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SYSTEMATIC REVIEWS

Internet addiction and problematic Internet use: A systematic review of clinical research

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Abstract

AIM: To provide a comprehensive overview of clinical studies on the clinical picture of Internet-use related addictions from a holistic perspective. A literature search was conducted using the database Web of Science.

METHODS: Over the last 15 years, the number of Internet users has increased by 1000%, and at the same time, research on addictive Internet use has proliferated. Internet addiction has not yet been understood very well, and research on its etiology and natural history is still in its infancy. In 2013, the American Psychiatric Association included Internet Gaming Disorder in the appendix of the updated version of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) as condition that requires further research prior to official inclusion in the main manual, with important repercussions for research and treatment. To date, reviews have focused on clinical and treatment studies of Internet addiction and Internet Gaming Disorder. This arguably limits the analysis to a specific diagnosis of a potential disorder that has not yet been officially recognised in the Western world, rather than a comprehensive and inclusive investigation of Internet-use related addictions (including problematic Internet use) more generally.

RESULTS: The systematic literature review identified a total of 46 relevant studies. The included studies used clinical samples, and focused on characteristics of treatment seekers and online addiction treatment. Four main types of clinical research studies were identified, namely research involving (1) treatment seeker characteristics; (2) psychopharmacotherapy; (3) psychological therapy; and (4) combined treatment.

CONCLUSION: A consensus regarding diagnostic criteria and measures is needed to improve reliability across studies and to develop effective and efficient treatment approaches for treatment seekers.

Key words: Internet addiction; Problematic Internet use; Gaming addiction; Internet Gaming Disorder; Clinical studies; Treatment seekers; Treatment; Therapy

Core tip: Internet addiction has appeared as new mental health concern. To date, reviews have focused on clinical and treatment studies of Internet addiction and Internet Gaming Disorder, limiting the analysis to a specific diagnosis of a potential disorder that has not yet been officially recognised, rather than a comprehensive investigation of Internet-use related addictions (including problematic Internet use) more generally. This systematic literature review outlines and discusses the current empirical literature base for clinical studies of Internet addiction and problematic Internet use. A total of 46 relevant studies on treatment seeker characteristics, psychopharmacotherapy, psychological therapy, and combined treatment were identified.

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INTRODUCTION

Over the last 15 years, the number of Internet users has increased by 1000%[1], and at the same time, research on addictive Internet use has proliferated. Internet addiction has not yet been understood very well, and research on its etiology and natural history is still in its infancy[2]. Currently, it is estimated that between 0.8% of young individuals in Italy[3] and 8.8% of Chinese adolescents[4] are affected. The reported higher prevalence rates in China suggest Internet addiction is a serious problem in China, and the country has acknowledged Internet addiction as official disorder in 2008[5].

A comprehensive systematic review of epidemiological research of Internet addiction for the last decade[6] indicated Internet addiction is associated with various risk factors, including sociodemographic variables (including male gender, younger age, and higher family income), Internet use variables (including time spent online, using social and gaming applications), psychosocial factors (including impulsivity, neuroticism, and loneliness), and comorbid symptoms (including depression, anxiety, and psychopathology in general), suggesting these factors contribute to an increased vulnerability for developing Internet-use related problems. Despite the gradually increasing number of studies concerning Internet addiction, classification is a contentious issue as a total of 21 different assessment instruments have been developed to date, and these are currently used to identify Internet addiction in both clinical and normative populations[6]. Conceptualisations vary substantially and include criteria derived from pathological gambling, substance-related addictions and the number of problems experienced. In addition to this, the cut-off points utilised for classification differ significantly, which impedes research and cultural cross-comparisons and limits research reliability.

Increasing research efforts on Internet addiction have led the American Psychiatric Association (APA) to include Internet Gaming Disorder in the appendix of the updated version of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) in 2013 as condition that requires further research before it can be accepted for inclusion in the main manual[7]. This has resulted in researchers commencing efforts to reach an international consensus for assessing Internet Gaming Disorder using the new DSM-5 approach based on an international expert panel[8]. However, various limitations to this recently proposed "consensus" have been identified, including the lack of a representative international community of experts in the field, the voting method used to arrive at the consensus, the criteria and nosology identified, lack of critical measurement of the disorder and lack of field testing[9]. For the purpose of a comprehensive and inclusive understanding of the potential disorder, in this systematic literature review, Internet addiction will be referred to as encompassing Internet-use related addictions and problematic Internet use, including Internet Gaming Disorder. It is argued that until this concept is understood more fully (including nosology, etiology and diagnostic criteria), limiting our understanding of Internet-use related addictions to Internet gaming-related problems does neither pay sufficient respect to the affected individuals' personal experience nor to the variety of online behaviours that can be engaged in excessively online. For example, other potential online addictions and Internet-use related disorders have been recently reviewed[10], suggesting that limiting a diagnosis to online gaming exclusively misses out many cases of individuals who experience negative consequences and significant impairment due to their Internet use-related behaviours.

For some individuals, their online behaviours are problematic and they require professional help as they cannot cope with their experiences by themselves, suggesting treatment is necessary. Based on in-depth interviews with 20 Internet addiction treatment experts from Europe and North America, Kuss and Griffiths[11] found that in inpatient and outpatient clinical settings, Internet addiction and Internet-use related problems are associated with significant impairment and distress for individuals, which have been emphasised as the criteria demarcating mental disorders[12]. This suggests that in the clinical context, Internet addiction can be viewed as mental disorder requiring professional treatment if the individual presents with significant levels of impairment. Psychotherapists treating the condition indicate the symptoms experienced by the individuals presenting for treatment appear similar to traditional substance-related addictions, including salience,

mood modification, tolerance, withdrawal, conflict and relapse[11]. This view is reflected by patients who seek treatment for their excessive gaming[13].

In 2002, the South Korean government-funded National Information Society Agency has opened the first Internet addiction prevention counselling centre worldwide, and has since developed large-scale projects (including prevention, training, counselling, treatment, and policy formulation) to tackle the pervasive problem of technology overuse[14]. Across the United States and Europe, Internet addiction treatment is not funded by the government, often leaving individuals seeking help either for other primary disorders or through private organisations, although new clinical centres that specialise in treating Internet-use related problems are being developed[15]. Based on the available evidence, recent research furthermore suggests that the best approach to treating Internet addiction is an individual approach, and a combination of psychopharmacotherapy with psychotherapy appears most efficacious[16].

To date, reviews have focused on clinical and treatment studies of Internet addiction[16-19] and Internet Gaming Disorder[2]. This arguably limits the analysis to a specific diagnosis of a potential disorder that has not yet been officially recognised in the Western world, rather than a comprehensive and inclusive investigation of Internet-use related addictions (including problematic Internet use) more generally. Previous reviews relied on overly restrictive inclusion criteria, and this has led to ambiguities in the conceptualisation of the problem, and consequently resulted in limitations regarding both validity and reliability. In order to overcome these problems, the aim of this literature review is to provide a comprehensive overview of clinical studies on the more inclusive clinical picture of Internet-use related addictions from a holistic perspective.

MATERIALS AND METHODS

Between July and August 2015, a literature search was conducted using the database Web of Science. This database is more comprehensive than other commonly used databases, such as PsycINFO or PubMed because it includes various multidisciplinary databases. The following search terms (and their derivatives) were entered: "Internet addict*", "Internet gaming addiction", "gaming addiction", "Internet Gaming Disorder", "compuls* Internet use", "compuls* gam*", "pathological Internet use", "excessive internet use", or "problematic Internet use", and "clinic*", "diagnos*", "treat*, "therap*", or "patient*". Studies were selected based on the following inclusion criteria. Studies had to (1) contain quantitative empirical data; (2) have been published after 2000; (3) include clinical samples and/or clinical interventions for Internet and/or gaming addiction; (4) provide a full-text article (rather than a conference abstract); and (5) be published in English, German, Polish, Spanish, Portuguese, or French as the present authors speak these languages. The initial search yielded 152 results. Following a thorough inspection of the articles' titles and abstracts, the articles that did not meet the inclusion criteria were excluded. The search strategy is presented in Figure 1.

Additional articles were identified through searching the citations in the literature selected, resulting in the inclusion of another eight studies[20-27].

RESULTS

A total of 46 studies met the inclusion criteria. These studies are presented in Table 1. The included studies used clinical samples, and focused on characteristics of treatment seekers and online addiction treatment. Four main types of clinical research studies were identified, namely research involving (1) treatment seeker characteristics; (2) psychopharmacotherapy; (3) psychological therapy; and (4) combined treatment. The results section will outline each of these.

Treatment seeker characteristics

A total of 25 studies[19,26,27,32,43,50,62,72,78,79,93,106,109,111,112,118,124,130,133,143,146,163,164,188,204] investigated the characteristics of treatment seekers. Here, treatment seekers are defined as individuals seeking professional support for online addiction-related problems. The following paragraphs will outline the treatment seekers' sociodemographic characteristics, Internet/gaming addiction measures used to ascertain diagnostic status in the respective studies, differential diagnoses and comorbidities.

Sociodemographic characteristics

In the included studies, sample sizes ranged from a case study of a male in Australia presenting with the problem of generalised pathological Internet use[112] to a total of 1826 clients sampled from 15 inpatient alcohol addiction rehabilitation centres in Germany, of which 71 also presented with Internet addiction and were then compared to a control group of 58 patients treated for alcohol addiction only[188]. Ages ranged from 16 years[112] to a mean age of 30.5 years[72]. The majority of studies used male participants, with one study using female participants only[50]. Most studies included individuals seeking treatment for Internet addiction and/or problematic Internet use in specialised inpatient and outpatient treatment centres. A number of studies included particular samples, such as individuals sampled *via* phone consultations (*i.e.,* including 86% relatives of the affected individuals)[43], patients sampled in alcohol rehabilitation centres[130], patients diagnosed with obsessive compulsive disorder (OCD)[46], and female patients treated for eating disorders[50].

Treatment seekers were sampled from various continents. Within Europe, samples included treatment seekers in Germany[43,78,124,130,133,164,188,197], The Netherlands[50], Italy[26,27,32], and Greece[79]. In North America, a Canadian sample was included[72]. In South America, samples included individuals from Perú[62], Puerto Rico[118], and Brazil[139]. In Western Asia, Turkish individuals were sampled in two studies[143,146], whereas in East Asia, participants were from China[163,204], South

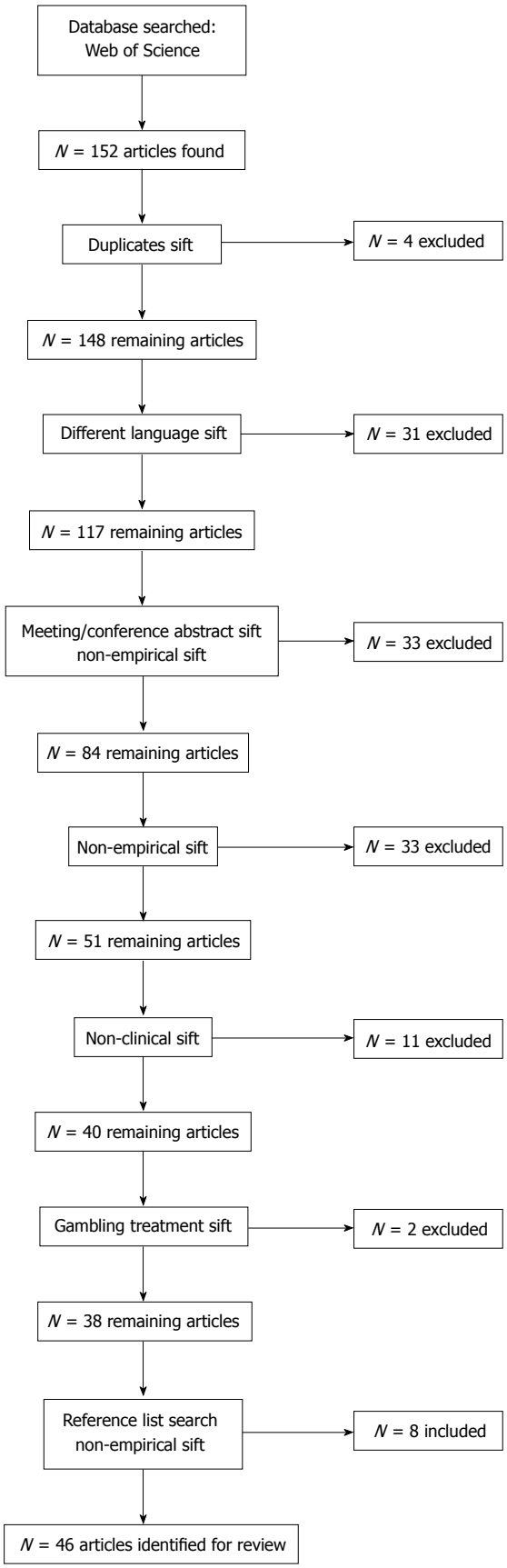

Figure 1 Flow chart displaying the search process.

Korea[93,106,109], and Taiwan[113]. One case study included an Australian adolescent[112].

Internet/gaming addiction

Internet and/or gaming addiction were measured with a number of different psychometric tools in the included studies, sometimes combined with structured clinical interviews. Clinical interviews were explicitly mentioned in the reports of eight studies[32,50,62,93,106,109,164,204], and these consisted mostly of the Structured Clinical Interview for DSM-Ⅳ[64], a semi-structured interview for DSM-Ⅳ Axis Ⅰ diagnoses for mental disorders.

In terms of psychometric measures, in the majority of studies, Young's popular Internet Addiction Test[48], the IAT, was used[26,32,72,93,106,109,118,143,146]. The IAT is a 20-item self-report scale that measures the extent of Internet addiction based on criteria for substance dependence and pathological gambling[51], and includes loss of control, neglecting everyday life, relationships and alternative recreational activities, behavioural and cognitive salience, negative consequences, escapism/mood modification, and deception. Significant problems due to Internet use are identified if individuals score between 70-100 on the test, and frequent problems when they score between 40-69[48]. However, previous research has suggested that across studies, different cut-off scores for the IAT have been used to classify individuals[6], impairing comparisons across studies.

Another popular measure appeared to be the Assessment of Internet and Computer Game Addiction Scale (AICA-S)[44,194], which was used in seven studies[43,78,124,130,133,188,197]. The AICA-S is a 16-item scale and includes questions about the frequency of specific Internet usage, associated negative consequences and the extent to which use is pathological from a diagnostic point of view. Fourteen out of the total sixteen main questions are used to calculate a clinical score, and to distinguish normal from potentially addictive use[211].

Other measures included the Compulsive Internet Use Scale (CIUS)[55], a 14-item unidimensional self-report questionnaire including loss of control, preoccupation (cognitive and behavioural), withdrawal symptoms, coping/mood modification, and conflict (inter- and intrapersonal). The CIUS classification is based on the DSM-Ⅳ TR diagnoses for substance dependence and pathological gambling[12], and was used in one study[50]. Moreover, in one study[79], the Online Cognitions Scale was used[80], which is a 36-item questionnaire that measures cognitions related to problematic Internet use, and includes subscales on loneliness/depression, diminished impulse control, social comfort, and distraction. In another study[113], Chen's Internet Addiction Scale[117] was administered, which is a 26-item self-report measure of core Internet addiction symptoms, including tolerance, compulsive use, withdrawal, and related problems (*i.e.,* negative impact on social activities, interpersonal relationships, physical condition, and time management). Another study[164] used the Internet Addiction Scale[212], as well as a combination of Young's[213] and Beard's[66] Internet addiction criteria, including preoccupation, tolerance, loss of control, withdrawal, overall impairment, deception,

Table 1 Clinical studies reviewed

Study	Aims	Sample and design	Treatment approach	Instruments	Results
Atmaca[28]	To describe a case of problematic Internet use successfully treated with an SSRI-antipsychotic combination	Case report *n* = 1 male 23-yr old single 4th year medical student	SSRI-antipsychotic combination: Citalopram 20 mg/d increased to 40 mg/d within 1 wk, continued for 6 wk; then quetiapine (50 mg/d) added and increased to 200 mg/d within 4 d	SCID-Ⅳ to assess Axis Ⅰ psychiatric comorbidity[29] YBOCS[30,31]	Y-BOCS score decreased from 21 to 7 after treatment Nonessential Internet use decreased from 27 to 7 h/wk; essential Internet use decreased from 4.5 to 3 h/wk Improvement maintained at 4 mo follow-up with the same medication
Bernardi *et al*[32]	To describe a clinical study of individuals with Internet addiction, comorbidities and dissociative symptoms	*n* = 50 adult outpatients self-referred for internet overuse in Italy (age M = 23.3, SD = 1.8 yr) 9 women and 6 men scored ≥ 70 on Internet Addiction Scale; 19 with "possible Internet addiction" (scoring 40-69 on IAT)	N/A	Youngs Internet Addiction Scale IAS[33] Clinical interview DES[34] CGI[35] Sheehan Disability Scale[36] Structured Clinical Interviews for DSM-Ⅳ (SCID Ⅰ and Ⅱ)[37,38] Hamilton Rating Scale for Depression[39] Hamilton Rating Scale for Anxiety[40] Liebowitz Social Anxiety Scale[41] YBOCS[30] CAARS:S[42]	Clinical diagnoses included 14% ADHD, 7% hypomania, 15% generalized anxiety disorder, 15% social anxiety disorder; 7% dysthymia, 7% obsessive compulsive personality disorder, 14% borderline personality disorder, and 7% avoidant personality disorder, 2% binge eating disorder IAD associated with higher perception of family disability and higher Yale-Brown Obsessive Compulsive Severity score Scores for the Dissociative Experience Scale were higher than expected and related to higher obsessive compulsive scores, hours per week on the Internet, and perception of family disability
Beutel *et al*[43]	To present the assessment and clinical characterisation of individuals seeking help for computer and Internet addiction *via* a telephone hotline	*N* = 346 phone consultations (85.8% relatives, 14.2% persons affected) *n* = 131 patients (M = 21.9, SD = 6.6, range 13-47 yr, 96.2% male) Specialised clinic for behavioural addictions in Germany	Telephone consultations First diagnostic interview with expert clinicians	Skala zum Computerspielverhalten [CSV-S (Scale for the Assessment of Pathological Computer Gaming)][44] Symptom-Checklist SCL-90-R[45]	Consultation mainly sought by relatives (86% mothers) 48% reported achievement failure and social isolation, lack of control (38%), family conflicts (33%) 96% of patients (*n* = 131) met criteria for pathological computer gaming
Bipeta *et al*[46]	To compare control subjects with or without Internet addiction with patients with pure obsessive compulsive disorder with or without Internet addiction	*n* = 34 control subjects with or without Internet addiction (age M = 26.9, SD = 6.6 yr) *n* = 38 patients with obsessive compulsive disorder with or without Internet addiction (age M = 27.0, SD = 6.1 yr)	OCD patients treated for 1 year with standard pharmacological treatment for OCD (TAU), received clonazepam, tapered off in three weeks, and an SSRI or clomipramine IA OCD group: 5 received 150-200 mg fluvoxamine/d, 4 received 150-200 mg sertraline/d, 1 received 60 mg fluoxetine/d, 1 received 200 mg clomipramine/d Non-IA OCD group: 8 received 150-300 mg fluvoxamine/d, 5 received 100-200 mg sertraline/d, 11 received 40-80 mg fluoxetine/d, 3 received 150-200 mg clomipramine/d	Youngs Diagnostic Questionnaire[47] IAT[48] Diagnostic and Statistical Manual of Mental Disorders, DSM-Ⅳ (psychiatric interview)[12] BIS-11[49] YBOCS[30]	11 OCD patients (28.95%) diagnosed with IA compared to 3 control subjects OCD group, no difference in OCD scores btw IA/OCD and non-IA/OCD groups IA scores higher in IA/OCD group Treatment improved test scores At 12 mo, 2/11 patients with OCD fulfilled IA criteria

Claes *et al*[50]	To investigate the association among CB, CIU, and reactive/regulative temperament in patients with ED	*n* = 60 female patients with eating disorders in the Netherlands (38.3% with Anorexia nervosa, 6.7% with Anorexia binging-purging type, 26.7% with bulimia nervosa, and 28.3% with Eating Disorder not otherwise specified; age range 15-57 yr, mean age = 27.8, SD = 9.8 yr)	N/A	DSM-Ⅳ, standardised clinical interview[51] EDI-2[52,53] CBS[54] Dutch Compulsive Internet Use Scale[55] BIS/BAS scales[56,57] DAPP[58,59] Adult Temperament Questionnaire-Short Form[60,61]	Positive association btw CB and CIU, emotional lability, excitement seeking, lack of effortful control (lack of inhibitory and lack of activation control) 11.7% of CB patients with IA No significant differences between ED subtypes regarding CIU
Cruzado Díaz *et al*[62]	To describe clinical and epidemiological characteristics of inpatients in a clinical centre in Perú between 2001-2006	*n* = 30 patients with "IA" 90% devoted themselves to online games) in Perú All single males from 13 to 28 yr old (M = 18.3, SD = 3.8), 63.3% with secondary education completed and 66.7% dropped out Descriptive, retrospective and transversal study	N/A	Reviewed 30 clinical registers through FEIA[63], a semi-structured instrument for psychiatric evaluation applied to clinical histories Patients completed a brief survey through an interview regarding information about their Internet use and online behaviours	Patient characteristics: Young age (18.3 ± 3.8 yr old) Extensive daily Internet use (50% remained online for more than 6 h/d) Primary Internet use: Online gaming (43.3% excessive gaming and 6.7% excessive gambling) Comorbidities (DSM-Ⅳ): High frequency of psychopathic behaviours (antisocial personality traits: 40%), 56.7% affective disorders (30% major depression and 26.7% dysthymia), 26.7% other addictions (13.3% gambling, 10% alcohol, 10% marihuana, 6.7% nicotine and 3.3% cocaine), 16.7% antisocial disorders (13.3% ADHD, social phobia 10% and 3.3% dysmorphic corporal disorder)
DellOsso *et al*[20]	To assess the safety and efficacy of escitalopram in IC-IUD using a double-blind placebo-controlled trial	*n* = 19 adult subjects (12 men, mean age = 38.5, SD = 12.0 yr) with IC-IUD (as primary disorder) 19 wk prospective trial with 2 consecutive phases: 10 wk treatment phase (*n* = 17, 11 men, mean age = 37.5, SD = 12.0 yr = and 9 wk randomised double-blind placebo controlled trial (*n* = 14, 10 men, mean age = 40.0, SD = 11.5 yr)	Escitalopram started at 10 mg/d, increased and maintained at 20 mg/d for 10 wk Subsequently, participants randomly assigned to placebo or escitalopram for 9 wk	Structured Clinical Interview for DSM-Ⅳ Axis I[64] Time spent in non-essential Internet use (hours/wk) CGI-I[35] BIS[49] IC-IUD version of YBOCS[30]	Following double-blind phase, there were no significant differences in weekly non-essential Internet use and overall clinical response between treatment and placebo group Side effects: Fatigue and sexual side effects in treatment, but not placebo group

Du *et al*[65]	To evaluate the therapeutic effectiveness of group CBT for Internet addiction in adolescents	*n* = 56 adolescents with IA (age range 12-17 yr) *n* = 32 active treatment group (28 male, mean age = 15.4, SD = 1.7 yr) *n* = 24 clinical control group (17 male, mean age = 16.6, SD = 1.2 yr)	Group cognitive behavioural therapy: Active treatment group: 8 1.5-2 h sessions of multimodal school-based group CBT with 6-10 students/group run by two child and adolescent psychiatrists (topics: Control, communication, Internet awareness, cessation techniques); group CB parent training; psychoeducation delivered to teachers Clinical control group: No intervention	Beards Diagnostic Questionnaire for Internet addiction[66] Internet Overuse Self-Rating Scale[67,68] Time Management Disposition Scale[69] Strength and Difficulties Questionnaire (Chinese edition)[70] SCARED[71]	Internet use decreased in both groups Only treatment group had improved time management skills and better emotional, cognitive and behavioural symptoms
Dufour *et al*[72]	To describe the sociodemographic characteristics of Internet addicts in a CDR, and to document their problems associated with other dependencies (alcohol, drugs, game practices), self-esteem, depression and anxiety	*n* = 57 Internet addiction treatment seekers (88.4% males, 11.6% females; age range = 18-62 yr (M = 30.5, SD = 11.8 yr). Canada	N/A	IAT[48,73] Becks Anxiety inventory[74] Becks Depression inventory[75] DÉBA-Alcohol/Drugs/Gaming[76] Self-esteem[77]	88% of Internet addicts were male, with a mean age of 30, living with their parents with low income M = 65 h of Internet use per week: 57.8% MMORPGs, 35,1% video streaming, and 29.8% chat rooms Rosenberg test: 66.6% weak and very weak self-esteem; Depression in only 3.5% and anxiety in 7.5% 45.6% received pharmacological treatment for mental disorders (psychotropic) and 33.3% had a chronic physical problem
Duven *et al*[78]	To investigate whether an enhanced motivational attention or tolerance effects are reported by patients with IGD	*n* = 27 male clinical sample from specialised behavioural addiction centre in Germany (*n* = 14 with IGD, *n* = 13 casual computer gamers) Semi-natural EEG designed with participants playing a computer game during the recording of event-related potentials to assess reward processing	N/A	AICA-S[44] SCL-90-R[45]	Attenuated P300 for patients with IGD in response to rewards relative to a control group Prolonged N100 latency and increased N100 amplitude, suggesting tolerance during computer game play, and gaming reward attention uses more cognitive capacity in patients
Floros *et al*[79]	To assess the comorbidity of IAD with other mental disorders in a clinical sample	*n* = 50 clinical sample of college students presenting for treatment of IAD in Greece (39 males, mean age = 21.0, SD = 3.2 yr; 11 females, mean age = 22.6, SD = 4.5 yr) Cross-sectional study	N/A	OCS[80] DSQ[81] ZKPQ[82,83] SCL-90[84,85]	25/50 presented with comorbidity of another Axis I disorder (10% with major depression, 5% with dysthymia and psychotic disorders, respectively), and 38% (19/50) with a concurrent Axis II personality disorder (22% with narcissistic, and 10% with borderline disorder) The majority of Axis I disorders (51.85%) were reported before IAD onset, 33.3% after onset
Ge *et al*[86]	To investigate the association between P300 event-related potential and IAD	*n* = 41 IAD subjects (21 males, age M = 32.5, SD = 3.2 yr) *n* = 48 volunteers (25 males, age M = 31.3, SD = 10.5 yr) Experimental task	CBT	Standard auditory oddball task using American Nicolet BRAVO Instrument	IA individuals had longer P300 latencies, but similar P300 amplitudes compared to controls Following treatment, P300 latencies decreased significantly, suggesting cognitive function deficits associated with IAD can be ameliorated with CBT

Han and Renshaw[21]	To test whether bupropion treatment reduces the severity of EOP and MDD	*n* = 50 male subjects with EOP and MDD (aged 13-45 yr) *n* = 25 treatment group (mean age = 21.2, SD = 8.0 yr, range = 13-42) *n* = 25 placebo group (mean age = 19.1, SD = 6.2 yr, range = 13-39) Randomised controlled double-blind clinical trial	Random allocation to either bupropion and EDU group or placebo and EDU group 12-wk treatment (8 wk active treatment phase and 4-wk post treatment follow-up period) 150 mg/d Bupropion SR given and increased to 300 mg/d during first week	Structured Clinical Interview for DSM-Ⅳ[64] Youngs Internet Addiction Scale[87,88] Becks Depression Inventory[89]	During active treatment period, Internet addiction, gaming, and depression decreased relative to placebo group During follow-up, bupropion-associated reductions in gaming persisted, while depressive symptoms recurred
Han *et al*[24]	To test the effects of bupropion sustained release treatment on brain activity for Internet video game addicts	*n* = 11 IAG (IAG; mean age = 21.5, SD = 5.6 yr; mean craving score = 5.5, SD = 1.0; mean playing time = 6.5, SD = 2.5 h/d; mean YIAS score = 71.2, SD = 9.4) *n* = 8 HC (HC; mean age = 11.8, SD = 2.1 yr; mean craving score = 3.9, SD = 1.1; mean Internet use = 1.9, SD = 0.6 h/d; mean YIAS score = 27.1, SD = 5.3) in South Korea Experimental design	Placebo group started with one pill and then raised to two pills Buproprion sustained release treatment: 6 wk Participants underwent 6 wk of bupropion sustained release treatment (150 mg/d for first week, 300 mg/d afterwards)	Structured Clinical Interview for DSM-Ⅳ[64] Beck Depression Inventory[89] Youngs Internet Addiction Scale[87] Craving for Internet video game play: 7-point visual analogue scale Brain activity measured at baseline and after treatment using 1.5 Tesla Espree fMRI scanner	Bupropion sustained release treatment works for IAG in a similar way as it works for patients with substance dependence During exposure to game cues, IAG had more brain activation in left occipital lobe cuneus, left dorsolateral prefrontal cortex, left parahippocampal gyrus relative to HC After treatment, craving, play time, cue-induced brain activity decreased in IAG
Han *et al*[22]	To assess the effect of methylphenidate on Internet video game play in children with ADHD	*n* = 62 children (52 males, mean age = 9.3, SD = 2.2 yr, range = 8.12), drug-naïve, diagnosed with ADHD, and Internet video game players in South Korea	Treatment with Concerta (OROS methylphenidate HCl, South Korea) Initial dosage: 18 mg/d, and maintenance dosage individually adjusted based on changes in clinical symptoms and weight	YIAS-K[87,88] Korean DuPaul's ADHD Rating Scale[90,91] Visual Continuous Performance Test using the Computerised Neurocognitive Function Test[92]	Following treatment, Internet addiction and Internet use decreased Changes in IA between baseline and treatment completion correlated with changes in ADHD, and omission errors from the Visual Continuous Performance Test
Hwang *et al*[93]	To directly compare patients with IA to patients with AD regarding impulsiveness, anger expression, and mood	*n* = 30 patients with IA (mean age = 22.7, SD = 6.7 yr) *n* = 30 patients with AD (mean age = 30.0, SD = 5.9 yr) *n* = 30 HCs (HCs, mean age = 25.3, SD = 2.8 yr) Outpatient clinic in South Korea	N/A	Korean version of Youngs IAT[48,94] SCID[64] Alcohol Use Disorder Identification Test-Korean version[95] Korean version of the NEO-PI-R[96,97] Korean version of the BIS-11[98,99] Korean version of the STAXI-K[100,101]	IA and AD groups showed lower agreeableness and higher neuroticism, impulsivity, and anger expression compared to the HC group (all related to aggression) Addiction groups had lower extraversion, openness to experience, and conscientiousness, were more depressive and anxious than HCs Severity of IA and AD positively correlated with these symptoms

Kim[23]	To examine the effect of a reality therapy (R/T) group counselling programme for Internet addiction and self-esteem	*n* = 25 university students in South Korea (20 males, mean age = 24.2 yr) Randomised controlled trial/quasi- experimental design	Treatment group (*n* = 13, 10 males): Participated in R/T group counselling programme, 2 60-90 min sessions/wk for 5 consecutive weeks (with the purpose of taking control and changing thinking and behaviours) Control group (*n* = 12, 10 males): No treatment	K-IAS[102] CSEI[103]	Treatment programme reduced addiction level and increased self-esteem
Kim *et al*[25]	To evaluate the efficacy of CBT combined with bupropion for treating POGP in adolescents with MDD	*n* = 65 adolescents with MDD and POGP in South Korea (aged 13-18 yr)	*n* = 32 CBT group (medication and CBT): 8 wk intervention; 159 mg bupropion/d for 1 wk, then 300 mg/d for 7 wk; participated in 8 session weekly group CBT; weekly 10 min interviews	BDI[89] BAI[74] YIAS[87,88]	Internet addiction decreased and life satisfaction increased in CBT and medication group relative to medication only group, but no changes in depression
				Modified-School Problematic Behaviour Scale[104]	Anxiety increased in medicated group
		Prospective trial	*n* = 33 clinical control group (medication only, as above)	Modified Students Life Satisfaction scale[105]	
Kim *et al*[106]	To investigate the value of Youngs IAT for subjects diagnosed with Internet addiction	*n* = 52 individuals presenting with Internet addiction at university hospital in South Korea (47 males; mean age = 21.7, SD = 7.1 yr, range: 11-38)	N/A	Clinical interview Youngs IAT[107,108] Classification of IA severity *via* DSM-IV-TR[12]	Samples mean IAT score below cut-off (70) IAT detected only 42% of sample as having Internet addiction No significant differences in IAT scores between mild, moderate and severe Internet addition found No association between IAT scores and Internet addiction duration of illness found IAT has limited clinical utility for evaluating IA severity
Kim *et al*[109]	To compare patients with IGD with patients with AUD and HC regarding resting-state ReHo	*n* = 45 males seeking treatment in South Korea *n* = 16 IGD patients (mean age = 21.6, SD = 5.9 yr) *n* = 14 AUD patients (mean age = 28.6, SD = 5.9 yr) *n* = 15 HCs (mean age = 25.4, SD = 5.9 yr)	N/A	Youngs IAT[87] SCID[64] AUDIT-K[110] BDI[89] BAI[74] BIS-11[111] FMRI resting data acquired via Philips Achieva 3-T MRI scanner using standard whole-head coil, obtaining 180 T2 weighted EPI volumes in each of 35 axial planes parallel to anterior and posterior commissures	Significantly increased ReHo in PCC of the IGD and AUD groups Decreased ReHo in right STG of IGD, compared with AUD and HC groups Decreased ReHo in anterior cingulate cortex of AUD patients Internet addiction severity positively correlated with ReHo in medial frontal cortex, precuneus/ PCC, and left ITC in IGD Impulsivity negatively correlated with ReHo in left ITC in IGD Increased ReHo in PCC: Neurobiological feature of IGD and AUD Reduced ReHo in STG: Neurobiological marker for IGD specifically relative to AUD and HCs
King *et al*[112]	To present a case study of an individual with GPIU	*n* = 1, 16-yr old male in Australia Case study	N/A	N/A	PIU identified due to: (1) use of several different Internet functions; (2) social isolation; (3) procrastination and time-wasting tendencies Problems unlikely to have occurred without the Internet

Ko *et al*[113]	To evaluate the diagnostic validity of IGD criteria, and to determine the cut-off point for IGD in DSM-5	*n* = 225 adults in Taiwan (*n* = 75 individuals with IGD (63 males, mean age = 23.4, SD = 2.6 yr), no IGD (63 males, mean age = 22.9, SD = 2.5 yr), and IGD in remission (63 males, mean age = 23.8, SD = 2.9 yr), respectively)	N/A	Diagnostic interview based on DSM-5 IGD criteria[7] DC-IA-C[114] Chinese version of the MINI[115] QGU-B[116] CIAS[117]	Diagnostic accuracy of DSM-5 IGD items between 77.3% and 94.7% (except for deceiving and escape), and differentiated IGD from remitted individuals Meeting ⩾ 5 IGD criteria: Best cut-off point to differentiate IGD from non-IGD and remitted individuals
Liberatore *et al*[118]	To describe the prevalence of IA in a clinical sample of Latino adolescents receiving ambulatory psychiatric treatment	*n* = 71 adolescent patients in Puerto Rico (39 males, aged 13-17 yr), 39.4% diagnosed with disruptive disorder, 31.0% with mood disorder, 19.7% with mood and disruptive disorder	N/A	Spanish version of the Internet Addiction Test (IAT)[87]	Sample did not involve any cases of severe IA 71.8% of the sample had no IA problem 11.6% discussed Internet use with therapists IA correlated with mood disorders
Liu *et al*[119]	To test the effectiveness and underlying MFGT	*n* = 92 (46 adolescents with 12-18 yr old, and 46 parents, aged 35-46 yr old) 2 groups: 1 experimental (EG; MFGT adolescents and parents) and 1 control (CG; waiting-list similar adolescents and parents) EG: Adolescents: 17 males and 4 females (age: M = 15, SD = 1.73); Parents: 5 males and 16 females (age: M = 40.9, SD = 2.85) CG: Adolescents: 21 males and 4 females (age: M = 15.7, SD = 1.2); Parents: Idem to EG (no sign. Diff). China Quasi-experimental design	MFGT is a new approach to treat Internet addiction (IA) behaviours that has not been tested before MFGT = group therapy for families, both adults and adolescents that have the same problem (IA) Advantage: Peer group (support and learn from peer confrontation) Transference reactions occur within and between families	Structured questionnaires at pre-test (T1), post-test (T2) and follow-up (T3): Adolescents scales: Adolescent Pathological Internet Use Scale APIUS[120] Parents scales: Closeness to Parents[121] Parent-Adolescent Communication Scale[122] College Students Psychological Needs and Fulfillment Scale[123]	Significantly decreased IA in EG at T2 and maintained in T3 (adolescents IA rate dropped from 100% at baseline to 4.8% after intervention, then remained at 11.1%) Significantly better reports in the EG from adolescents and parents compared with those in the CG Underlying mechanism of less IA was partially explained by adolescent satisfaction of their psychological needs and improved parent-adolescent communication and closeness
Müller *et al*[124]	To characterize German treatment seekers and to determine the diagnostic accuracy of a self-report scale for IA	*n* = 290 mostly male (93.8%) treatment seekers between 18 and 64 yr (M = 26.4, SD = 8.22) Germany	Treatment of behavioural addictions Non-experimental design	SCL-90R[125] PHQ[126] GAD-7[127] CDS-2[128] AICA-S[129]	71% met clinical IA diagnosis Displayed higher levels of psychopathology, especially depressive and dissociative symptoms Half met criteria for one further psychiatric disorder, especially depression Level of functioning decreased in all domains AICA-S showed good psychometric properties and satisfying diagnostic accuracy (sensitivity: 80.5%; specificity: 82.4%)
Müller *et al*[130]	To compare personality profiles of a sample of patients in different rehabilitation centres	IA group: 70 male patients with an addiction disorder that additionally met the criteria for IA; M =29.3 yr (SD = 10.66; range 16-64) AD group: 48 male patients suffering from AD; M = 31.7 yr; SD = 9.18; range 17-65) Germany	N/A Non-experimental design	Computer game Addiction (AICA-S)[129] NEO-FFI[131] BDI-II[132]	Patients with comorbid IA can be discriminated from other patients by higher neuroticism and lower extraversion and lower conscientiousness After controlling for depressive symptoms, lower conscientiousness turned out to be a disorder-specific risk factor

Müller *et al*[133]	To evaluate the relationships between personality traits and IGD	*n* = 404 males aged 16 yr and above 4 groups: IGD group: 115 patients with IGD Clinical CG: 74 controls seeking treatment for IGD, but not diagnosable Gambling group: 115 gambling patients Healthy CG: 93 individuals with regular or intense use of online games Germany	N/A Experimental design: Characteristics of people selected for assigning them to two groups, non-random allocation	AICA-S[44] AICA-C[134] Berlin Inventory for Gambling[135] NEO Five-Factor Inventory[131]	IGD associated with higher neuroticism, decreased conscientiousness and low extraversion The comparisons to pathological gamblers indicate that low conscientiousness and low extraversion in particular are characteristics of IGD Etiopathological model proposed for addictive online gaming
Park *et al*[136]	To examine the effectiveness of treating an Internet-addicted young adult suffering from interpersonal problems based on the MRI interactional model and Murray Bowen's family systems theory	1 family case study consisting of husband (age 50), wife (age 50), 2 sons (ages 22, 23), older son with Internet addiction and interpersonal problems South Korea		Comparative analysis method Miles and Huberman's matrix and network[137]	Characteristics of the parents family of origin and dysfunctional communication pattern associated with interpersonal problems revealed by participants Both the MRI model and Bowen's family systems theory produced effective treatments
Poddar *et al*[138]	To describe a pilot intervention using MET and CBT principles to treat IGD in an adolescent	*n* = 1 14-yr-old boy India Case study	Initial therapy session: Rapport building with patient, detailed interview, primary case formulation Subsequent sessions: Psychoeducation, cost/benefit analysis of behaviour (motivation level improved) Progressive muscle relaxation because gaming urge accompanied by physiological/emotional arousal Subsequently: Game addiction assessment, contract for behaviour modification (reduce gaming time, increase other activities) Tokens introduced as positive reinforcement Less time spent gaming on weekdays, but excess on weekends Patient recorded Thoughts, Emotions and Behaviors (TE and B) contributing to gaming (result: Gaming due to boredom) Non-gaming behaviour reinforced *via* scooty rides	IQ ESDST, BVMGT, and TAT IAT	IGD due to child neglect and boredom, consolidated by subsequent negative reinforcements Individual interventions encouraged as there are varied antecedents and consequences for IGD development MET-CBT principles for IGD resulted in improvement Therapy terminated when gains had consolidated Good exam scores achieved Weekend gaming times reduced IAT score reduced to 48 (from 83)

Santos *et al*[139]	To describe a treatment of a patient with PD, OCD (both anxiety disorders) and IA involving pharmacotherapy and CBT and test its efficacy	Case report *n* = 1 24-yr-old Caucasian woman A patient with PD, OCD and IA Brazil	Pharmacotherapy and CBT CBT 1x/week for 10 wk Pharmacotherapy [clonazepam (0.5 mg) and sertraline (50 mg) once daily] Both (pharmaco and CBT) started together CBT focus: Teach patient how to deal with anxiety and internet use (*i.e.*, breathing retraining with diaphragmatic breathing exercise, education about PD and OCD symptoms and internet use, time management, identifying PIU triggers, changing habits, cognitive restructuring, exposure and response prevention, social support promotion, building alternative activities, functional internet use promotion)	Hamilton Anxiety Scale (HAMA-A)[40] Hamilton Depression Scale (HAM-D)[59] Chambless BSQ[140] Bandelow PA[141] IAT CGI[142]	Treatment effective for anxiety and IA
Senormanci *et al*[143]	To investigate the attachment styles and family functioning of patients with IA	*n* = 60 2 groups: EG: 30 male patients with IA [age: M = 21.6 (18-20) yr] CG: 30 healthy males without IA Non-experimental	N/A	IAT[48] BDI[89] Experiences in Close Relationships Questionnaire-r [144] Family Assessment Device[145]	Patients with IA had higher BDI and higher attachment anxiety sub-scores on the ECR-r compared with those in the CG IA patients evaluated their family functioning as more negative and reported problems in every aspect addressed by the FAD Scores on the FAD behaviour control, affective responsiveness, and problem-solving subscales (and on the FAD communication, roles, and general functioning subscales) significantly higher in patients compared with CG
Senormanci *et al*[146]	To determine the predictor effect of depression, loneliness, anger and interpersonal relationship styles for IA in patients diagnosed with IA	*n* = 40 male IA patients with at least 18-yr-old Turkey	N/A	IAT[48] BDI[89] STAXI[100] UCLA Loneliness Scale[147] IRSQ, subscale "Contributing and inhibiting styles"[148]	Duration of Internet use (hours/day) and STAXI anger in subscale predicted IA. Although the duration is not adequate for IA diagnosis, it predicts IA It is helpful for clinicians to regulate the hours of Internet use for patients with excessive or uncontrolled internet use Psychiatric treatments for expressing anger and therapies focussing on emotion validation may be useful

Shek *et al*[149]	To described an indigenous multi-level counselling programme designed for young people with IA problems based on the responses of clients	*n* = 59 58 male and 1 female Most in early adolescence (aged 11-15 yr; *n* = 29) and late adolescence (aged 16-18 yr; *n* = 27), while 3 were over 18 China	Indigenous multilevel counselling program designed to provide services for young people with Internet addictive behaviour in Hong Kong: (1) Emphasis on controlled and healthy use of the Internet; (2) Understanding the change process in adolescents with Internet addiction behaviour; (3) Utilization of motivational interviewing model; (4) Adoption of a family perspective; (5) Multi-level counselling model; (6) Utilization of case work and group work	3 versions of IA Young's assessment tools[150]: 10-item, 8-item and 7-item measures[151-153] Goldberg's framework[154] Chinese Internet Addiction Scale (CIA-Goldberg) Items for assessing beliefs and behaviours for using Internet: 7 items from Computer Use Survey[155] 6 items from OCS[80] 6 items from Internet Addiction-Related Perceptions and Attitudes Seale[156] 2 items from IAD-Related Experience Scale[157] 33-item C-FAI developed[158] Chinese Purpose in Life Questionnaire[159] Chinese Beck Depression Inventory[160] Chinese Hopelessness Seale[161] Chinese Rosenberg Self-Esteem Seale[162]	The outcome evaluation, pretest and posttest data showed IA problems decreased after joining programme Slight positive changes in parenting attributes Participants subjectively perceived the programme was helpful
Tao *et al*[163]	To develop diagnostic criteria for IAD and to evaluate the validity of proposed diagnostic criteria for discriminating non-dependent from dependent Internet use in the general population	3 stages: Criteria development and item testing; criterion-related validity testing; global clinical impression and criteria evaluation; Stage 1: *n* = 110 patients with IA in SG, M = 17.9 SD = 2.9 yr (range: 12-30 yr), 91.8% (*n* = 101) males; 408 patients in IA in TG, M = 17.6, SD = 2.7 yr (range: 12-27 yr), 92.6% (*n* = 378) male; Stage 2: *n* = 405; Stage 3: *n* = 150 (M = 17.7, SD = 2.8, (92.7% males) China	N/A	N/A: Authors developed the proposed Internet addiction diagnostic criteria, which have been one of the main sources for the APAs IGD criteria	Proposed Internet addiction diagnostic criteria: Symptom criterion (7 clinical IAD symptoms), clinically significant impairment criterion (functional and psychosocial impairments), course criterion (duration of addiction lasting at least 3 mo, with at least 6 h of non-essential Internet use per day) and exclusion criterion (dependency attributed to psychotic disorders) Diagnostic score of 2 + 1, where first 2 symptoms (preoccupation and withdrawal symptoms) and min. 1/5 other symptoms (tolerance, lack of control, continued excessive use despite knowledge of negative effects/ affects, loss of interests excluding Internet, and Internet use to escape or relieve a dysphoric mood) was established Inter-rater reliability: 98%