral problems	Decrease in game addiction scores (GAST). Improvement in game addiction and quality of life (GAME-Q) scores, self-esteem, social skills, problem solving skills, self-awareness, and self- motivation.
Riley et al. (2022)	Australia	Qualitative Case study	Four months	Reports treatment response among treatment-refusing individuals with GD and highlights the value of the therapeutic alliance with parent	$N = 1$ 100% males Aged (19)	Mentioned twice	Decrease /reduction in gaming behavior; increased health, well-being and functioning	Decrease in average gaming time, increased daily functioning (e.g., showering), social interactions (communicating with mother), initiatives (e.g., interest in future and appearance). Mood and anxiety issues persisted. (continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Sachdeva and Verma (2015)	India	Qualitative Case-study	Seven months	Reports the cases of two brothers, diagnosed with internet gaming addiction and managed by pharmacological and non-pharmacological therapies	N = 2 100% males Aged (19, 22)	Mentioned once	Decreased symptom severity and craving; Improved quality of life; sustained improvement	Reduced irritability and craving for online games, improved self- care, hygiene, sleep, and interest in studies.
Sakuma et al. (2017)	Japan	Quantitative Longitudinal	Three months	Evaluate whether a self- discovery camp improved symptoms of IGD	N = 10 100% males Mean age 16.2 (± 2.15)	Not mentioned	Decrease in game time; improvement in self-efficacy and hours spent online; positive change	Decrease in total game time per day and per week. Improvement in problem recognition and self-efficacy towards positive change.
Sharma and Mahapatra (2021)	India	Qualitative Case study	12 weeks	Reports the case of a boy who developed IGD associated with maladaptive day- dreaming managed by psychological intervention	N = 1 100% males Age (16)	Not mentioned	Decrease in symptom severity	Decrease in internet gaming scores (IGT-20) and maladaptive daydreaming scores (MDS-16) scores.
Siste et al. (2020)	Indonesia	Qualitative Case study	Three months	Reports cases of parenting style as a risk factor for GD	N = 2 100% males Aged (20,18)	Mentioned twice	Improvement in symptom severity	Decrease in internet addiction scores (IAT) scores.
Song et al. (2016)	South Korea	Quantitative Open trial and controlled study	Six weeks	Compares the efficacy of Bupropion and Escitalopram treatments in IGD patients	N = 119 100% males Mean age 19.8 (± 3.93)	Not mentioned	Improvement/ decrease in symptom severity	Decrease in clinical impression severity (CGI-S), internet addiction (YIAS), depression (BDI); ADHD (ARS), impulsivity (BIS); Behavioral Inhibition and Activation (BIS/ BAS) scores. (continued)

Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Torres-Rodriguez et al. (2018)	Spain	Quantitative Clinical trial	Nine months	Evaluated the efficacy of a specialized psychotherapy program (PIPATIC) for adolescents with IGD	$N = 31$ 100% males Mean age Experiment (15.19 ± 1.9), Control (14.73 ± 1.58)	Not mentioned	Reduction/decrease in symptom severity and comorbid symptoms; improvement in intrapersonal abilities	Decrease in IGD symptoms (IGD-20 TEST) and fewer family conflicts. Improvement in identity diffusion, self- devaluation, emotional intelligence and social abilities.
Torres-Rodríguez et al. (2019)	Spain	Qualitative Case study	22 weeks	Report the effects of the PIPATIC treatment on four adolescents with IGD	$N = 4$ 100% male Aged (18, 13, 16,17)	Not mentioned	Decrease/reduction in symptom severity and gaming time; improvement	Decrease in IGD symptoms (IGD-20 TEST), amount of time spent on gaming and in scores on clinical tests related to comorbid disorders (e.g., depression and social phobia).
Wang et al. (2022)	China	Quantitative Experimental	Six weeks	Examined the potential of multi-voxel pattern analysis in classifying IGD subjects using cue- reactivity data; Examined the potential of multi-voxel pattern analysis in predicting treatment responses in IGD subjects receiving CBI	$N = 59$ (40 IGD) 100% males Mean age IGD (22.05 ± 1.78) HC (22.89 ± 2.23)	Mentioned once	Decrease in gaming time	Decrease in weekly gaming time and activity in regions of the brain associated with craving.
Yao et al. (2017)	China	Quantitative Experimental	Six weeks	Evaluated the efficacy of a group behavioral intervention combining reality therapy and mindfulness meditation in reducing decisional impulsivity and IGD severity	$N = 46$ (25 IGD) Gender NR Mean age IGD (22.28 ± 1.62) HC (22 ± 2.26)	Not mentioned	Decrease/reduction in symptom severity; remission	Decrease in internet addiction scores (CIAS), anxiety (BAI), depression (BDI) scores and in intertemporal decisional impulsivity.

(continued)





Table 1. Continued

Authors Year Country	Country	Study design and method	Study period	Study aims	Sample characteristics	Is the term “recovery” mentioned? **	Terminology used for recovery	Results
Zhang et al. (2018)	China	Quantitative Cross-sectional study	Six weeks	Identify how the cortical-ventral striatum circuitry responds to psycho-behavioral interventions in IGD patients	$N = 36$ 100% males Mean age CBI+ (21.80 ± 1.70) CBI- (22.38 ± 1.71)	Not mentioned	Decrease; amelioration in symptom severity; changes in brain activity	Decrease in internet addiction scores (CIAS) and craving scores, in time spent on internet gaming and in connectivity of the craving pathways in the brain.
Zhang et al. (2016a)	China	Quantitative Experimental	Six weeks	Examined differences between IGD and HC subjects and how CBI may operate to alter brain function	$N = 55$ (36 IGD) 100% males Mean age CBI+ (21.80 ± 1.70) CBI- (22.38 ± 1.71) HC NR	Not mentioned	Decrease/reduction in symptom severity and gaming time; changes in brain activity	Decrease in internet addiction scores (CIAS) and craving scores, time spent on internet gaming and in resting state functional connectivity.
Zhang et al. (2016b)	China	Quantitative Experimental	Six weeks	Examined the effects of CBI on cue-induced craving and neural activation in IGD	$N = 59$ (40 IGD) 100% males Mean age IGD (21.95 ± 1.84) HC (22.89 ± 2.23)	Mentioned once	Decrease/reduction in symptom severity and in craving; changes in brain activity	Decrease in internet addiction scores (CIAS) and craving scores, duration of weekly gaming and in functional connectivity in regions of visual addiction related cues. Increased activation in regions related to cognitive control.
Zheng et al. (2022)	China	Quantitative Experimental	Seven days	Examined the effects of 7 days of abstinence from gaming on automatic detection bias, negative affect and craving in individuals with IGD	$N = 50$ Gender NR Mean age Abstinence (21.40 ± 1.80) Control (21 ± 2.06)	Mentioned four times	Abstinence; decrease in symptom severity and in craving; changes in brain activity and affect; desensitization; restored.	Decreased response to gaming cues and decrease in negative affect and craving.

*In these studies, the term recovery is used in a fundamental manner (e.g. in relation to the aims of the study, the hypotheses and/or the sample characteristics and/or findings).

**The term recovery was only counted when it appeared in the context of GD in the title, abstract, or the body of the article (It was not counted when it appeared in the running head, figures, or references).

Abbreviations: ADHD, Attention Deficit Hyperactivity Disorder; NR, Not Reported; IGD, Internet Gaming Disorder; IGD-20 TEST, Internet Gaming Disorder Test; BDI, Beck Depression Inventory; CIAS, Chen Internet Addiction Scale; K-ARS, Korean ADHD Rating Scale; BIS, Barratt Impulsiveness Scale; BIS/BAS, Behavioral Inhibition and Activation Scales; IAT/YIAS, Young Internet Addiction test; ARS, ADHD Rating Scale; CBI, Craving Behavioral Intervention; HC, healthy controls; CGI-S, Clinical Global Impression-Severity scale; CBT, Cognitive Behavioral Therapy; SADS, Social Avoidance and Distress Scale; BAI, Beck Anxiety Inventory; SAS, Smartphone Addiction Scale; OCS, Online Cognition Scale; DSM-5, Diagnostic and Statistical Manual of Mental Disorders; GAST, Game Addiction Screening Test; GAM-Q, Game Addiction Quality of Life Scale; MDS-16, Maladaptive Daydreaming Scale-16.

Gender. Most samples ($n = 32$) were exclusively male (Li & Wang, 2013; Park et al., 2016; Park, Lee, Sohn, & Han, 2016; Riley, Baigent, Battersby, & King, 2022). Only 10 studies had a mixed sample of male and female participants. Nevertheless, in all of these studies, the female participants were the minority with percentages ranging from 5% to 35% (e.g., Dong et al., 2019; King et al., 2017; King, Kaptsis, et al., 2017; Lee, Bae, Kim, & Han, 2021). There was only one study where the percentage of female participants was close to half of the sample (Jeong et al., 2020). In five studies, the gender of the participants was not stated (Han, Kim, Lee, & Renshaw, 2012; Kim, Han, Lee, Kim, & Renshaw, 2012; Nam, Bae, Kim, Hong, & Han, 2017; Yao et al., 2017; Zheng, He, Nie, Fan, & Zhang, 2022).

Study method and design. Of the 47 studies included, the majority ($n = 39$) used a quantitative design, with most examining group differences ($n = 35$). Of these, there were longitudinal studies (e.g., Deng et al., 2017; Li & Wang, 2013), cross-sectional (e.g., Liu et al., 2018; Zhang et al., 2018), cohort (prospective) (Hong et al., 2020; Pornnoppadol et al., 2020) and randomized controlled trials (e.g., Park et al., 2016; Park, Lee, et al., 2016; Song et al., 2016). Most studies ($n = 23$) conducted a follow-up at one to six months, and involved assessments at several time points (e.g., baseline, three and six months), and described the manifestations of problematic gaming, where most studies ($n = 10$) covered a period of six weeks (Liu et al., 2021; Yao et al., 2017). A longer follow-up was used in one study that covered 11 months (Torres-Rodríguez, Griffiths, Carbonell, & Oberst, 2018), and four studies that covered 12 months (Dong et al., 2019; Han et al., 2021; Lee et al., 2018; Nielsen et al., 2021). Two studies reported a follow-up on participants who received professional treatment for GD over a remarkably extended period of 3 years (Lee et al., 2021) and 5 years (Han, Yoo, Renshaw, & Petry, 2018).

The eight remaining studies employed a qualitative case study design (Cuppone et al., 2021; Li et al., 2018; Nierdermoser et al., 2021; Riley et al., 2022; Sachdeva & Verma, 2015; Sharma & Mahapatra, 2021; Siste et al., 2020; Torres-Rodríguez, Griffiths, Carbonell, Farriols-Hernando, & Torres-Jimenez, 2019) in which they presented in-depth, detailed, prolonged, and individualized examinations of the course of GD.

Recruitment. In the majority of the studies ($n = 31$), the participants had sought treatment or were being treated in medical center facilities such as psychiatric departments in hospitals (e.g., Hong et al., 2020; Song et al., 2016), or outpatient clinics and research centers (e.g., Han et al., 2018; Kim et al., 2017; Nielsen et al., 2021). Nine studies were based on the general population who were recruited in most cases through advertisements (e.g., Pallesen et al., 2015; Pornnoppadol et al., 2020). Four studies recruited students from colleges or universities (Deng et al., 2017; Liu et al., 2018; Zhang et al., 2018; Zheng et al., 2022), and one study recruited high school students (Mulawarman & Afriwilda, 2021). In two studies, the sampling process was not clearly specified (Dong et al., 2019; Nam et al., 2017).

Sample size. The sample size in the quantitative studies ranged from 10 to 755 participants. Twenty-three studies had samples that ranged from 10 to 50 participants. Of these, only 13 samples were exclusively composed of a clinical population (e.g., individuals diagnosed as having GD/problematic gaming behavior) (e.g., Hong et al., 2020; Li et al., 2018; Nam et al., 2017). Nine studies had samples ranging from 51 to 100, five of which involved an exclusively clinical population (e.g., Han & Renshaw, 2012; Liu et al., 2018; Park et al., 2016; Park, Lee, et al., 2016).

The three largest samples had between 205 and 755 participants and were composed of clinical populations (Han et al., 2018, 2020; Lee et al., 2021). In addition, four samples exceeded 100 participants, of which two dealt exclusively with a clinical population (Pornnoppadol et al., 2020; Song et al., 2016). The number of participants in the case studies ranged from one to four.

Recovery terminology and measurements

Terminology used for recovery from GD. Most studies ($n = 42$) did not address the concept of recovery, or the course of recovery in depth, although significant improvement in gaming-related pathology was evident in all 47 studies. The most frequent terminology used to describe the changes in the subjects' disorder were 'reduction' and/or 'decrease' ($n = 39$), which were usually related to the severity of GD and other psychopathological symptoms, and various aspects of gaming behavior (Li & Wang, 2013). Of these, 23 studies used the terms 'symptom reduction' and/or 'decrease' and 'symptom improvement' and/or 'increase' concurrently (e.g., Cuppone et al., 2021). Four studies used the terms 'improvement' and/or 'increases' alone (Afriwilda & Mulawarman, 2021), or in conjunction with other terms (e.g., Han et al., 2018). All these terms paralleled the way these changes were measured.

Eighteen studies mentioned the word 'recovery' and/or 'recovered' in relation to GD at least once. Of these, the word 'recovery' was primarily used in relation to the aims of the study, the hypotheses and/or the sample characteristics and/or findings in only five studies (Dong et al., 2019; Han et al., 2018; Kim, Han, Lee, Kim, & Renshaw, 2012; Lee et al., 2018, 2021). All these five studies referred to recovery as a reduction in GD symptoms.

In the five studies that discussed recovery, diverse issues related to the notion of recovery were examined. These include predictors of recovery in recovered GD patients (Han et al., 2018), the associations between recovery, changes in brain activity, and improvement in working memory (Kim, Han, Lee, Kim, & Renshaw, 2012), the effects of ADHD comorbidity on the recovery process (Lee et al., 2021), factors that influence GD recovery (Lee et al., 2018) and the neurological factors related to GD recovery (Dong et al., 2019).

In six studies, the term 'good prognosis' was used (as the sole term or in conjunction with terms such as a 'decrease in symptoms') to describe improvement (e.g., Han et al., 2020; Lee et al., 2018). Interestingly, the term 'abstinence' was used in five studies (e.g., Kim, Han, Lee, Kim, & Renshaw, 2012;



King et al., 2017; King, Kaptis, et al., 2017; Zheng et al., 2022).

Recovery measures. All the studies ($n = 47$) evaluated and reported a decline in gaming-related pathology. The two most frequently used scales were the Young Internet Addiction Scale (YIAS) which was implemented in 15 studies (e.g., Bae et al., 2018; Hong et al., 2020; Nam et al., 2017; Song et al., 2016) whereas 11 studies used the DSM-5 criteria as a measure of reduction in IGD symptoms (e.g., Dong et al., 2019; Han et al., 2018; Torres-Rodriguez et al., 2019). Eighteen studies evaluated game play time and reported a drop (e.g., Han, Hwang, & Renshaw, 2010; Zhang et al., 2018).

Most studies ($n = 37$) were designed to measure improvement in the GD diagnosis in a broader context than that associated with gaming-related scales alone. These studies described the outcomes related to GD symptom reduction on psychological, bio-neurological and social markers. Thirty-two studies used additional psychological scales to further confirm the reduction in gaming-related pathology. Scales such as the Beck Depression Inventory (BDI) and the Beck Anxiety Inventory (BAI) (e.g., Han & Renshaw, 2012; Hong et al., 2020; Kim, Han, Lee, & Renshaw, 2012), the Social Avoidance and Distress Scale (SADS) (Han et al., 2020), the Online Gratification Psychological-Need Scale (Psy-Needs) (Deng et al., 2017) and the Korean ADHD rating scale (K-ARS) (e.g., Bae et al., 2018; Nam et al., 2017) were used. Twenty studies used bio-neurological measures to assess neurological changes in GD patients, such as fMRI to measure functional brain connectivity (FC) (e.g., Han et al., 2021; Nam et al., 2017; Park et al., 2016; Park, Lee, et al., 2016), and reactivity to gaming cues (Dong et al., 2019; Zhang et al., 2016b), PET-CT scans to assess metabolic rates (Jeong et al., 2020) and electroencephalogram (EEG) to assess brain activity (Hong et al., 2020; Kim et al., 2017). Finally, seven studies used social measures such as assessing the family environment (e.g., Han et al., 2012; Han et al., 2020; Nielsen et al., 2021; Torres-Rodriguez et al., 2018), and problematic behavior in school (Han et al., 2010; Kim, Han, Lee, & Renshaw, 2012). Most studies employed a diverse perspective where all or some of these markers were measured.

Although most studies tested for improvement in GD using a variety of measures, the dominant approach was the observation of a reduction in GD symptoms or in the psychological, bio-neurological and social measures mentioned above. Only 13 studies used an approach where positive components of life were examined in GD patients. These studies examined the increase in psychological well-being (e.g., Mulawarman & Afriwilda, 2021; Riley et al., 2022), family cohesion (Han et al., 2012, 2020), life satisfaction (Kim, Han, Lee, & Renshaw, 2012), quality of life (Lim et al., 2016; Pornnoppadol et al., 2020), improvement in identity diffusion, less self-devaluation and emotional intelligence (Torres-Rodriguez et al., 2018), problem recognition and self-efficacy towards positive change (Sakuma et al., 2017), improvement of emotional state, relational skills and

executive control (Cuppone et al., 2021), acquirement of new coping strategies (Li et al., 2018), increases in the importance of social life and fields of interests (Niedermoser et al., 2021) and improved self-care, hygiene, sleep, and interest in studies (Sachdeva & Verma., 2015).

Main topics

The fourth research question related to the main topics that emerged from the scoping review. The content analysis revealed one main theme that captured the idea of varied internal and external factors that promote or hinder recovery. Note that some of the studies covered more than one topic, so that the overall number of studies discussed below exceeds the total number of studies in the review.

Internal and external factors that promote/hinder recovery.

The articles included in this scoping review reported internal (psychological characteristics and personality traits, neurological), and external (social and treatment) factors that promote/hinder recovery from GD.

Internal factors. *Psychological characteristics and personality traits.* The studies included in this scoping review extensively reported impulsivity as a prevalent personality trait pertaining to the pathological course of problematic gaming and hindering recovery (Deng et al., 2017; Yao et al., 2017). Jeong et al. (2020) strengthened this association from a parallel direction. Their findings indicated that increases in self-control and changes in motivation decreased addiction severity and time spent on games. Other studies indicated that Bupropion (an antidepressant) targeted noradrenergic activity by reducing impulsivity in problematic gamers (Han & Renshaw, 2012; Nam et al., 2017). Other personality features that hindered recovery from internet gaming disorder and contributed to a worse prognosis included higher aggression, harm avoidance (Lee et al., 2018) and internalizing profiles (Martín-Fernández et al., 2017).

Comorbid disorders were also found to have an effect on the mitigation course of problematic gaming. Fourteen studies investigated the co-occurrence of other mental health disorders in GD patients. Four of these examined the comorbidity of GD with ADHD (Han et al., 2021; Lee et al., 2021; Park et al., 2016; Park, Lee, et al., 2016; Sakuma et al., 2017), four examined the comorbidity of GD with major depressive disorder (Han & Renshaw, 2012; Kim, Han, Lee, & Renshaw, 2012; Liu et al., 2018; Nam et al., 2017) and six examined both ADHD and major depressive disorder in relation to GD (e.g., Han et al., 2018; Lee et al., 2018; Torres-Rodriguez et al., 2018). Three of the latter also addressed other comorbid disorders such as anxiety disorder (Han et al., 2020), personality and/or mood disorders (Martín-Fernández et al., 2017), autism spectrum disorder and social phobia (Torres-Rodriguez et al., 2019).

The findings indicated that participants with GD with comorbid ADHD presented lower recovery rates and higher recurrence rates (Lee et al., 2021). Lower baseline Beck Depression Inventory (BDI) and ADHD scores were found to be critical predictors of recovery from GD (Han et al.,

2018). In addition, other components that related to individual characteristics and behaviors such as life satisfaction (Kim, Han, Lee, & Renshaw, 2012), school attendance and daily routine (Song et al., 2016) were negatively associated with gaming symptomology.

Neurological. Problematic gaming is considered to be connected to specific brain regions and associated with certain neural deficits. Most of the studies included in this scoping review were designed to identify which neural regions were correlated with symptom change (Kim et al., 2017; Park et al., 2017) and treatment outcomes (Han et al., 2010; Wang et al., 2022; Zhang et al., 2018), especially in response to gaming-related stimuli or cues that affect changes in craving (Liu et al., 2021; Park et al., 2016; Park, Lee, et al., 2016; Zhang et al., 2016b; Zheng et al., 2022). Recovery from GD was discussed in Dong et al. (2019). They found decreased brain reactivity to gaming cues in the lentiform nucleus and anterior cingulate cortex and reported that these regions also exhibited better connectivity in GD subjects after recovery. Lim et al. (2016) posited that subjects with GD with poor working memory and high executive functioning at baseline were more likely to respond to treatment and have faster cognitive recovery.

External factors. Social. A number of studies ($n = 8$) reported on the importance of enhancing external factors and reducing the social avoidance in problematic gamers, since these can prevent or significantly moderate use. For example, perceived family cohesion and the involvement of family members had a positive prolonged effect on the course of recovery by encouraging treatment attendance and completion (Han et al., 2018; Han et al., 2020; Nielsen et al., 2021; Torres-Rodríguez et al., 2018; Riley et al., 2022). One study examined the contribution of different parenting styles to the development and persistence of GD (Siste et al., 2020), thus emphasizing the clinical importance of the need to evaluate problematic gaming from a broad perspective.

Treatment. A substantial number of studies ($n = 31$) primarily aimed at evaluating different treatment methods to mitigate GD and focused on pre- to post-treatment changes. Of these, nine studies exclusively employed pharmacological treatment, with most studies assessing the effectiveness of Bupropion (e.g., Bae et al., 2018; Song et al., 2016). Six studies examined a cognitive-behavioral intervention, primarily cognitive behavioral therapy (e.g., Han et al., 2020; Li & Wang, 2013; Niedermoser et al., 2021). Since this form of treatment has consistently been proven effective in the literature, several studies examined its efficacy alone or compared or combined with other types of interventions (Hong et al., 2020). Another intervention employed in four studies was a craving behavioral intervention (CBI) aimed at reducing habitual craving (Liu et al., 2021; Zhang et al., 2016b). Other treatment methods included motivational interviewing counseling (Mulawarman & Afriwilda, 2021), family therapy (Han et al., 2012; Nielsen et al., 2021), parent-delivered contingency management (Riley et al., 2022), repetitive transcranial magnetic stimulation (rTMS) (Cuppone et al., 2021), transcranial

direct current stimulation (TDCS) (Jeong et al., 2020), virtual reality therapy (VRT) (Park et al., 2016; Park, Lee, et al., 2016), mindfulness (Li et al., 2018), combined reality therapy and mindfulness (Yao et al., 2017), therapeutic residential camps (Pornnoppadol et al., 2020; Sakuma et al., 2017), and psychotherapy (Torres-Rodríguez et al., 2019). In two studies the course of recovery was not mentioned, implying natural recovery (Dong et al., 2019; Lee et al., 2018).

Has the notion of GD recovery evolved over time?

The earliest study included in the scoping review was published in 2010 (Han et al., 2010), and the most recent in 2022 (Wang et al., 2022; Zheng et al., 2022). In terms of volume, two peaks were identified from 2016 to 2018 (21 studies) (e.g., Bae et al., 2018; Deng et al., 2017; Lim et al., 2016), and from 2020 to 2022 (16 studies) (e.g., Han et al., 2021; Liu et al., 2021; Pornnoppadol et al., 2020). All five studies that included recovery in their study aims/hypotheses were published from 2018 to 2021 (e.g., Han et al., 2018; Lee et al., 2021), suggesting that the notion of 'recovery' in the GD field is relatively new.

The focus on treatment of GD has apparently remained consistent over time. However, a recent trend points to greater interest in leveraging the potential of existing interventions and promoting psychosocial treatment methods such as multidimensional family treatment (Nielsen et al., 2021), motivational interview counseling (Mulawarman & Afriwilda, 2021), and mindfulness-oriented recovery enhancement (Li et al., 2018) to reduce negative symptoms while simultaneously promoting a balanced and healthy lifestyle by drawing attention to the need to view this disorder holistically.

DISCUSSION

This study was designed to map and summarize empirical studies on recovery from GD. Of all the articles reviewed here, only five clearly related to recovery as a concept in their study aims/hypotheses/sample characteristics or findings. All the others measured reduction or improvement in GD, aspects of gaming behavior, and/or in other related psychopathological symptoms (e.g., depression, anxiety) without even mentioning this term. More strikingly, even some extensive longitudinal studies did not posit or address the idea of recovery (e.g., Deng et al., 2017; Kim et al., 2017). This may be due to the fact that GD is a relatively new behavioral addictive disorder (WHO, 2019) in which theorizing is still evolving and where symptoms are still being explored and defined (Castro-Calvo et al., 2021). Thus, researchers may give priority to assessments of GD in terms of symptoms and the risk factors leading to this disorder, whereas theoretical and practical solutions may attract less attention since the disorder has yet to be clearly defined. This pattern parallels the evolution of the substance addiction field, where for many years, the pathology perspective dominated and where the focus was on the nature of the



disorder and the nature of vulnerabilities, based on the assumption that discovering the source of the problem would provide the key to recovery (White, 2005). However, in the gaming field, it remains unclear whether abstinence from GD is possible or whether a harm-reduction approach is preferable. Professionals and researchers are still debating whether abstinence is a realistic recovery goal or whether controlled gaming involvement is easier to achieve. We believe that as more data accumulate on the nature of GD, its course, and the risk factors leading to it, interest in recovery (e.g., approaches to it and definition) will increase.

Although most of the studies in this scoping review used the terminology of symptom reduction that drew on the deficit-based paradigm, as was the case for years in the substance addiction field that initially implemented this paradigm (White, 2007), about half associated the terms 'reduction' and 'improvement' to symptoms or other personal characteristics. This suggests that integrative approaches were implemented that combine deficit-based and strengths-based paradigms, and are in line with new theoretical and practice-oriented views of recovery (Commission, 2008).

The majority of the gaming studies here related to the changes in the individual in terms of the symptom reduction/improvement associated with medical, psychological, or combined interventions. This may represent a holistic perspective of recovery in which the recovery components are not only related to GD but to other variables as well. Therefore, a multicomponent model may best describe the recovery outcomes related to bio-neurological, psychological, and social markers in gamers.

Interestingly, most studies focused on the internal and external components that promote or hinder recovery. This division can be conceptualized under the theoretical umbrella of recovery capital (RC) (Cloud & Granfield, 2008), a holistic conceptual framework describing the internal and external resources (e.g., human, social) that help individuals initiate and achieve recovery (positive RC), or that hinder it (negative RC). Accordingly, treatment can be classified under positive community capital. Psychological characteristics such as impulsivity, aggression, and comorbidity (e.g., with ADHD) and neurological craving can be characterized as negative human capital that hinders recovery and challenges it, whereas family cohesion falls under the category of positive social capital. Understanding the contribution of these variables and others to recovery from GD can guide specialized treatment for individuals with GD. Since comorbid disorders such as ADHD constitute barriers and challenge the course of recovery, their associations with GD, including longitudinal changes, should be further examined on the clinical level to enhance treatment and prevention measures.

This scoping review found two peaks in publication frequency in 2016–2018 and 2020–2022. This is consistent with findings in other reviews which have reported an uptick in interest in facets of this disorder such as treatment (Zajac et al., 2020), and may be explained by the increasing interest elicited by including GD in the ICD-11 and its recognition and classification as a disease. Several studies discussed the

benefits stemming from this inclusion and highlighted the positive implications for public health and clinical perspectives (e.g., Király & Demetrovics, 2017; Long et al., 2022). Long et al. (2022) also called for capacity building in the management of GD.

Most of the studies included in this review were based on samples of adolescents and young adult males and were conducted in Asian countries. This is consistent with previous systematic reviews. For example, Burleigh et al. (2019) concentrated on the co-occurrence of GD with other potentially addictive behaviors, mainly including in their systematic review studies based on adolescents and young adults. The findings of studies conducted in Asian countries are congruent with a scoping review and diagnostic procedures and interventions for GD (Costa & Kuss, 2019), and Burleigh et al. (2020) that focused on GD and internet addiction in terms of resting-state EEG. In Asian countries where the prevalence of GD is soaring (Stevens et al., 2021), a relatively high volume of studies aspires to provide a possible solution and cure for this disorder.

Females were under-represented in the samples. This makes sense since previous clinical and epidemiological studies have shown that GD is more common among males (Lopez-Fernandez, Williams, Griffiths, & Kuss, 2019; Stevens et al., 2021). However, studies also show that women experience more severe psychological manifestations and more psychopathological symptoms than males, which may be related to the stigma triggered when traditional gender roles at home and work are not fulfilled as a result of GD (Granero et al., 2021; Lopez-Fernandez et al., 2019). Hence, researchers should include more women in their samples and devote studies to women alone, to better understand their special needs in treatment, and their special challenges during recovery. As in other addictions, dedicated treatment approaches should be developed including gender-responsive treatment programs that cater to women's specific needs (Grella, 2008).

The majority of the studies included in the current review used quantitative methods, and eight were case studies that focused on individuals with GD but from the point of view of the therapists. Recovery is a holistic and multi-dimensional phenomenon that can also be captured by qualitative research methods and from the perspectives of the recovered individuals themselves who can provide more detailed descriptions of recovery and its holistic experience and meaning in GD (Daher, Carré, Jaramillo, Olivares, & Tomicic, 2017).

This scoping review has some limitations that deserve attention and are related to the fact that only studies that used validated scales were included. Thus, studies in which the participants subjectively defined themselves as recovered from GD were not included. In addition, this review was based solely on studies published in English. Overall, however, this is the first scoping review on recovery in the gaming literature and is likely to contribute to the flourishing debate on the notion and meaning of this concept in the gaming field. Therapists, researchers and policy makers



can benefit from knowing more about the factors inherent to this concept that can lead to recovery from GD.

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SUPPLEMENTARY MATERIALS

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