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Behavioral Addictions as Mental Disorders: To Be or Not To Be?

Nancy M. Petry,
University of Connecticut School of Medicine, USA

Kristyn Zajac, and
University of Connecticut School of Medicine, USA

Meredith K. Ginley
University of Connecticut School of Medicine, USA

Abstract

Should excessive and problematic engagement in non-substance use behaviors be mental disorders? The fifth revision of the Diagnostic and Statistical Manual for Mental Disorders (DSM-5) repositioned gambling disorder in the substance use disorders section and introduced Internet gaming disorder in the research appendix; the International Classification of Diseases (ICD-11) is also considering it. This article outlines pros and cons of considering "behavioral addictions" as mental disorders and the DSM-5 decision making processes. It focuses upon three conditions: gambling disorder, Internet gaming disorder, and Internet addiction. The paper details assessment methods and prevalence rates for these conditions and outlines psychiatric comorbidities, demographic and biological risk factors, and promising treatment approaches. The paper also briefly discusses other putative behavioral addictions: eating/food, sex, exercise, shopping, and tanning "addictions." Overall, data are inconclusive, and consistent terminology and methodology are needed to define and evaluate these conditions more fully prior to considering them mental disorders.

Keywords

DSM-5; gambling disorder; Internet gaming disorder; gaming addiction; Internet addiction

I. Introduction

A. The debate about behavioral addictions

Researchers and clinicians have long deliberated the existence of behavioral addictions. The term "addiction" itself is a loaded one. Some feel this term is stigmatizing, while others propose it appropriately describes the nature of symptoms associated with excessive and

Correspondence concerning this article should be addressed to Nancy Petry, Ph.D., Professor of Medicine, Calhoun Cardiology Center, 263 Farmington Ave., Farmington, CT 06030-3944, USA, npetry@uchc.edu; 860-679-2593.

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problematic use of a substance or engagement in an activity. Not only does the term "addiction" instigate controversy but so does consideration of new mental disorders. In particular, those related to excessive engagement in non-substance activities stimulate considerable debate.

On the one hand, recognizing a constellation of symptoms as a mental disorder allows the condition to be diagnosed and classified consistently. Diagnosis also facilitates study of etiology, prevention, and treatment, which in turn can reduce morbidity and mortality. On the other hand, proliferation of mental disorders can minimize experiences of individuals with pronounced impairments. If chocolate or love addiction are mental disorders, how do they compare to schizophrenia, bipolar disorder, or generalized anxiety disorders with respect to priorities for funding research and treatment?

As society evolves, the expression of mental disorders changes, but is technology creating new disorders or addictions? Are we all addicted to our smartphones? Should a behavior that occurs outside the realm of "normal," or even on the high end of normal, be considered an illness? Are excessive behavior patterns simply "bad habits," or are they reflections of underlying neurobiological abnormalities or "hijacked brains?"

These are important questions when considering a new mental disorder, and they are perhaps particularly pertinent in the context of addictions. For centuries, the medical profession overlooked substance use disorders, the classic "addiction." Still today, substance use disorders are not given the legitimacy of other mental disorders. Treatment and insurance coverage for addictions is separated from other medical conditions, and even from other mental disorders. Insurers may have distinct deductibles and reimbursement maximums for substance use treatment. For non-substance or behavioral addictions, treatments in most countries, if available at all, occur in highly specialized sectors. Most insurers in the United States (US) do not cover their costs at all.

This paper describes the research and debate surrounding behavioral addictions. As we review the evidence for non-substance addictions, we consider issues related to psychiatric nosology in general. By using a broad framework, future research may inform the basic issues surrounding behavioral addictions.

B. The DSM-5 process and decisions

The American Psychiatric Association (APA) convened Workgroups to review research and suggest changes for conditions listed in the DSM-IV and to consider inclusion of new mental disorders. Stein et al. (2010) proposed guidelines for what constitutes a mental disorder: (1) a pattern of symptoms or syndrome, that (2) leads to clinically significant distress or disability; (3) it may stem from psychobiological dysfunction (although exact mechanism may be unknown); but it must not (4) reflect an expected response to stressors or a culturally sanctioned response (e.g. trances during religious rituals) or (5) result primarily from social conflicts or deviance. New mental disorders should have diagnostic validity, defined by demonstrations of prognostic significance, psychobiological disruption and/or treatment response; clinical utility; and diagnostic validators to differentiate disorders from similar conditions. Stein and colleagues (2010) also recognize there are rarely precise

boundaries for mental, or medical, disorders. When considering a new condition, potential for benefits such as improved care or outcomes, should outweigh potential harms, such as stigmatization.

The Substance Use and Related Disorders Workgroup evaluated the literature regarding several behavioral, or non-substance, addictions using this framework. These included gambling, Internet gaming, Internet use generally, eating, shopping, sex, exercise, and tanning. After considerable review and consultation with experts, this Workgroup ultimately recommended only one should be included alongside substance use disorders—gambling disorder. This condition was introduced in the DSM in 1980, and substantial data exist regarding its pattern of symptoms, associated distress and disability, differentiation from similar conditions, neurobiology, and treatment response (Petry et al. 2014a). Of the other possible behavioral addictions, the Workgroup recommended including only Internet gaming disorder in Section 3, the research appendix, as a condition requiring further study (Petry et al. 2015). The Workgroup concluded that existing data on other conditions were too preliminary to fit Stein's (2010) criteria as new mental disorders.

This paper focuses on gambling disorder, gaming disorder, and Internet addiction more generally, because these conditions have the largest evidence base. For each, methods of assessment and prevalence rates are presented. The paper also outlines psychiatric comorbidities and risk factors, such as demographic characteristics, neurobiology, and genetics. It reviews promising treatment approaches and suggests next steps. The paper also describes briefly other putative behavioral addictions prior to outlining specific and common issues for consideration.

II. Specific conditions

A. Gambling disorder

1. Defining features and methods for assessment—Gambling disorder was termed "pathological gambling" in earlier versions of the DSM and was included as an "Impulse control disorder not otherwise specified" before the DSM-5. There are now nine criteria, and a diagnosis necessitates meeting at least four in a one-year period. The criteria are: thinking about gambling excessively (i.e., "pre-occupation"); betting greater amounts (i.e., tolerance); being unable to cease or reduce gambling; exhibiting withdrawal symptoms (restlessness, irritability) when not gambling; gambling to escape adverse moods or problems; attempting to win back losses (i.e., "chasing"); financially relying on others to cover losses; lying about or covering up gambling; and losing important relationships, or a career or educational opportunity, because of gambling. These criteria accurately distinguish persons with clinically significant impairment, and although persons with the disorder endorse some of these criteria more than others, each lends to diagnosis (Petry et al. 2013).

Structured clinical interviews exist for assessing DSM criteria for gambling disorder such as the National Opinion Research Center Screen. It has acceptable to excellent internal consistency, test-retest reliability, construct, prospective, and discriminative validity (Gerstein et al. 1999, Hodgins 2004, Wickwire et al. 2008). The Canadian Problem Gambling Index (CPGI), a commonly used instrument, contains nine items assessing

gambling harms, but they are not aligned with the DSM criteria and therefore preclude diagnosis (Currie et al. 2013). Another popular screening instrument is The South Oaks Gambling Screen, but it has high false-positive rates (Stinchfield 2002), so DSM-based instruments are better suited toward establishing prevalence rates. It is also important to note that quantity or frequency items do not predict gambling disorder, and the DSM-5 criteria for gambling disorder, similar to substance use disorders, do not employ quantity or frequency indices (Hasin et al. 2013).

2. Prevalence rates—Many countries have undertaken surveys to determine the prevalence rate of gambling disorder. Table 1 outlines nationally representative studies that utilized DSM-based criteria to assess past-year gambling disorder in 3000 or more respondents through 2016. Rates range from 0.1% to 0.7%, with most estimates indicating about 2 in 1000 persons have clinically significant problems with gambling.

3. Comorbidities—Epidemiological studies that assess gambling and other psychiatric disorders ubiquitously find high rates of comorbidity. For example, one nationally representative US study (Kessler et al. 2008) found that 76.3% of individuals with gambling disorder also had a substance use disorder, a rate 5.5 times higher than those without gambling disorder. Similarly, Petry et al. (2005) noted that nearly half the persons with gambling disorder also had alcohol dependence, and over a third an illicit drug use disorder.

Rates of comorbities with other non-addictive psychiatric disorders are also high, including depression and anxiety disorders (Kessler et al. 2008, Petry et al. 2005). A meta-analysis of epidemiological studies (Lorains et al. 2011) found gambling disorder was significantly related to nicotine, substance use, mood, and anxiety disorders, with 60.2%, 57.5%, 37.9% and 37.4% of persons with gambling disorder experiencing these respective conditions. Severity of gambling problems appears to increase with severity of substance use problems, but similar patterns are not evident with other mental health disorders (Rush et al. 2008), suggesting associations between gambling and substance use disorders are unique.

4. Risk factors—Several demographic characteristics are risk factors for gambling disorder, including male gender (Kessler et al. 2008, Petry et al. 2005), and younger age (Kessler et al. 2008). Gambling disorder also occurs more often in lower socioeconomic groups and among racial/ethnic minorities (Kessler et al. 2008, Petry et al. 2005).

Impulsivity is linked with both substance use and gambling disorders. Persons with gambling and substance use disorders are more impulsive than their counterparts with neither condition, and those with both disorders have the highest rates of impulsivity (Petry 2001). Longitudinal studies demonstrate that impulsive behaviors early in childhood are associated with development of these disorders (Pagani et al. 2009, Slutske et al. 2012, Vitaro et al. 1999).

5. Neurobiology and genetics—The reward deficiency theory attempts to explain susceptibility to addictions through impaired functioning in brain regions that control impulsive decision making. It posits that hypoactive reward systems in the striatum and medial prefrontal cortex (PFC) require stronger stimuli such as drugs or gambling to activate

them. Compared to controls, persons with gambling disorder have reductions in grey matter volume, particularly within the PFC (Zois et al. 2017). They also have white matter abnormalities in regions including but not limited to the corpus callosum, cingulum, and inferior fronto-occipital fascicle, consistent with findings of substance use disorders (Joutsa et al. 2011). Many studies suggest functional impairment in persons with gambling disorder as well, generally decreased activation in the PFC, but the directionality of effects and regions of impairment sometimes vary. For example, reduced functioning in the ventral striatum is noted in some studies of gamblers relative to controls (Balodis et al. 2012) while others find greater activation (van Holst et al. 2012). The discrepancies may relate to the nature of the tasks or rewards. Gamblers appear particularly sensitive to high-risk rewards; some studies find no differences or reduced neural response when tasks involve low risk or non-monetary rewards, but enhanced activity during presentation of high-risk rewards (Limbrick-Olfield et al. 2013). In some cases, the pattern of results is similar between persons with gambling and substance use disorders (Limbrick-Olfield et al. 2013), but given different methodologies and results, it is difficult to state conclusively the extent to which substance use and gambling disorders have similar or distinct neurobiological features.

Gambling disorder, like substance use disorders, tends to run in families. Twin studies indicate strong evidence for heritability of gambling disorder and between alcohol and gambling disorders (e.g., Slutske et al. 2013). Studies of the molecular genetics of gambling disorder focus primarily on dopamine genes, with some finding an association with a polymorphism of the dopamine 2 receptor gene (DRD2) but not others (see Argawal et al. 2012 for review). Lind et al. (2013) conducted a genome-wide association study of gambling disorder in a large sample of twins and implicated four single nucleotide polymorphisms that appeared to relate to gambling as well as substance use disorders. Overall, molecular genetics findings support epidemiological data on the association of gambling and substance use disorders.

6. Treatments—Six placebo controlled trials of pharmacotherapies for gambling disorder randomized over 25 patients per condition (Table 2). One study of an opioid antagonist, nalmafene, found some benefits relative to placebo (Grant et al. 2006), but follow-up studies yielded no advantage (Grant et al. 2010, Toneatto et al. 2009). In these studies, placebo response rates ranged from 31% (Grant et al. 2006) to 63% (Saiz-Ruiz et al. 2005), underscoring the need to include attention- and expectation-matched control conditions in psychotherapy trials as well.

Table 2 outlines psychotherapy trials with a time and attention matched control for at least one of the experimental conditions and randomized 25 or more persons per condition, allowing a reasonably stable estimate of effects (Chambless & Hollon 1998). Some trials of cognitive-behavioral therapy (CBT) alone (Casey et al. 2017, Petry et al. 2006) or combined with motivational interviewing (Petry et al. 2016a) demonstrated benefits relative to control conditions, and therapist contact generally improved outcomes compared to entirely self-directed CBT via workbooks or the Internet (Diskin & Hodgins 2009, Hodgins et al. 2001, 2009, Petry et al. 2006). Still, many studies evaluating interventions comparable in intensity found limited, or no, differences between them (Cunningham et al. 2012, LaBrie et al. 2012, Luquiens et al. 2016, Oei et al. 2010, Petry et al. 2016a, Martens et al. 2015, Smith et al.

2015). No intervention meets criteria as empirically validated (Chambless & Hollon 1998) for gambling disorder.

7. Summary—Gambling disorder is an established mental condition and the American Psychiatric Association recognizes it as the first non-substance "addiction." It has well-defined criteria and instruments with established psychometric properties, and it is readily distinguishable from other conditions that commonly co-occur, i.e., substance use disorders, depression, bipolar disorder. Reliable risk factors have been identified, and ongoing research is evaluating the neurobiological and genetic basis of gambling disorder. Adequately powered studies with high quality designs suggest some potentially promising interventions to guide treatment efforts, although none yet rise to the level of empirically validated (Chambless & Hollon 1998).

B. Internet gaming disorder

The proposed DSM-5 criteria for Internet gaming disorder (IGD) have some parallels to gambling disorder, and they share some other features as well. The modality of gambling or gaming is not relevant to classifying the conditions, although some forms of gambling (e.g., slot machines; Petry 2007) and gaming (e.g., online games like massively multiplayer online roleplaying games; Rehbein et al. 2010) are more likely to lead to problems than others (e.g., lotteries or offline single player games). Underscoring a common misperception, the DSM-5 text states clearly that gaming offline or on devices that do not connect to the Internet can also constitute the condition. Because Internet-based applications of videogames are most linked with problems and to better distinguish the title of the condition from "gambling disorder," the term Internet was included, i.e., Internet gaming disorder.

Although the two conditions may overlap on some levels, there are important distinctions as well. First, gambling refers to risking money or items of value in hopes of a larger payout; financially-based gains and losses are less central for gaming. In some videogames, players uncover items or powers that have monetary value, but a primary purpose of playing is not for financial gain, and money is typically not risked, or at least not frequently as is the case for gambling. Second, gambling outcomes are only partially skill dependent (i.e., some card or sports games) or not at all (i.e., lotteries, slot machines), whereas videogame outcomes are largely based on skill or knowledge.

1. Defining features and methods for assessment—Gaming is a popular pastime, especially in male adolescents, many of whom play videogames frequently, with estimates indicating over 90% of boys play videogames and an average of 12 hours per week (Gentile 2009). However, spending a lot of time gaming is not analogous to experiencing problems. Similar to gambling and substance use disorders, time and frequency descriptors are not included in diagnostic criteria (Hasin et al. 2013). The DSM-5 lists nine possible criteria for IGD, with a recommended cut-point of meeting five or more. The criteria are intended to reflect clinically significant distress along these dimensions: pre-occupation with games; tolerance toward games or gaming; inability to cease or reduce gaming; withdrawal symptoms when gaming is not possible; gaming to escape adverse moods or problems; loss of interests in other activities; continued excessive gaming despite knowledge of problems;

lying about or covering up gaming; and risking or losing a relationship, job, or vocational or education opportunity because of gaming. Throughout this paper, the term IGD is intended to reflect a severe form of gaming problems, with the understanding that not all studies applied the DSM-5 or any specific criteria.

The DSM-5 establishes a standard for classifying IGD, but it also notes that the criteria and cut-point may not reflect a unique mental disorder, nor may these criteria be optimal. Even the suggested criteria themselves need consistent operationalization. Consensus-derived meanings of the criteria exist (Petry et al. 2014b), and although not all agree with these descriptors (Griffiths et al. 2016, but see Petry et al. 2016b), more consistent and precise measurement of IGD appears to have arisen since the DSM-5.

Some clinical assessments based on the DSM-5 criteria have been tested preliminarily. For example, Ko and colleagues (2014) administered clinical interviews based on the DSM-5 criteria to three groups (N = 75/group): those with current gaming problems; those with past but not current gaming problems; and a control group. Most criteria contributed substantially to classification status, and the cut point of five criteria had the greatest sensitivity and specificity for distinguishing those with normal levels of play from those who had experienced clinically significant problems. Koo et al. (2017) administered a structured assessment to 236 adolescents and found good test-retest reliability over one month, good concordance with clinical impression, and adequate discriminative validity. Although promising, more work is needed evaluating criteria with larger cross cultural samples that span general population, high risk, and clinical groups.

Brief screening instruments based on these DSM-5 criteria also exist, but psychometric testing is limited. For example, Rehbein et al. (2015) administered the Video Game Dependency Scale to 11,003 ninth-graders and found concurrent validity with indices of self-reported play durations, problems in school and sleep difficulties. Students most frequently endorsed criteria for escape and pre-occupation, but these rarely related to diagnosis, while giving up other activities, tolerance and withdrawal criteria were most associated with IGD classification in this sample. Pontes et al. (2014) administered a 20-item scale (the IGD-20) to 1003 gamers recruited from online gaming forums. Items had good internal consistency, and a score of 71 of 100 points maximized sensitivity and specificity for distinguishing problematic from non-problematic players as ascertained from response patterns on this same scale. One concern about evaluating screening instruments in non-clinical contexts is that no “gold standard” exists by which to compare scores on a self-report measure. It is imperative that some clinical or objective index of harm is assessed prior to considering any instrument validated.

2. Prevalence—Determining prevalence rates is clearly difficult when criteria are not established and instruments with sound psychometric properties are lacking. Table 3 outlines estimated rates of IGD from large-scale studies containing at least 3,000 respondents conducted in school or general population samples through 2016. It does not include surveys of convenience samples, such as online gamers, nor those that assessed a myriad of online activities of which gaming was one. Prevalence rates ranged from 0.3% to up to 4.9%, with over half the studies finding rates below 2.0%. Rates varied across studies, in part because of

differences across samples, instruments and criteria. Given concerns about classification, these rates should be interpreted cautiously.

3. Comorbidities—Depression and IGD co-occur in multiple studies (Desai et al. 2010, Gentile et al. 2011, van Rooij et al. 2011). Individuals with IGD also exhibit high rates of anxiety, especially social anxiety (Gentile et al. 2011, van Rooij et al. 2014). Impulsivity and attention deficit hyperactivity disorder (ADHD) also appear at high rates with IGD (Choo et al. 2010, Gentile 2009, Walther et al. 2012). Chan and Rabinowitz (2006) surveyed adolescents and their parents about electronic game use, Internet use more generally, and symptoms of ADHD. Compared with adolescents who played games less than one hour a day, those who played more than an hour a day scored higher on scales assessing inattention and ADHD, but ADHD scores did not differ with respect to use of other electronic media (television or Internet use generally), suggesting the association between heavy electronic use and inattention may be specific to gaming.

Some research links IGD with substance use disorders. In US high school students (Desai et al. 2010), those with gaming problems had higher rates of smoking and some forms of illicit drug use. In Dutch students, excessive online gaming was associated with smoking, drinking and marijuana use (van Rooij et al. 2014). A study of German students (Walther et al. 2012) also noted a relation between marijuana use and problem gaming. This study also evaluated associations between personality characteristics and substance use, gambling, and game playing. It found that these behaviors had the feature of impulsivity in common. Impulsivity is a core aspect of substance use disorders and may play a role in the development or maintenance of other excessive behavioral patterns as well.

4. Risk factors—Males are much more likely than females to have IGD in most all prevalence studies, and adolescents develop this condition at higher rates than adults (Festl et al. 2013, Wittek et al. 2016). The media depicts extraordinarily problems with Internet gaming in some Southeast Asian countries, and some data suggest that US youth who are of racial and ethnic minority backgrounds, particularly Asian (Desai et al. 2010), have higher rates of IGD than Caucasians. Nevertheless, studies using parallel procedures in the US and Singapore (Choo et al. 2010, Gentile 2009) found similar rates.

Longitudinal studies find that attention problems, depression and anxiety may arise from excessive gaming, while impulsivity and low social competence appear to predict development of IGD over time. For example, Swing et al. (2010) found that children who increased gaming over a one-year period developed more attention problems than those who did not. Gentile et al. (2011) found impulsivity, low social competence, and poor emotion regulation predicted development of Internet gaming problems over time; in this study depression and anxiety more often arose from, rather than lead to, IGD. Rehbein and Baier (2013) noted that 10-year olds from single parent families who were not well integrated at school were more likely to develop gaming problems over the next 5 years than their counterparts without these characteristics. Additional systematic investigation is needed along with a greater understanding of the directionality between IGD and other psychological conditions, and whether these relationships differ in youth compared to adults.

5. Neurobiology and genetics—Neurobiological studies of IGD, similarly to gambling and substance use disorders, focus on the PFC. Some studies find changes in grey matter in the orbitofrontal cortex (OFC), bilateral insula, and supplemental motor area (Weng et al. 2013, Yuan et al. 2013). Others find differences in regions linked more broadly to decision making, emotion, and cognitive demand including decreased grey matter in the inferior frontal and cingulate gyrus, lingual, hippocampus, and precuneus, as well as white matter changes in the inferior frontal and lingual gyrus, insula, precuneus, anterior cingulate, and amygdala (Lin et al. 2015). Weng and colleagues (2013) reported an inverse relation between right OFC and bilateral insula grey matter atrophy and severity of gaming problems, while Dong et al. (2012a) noted increased white matter integrity in the thalamus and the posterior cingulate cortex was associated with severity of gaming problems. Thus, not all studies yield consistent findings.

Functional magnetic resonance imaging (fMRI) studies in IGD commonly apply cue-induced craving tasks, in which participants view game-related stimuli while recording brain responses. Findings from participants with gaming problems resemble, to some degree, those with substance use disorders, with greater activation in the PFC as well as the anterior cingulate cortex and insula (Ko et al. 2013). During resting state in IGD (Dong et al. 2012b), anomalies in the cerebellum and inferior parietal lobule, regions related to sensory-motor coordination have been reported, and similar patterns in these areas may also be related to predisposition for substance use disorders (Moulton et al. 2014).

Not surprisingly, little data are available regarding the genetics of IGD. One study (Han et al. 2007) reports that, compared to controls, youth with IGD were more likely to have the Taq1A1 allele of the DRD2 gene and the low activity allele Val158Met of the Catecholamine-O-Methyltransferase gene, that regulates dopamine. The degree to which IGD is heritable and linked with genes that increase risk for substance use and other problems requires further study.

6. Treatments—Few controlled trials for IGD treatments exist. Table 4 outlines the six randomized trials available that included more than 25 participants per condition. Two pharmacotherapy trials (Han & Renshaw 2012, Song et al. 2016) found benefits of bupropion, an antidepressant, relative to placebo or a no treatment control condition, respectively. However, one of them (Han & Renshaw 2012) included only patients with comorbid IGD and major depressive disorder, so one possibility is that the medication primarily impacted depression and only improved gaming indirectly. Another found that adding CBT to bupropion improved outcomes relative to bupropion alone (Kim et al. 2012) but had no control condition. No differences on gaming outcomes were noted between two medications for ADHD in adolescents with IGD (Park et al. 2016) or between a game-related speaking and writing intervention and a general educational intervention (Kim et al. 2013). These data suggest that bupropion may have benefits in reducing gaming. However, these results should be considered preliminary due to the small number of trials, short durations of treatment and follow-up, inclusion of comorbid conditions that on their own may respond to the therapies, and in some cases lack of matched control conditions.

7. Summary—Inclusion of IGD in the DSM-5 provides a uniform direction for studying this condition, but a greater understanding of the criteria that underlie it are needed, along with development and assessment of psychometric properties of clinical interviews and screening tools. Instruments should: reflect criteria in a comprehensive, and understandable, manner; apply to persons across the age span; be relevant cross culturally; assess online as well as offline gaming behaviors and problems; and allow for a categorical decision based on the number of criteria endorsed. Determining internal consistency, factor structure, and concurrent validity with other indices of distress are necessary, but not sufficient, steps to establishing psychometrically sound instruments. Evaluating test-retest reliability, validity with collateral reports and objective indices, and prospective validity in multiple samples, including clinical populations, is critical. Once psychometrically sound instruments exist, epidemiological surveys can ascertain prevalence rates.

Another important consideration relates to the relationship of IGD and other mental disorders, including substance use disorders. For IGD to be a mental disorder, it must be unique from other psychiatric conditions, and if it is a behavioral addiction then it should be aligned more closely with substance use disorders and other behavioral addictions (i.e., gambling disorder) than other mental disorders such as ADHD. Ultimately, neurobiological and genetic studies may guide an understanding of these conditions, and longitudinal studies are important for examining their natural course, including the extent to which persons "mature out" of gaming problems on their own. Growing evidence suggests clinically significant harms arise in at least a small subset of gamers, but the extent to which these problems are transient or foretell long-term adverse effects when left untreated remains unknown.

C. Internet addiction

People can use the Internet problematically for many activities, including gambling, gaming, socializing (e.g., Facebook), information gathering, shopping, and pornography viewing. This section outlines research related to a condition known as Internet addiction (IA). Unless otherwise stated, IA is intended to relate to problematic usage of the Internet for a range of activities. It is meant to exclude problematic Internet-based gambling and gaming for the purposes of this paper, although oftentimes reports do not distinguish activities.

1. Defining features and methods for assessment—The proposed DSM-5 criteria for IGD could be applied to problems that arise from extensive Internet use beyond gaming, but the DSM-5 cautions that care should be taken in making direct applications of IGD criteria toward other Internet uses. Simply adapting existing criteria to new indications may overlook important aspects, and psychometric testing of other applications of the criteria is necessary prior to considering them appropriate for classifying addictions to the Internet or other activities.

Similar to IGD, much research on IA suffers from non standardized definitions and applications of multiple instruments addressing different symptoms and constructs. One review (Laconi et al. 2014) identified 45 different instruments to assess IA. Relatively little information on their psychometric properties is available, and what does exist is derived

primarily from cross-sectional survey studies, often devoid of testing in clinical contexts. Among the most commonly used instruments is the Internet Addiction Test (IAT; Young 1998), a 20-item measure based on the DSM-IV criteria for substance dependence and pathological gambling, derived from the Young Internet Addiction Diagnostic Questionnaire. Some studies indicate that the IAT has adequate internal consistency, test-retest reliability, convergent validity with other IA measures, and convergent validity with time spent online (see Laconi et al. 2014 for a review). However, comparisons across studies highlight potential concerns about reliability and stability of the factor structure. There are also insufficient data on its validity and cut-off scores.

Many instruments are also designed to tap specific problematic aspects of Internet use, with social networks being one, or methods of accessing the Internet, such as smartphone addiction. For example, The Bergen Facebook Addiction Scale (BFAS; Andreassen et al. 2012) addresses problems with this social media site; it has good internal consistency and test-retest reliability and correlates with other problem indices, but there are limited data on its association with objective or clinical indices of harm. Likewise, several smartphone addiction scales exist (e.g., Kwon et al. 2013), but evaluation of their validity is lacking.

It is unclear whether discrete items and instruments are needed to address each specific form of excessive Internet use, or if these putative conditions could be assessed with a more parsimonious approach by a single tool. On one hand, some applications of the Internet seem to attract quite distinct groups of persons and may lead to discrete problems. For example, people who use social networks excessively may have different risk factors and comorbidities and they appear to develop different problems than those who view pornography online problematically. On the other hand, given the extent to which applications on the Internet change over time, developing and assessing instruments for each new site or function will become unwieldy and quickly outdated.

A consensus on defining features of IA is required to move this field forward and may best follow by thoughtfully considering research related to IGD. A point of caution is that clinically significant harms must be documented for any condition to be considered a mental disorder, and criteria and instruments that assess heavy usage, or cognitions alone irrespective of harms are unlikely to be assessing “addiction” as a clinical construct.

2. Prevalence rates—Prevalence rates of IA generally, or its specific formats, are difficult to estimate because of inconsistencies in instruments and thresholds for classifications. Because hundreds of studies have been published, Table 5 focuses on surveys of over 3,000 respondents drawn from nationally representative general population samples conducted through 2016. Across these studies, prevalence rates range from 0.6% to over 22%. These 17 studies utilized 10 different instruments, clearly leading to the discrepancies in rates.

3. Comorbidities—Carli et al. (2013) identified 20 studies evaluating comorbidities between IA and other mental disorders. Although not all 20 studies assessed each of these other conditions, 100% of those that evaluated IA along with symptoms of ADHD found a significant association between the two conditions. For depression, 75% of studies found a relationship, 60% for obsessive-compulsive symptoms, and 57% for anxiety. This review did

not include substance use disorders, but links between IA and substance use problems are reported as well (Ko et al. 2008, Yen et al. 2009).

4. Risk factors—Men and women appear equally likely to exhibit general IA symptoms (Durkee et al. 2012), but studies specific to problems with social network sites reveal women have more difficulties with these applications (Andreassen & Pallesen 2014). Young age is also generally associated with greater difficulties (Bakken et al. 2009; Kim et al. 2016; Macur et al. 2016; Rumpf et al. 2014). Three studies of IA using parallel procedures in multiple countries (Durkee et al. 2012; Mak et al., 2014; Tsitsika et al., 2014) reveal some, but not marked, differences in prevalence rates across European and Asian countries.

Several longitudinal studies of IA reveal that difficulties related to gaming in particular predict continued IA problems over time (Hokby et al. 2016, Ko et al. 2007, Stavropoulos et al. 2017). In addition, prospective studies find emotional problems, such as depression, ADHD, social phobia, and hostility, are associated with developing IA problems up to two years later (Ko et al. 2009, Strittmatter et al. 2016). Family factors, including parental conflict and lack of regulating Internet use, predicted IA in adolescents as well (Ko et al. 2015). Systematic evaluation of IA, family functioning and other mental disorders is necessary to confirm these initial findings to ascertain whether IA is a unique mental disorder or merely an expression of other mental disorders, and which factors precipitate or stem from IA.

5. Neurobiology and genetics—Similarly to substance use populations, persons with IA have lower fractional anisotropy, an index of white matter abnormalities (Lin et al. 2012) and decreased grey matter volume in the left anterior and posterior cingulate cortex, left insula, and left lingual gyrus (Zhou et al. 2011). Studies of fMRI resting state scans in those with IA find increased regional homogeneity in frontal and anterior cingulate cortex regions (Liu et al. 2010), which may reflect greater sensitivity to reward. Studies using similar regional homogeneity assessment methods, however, have only been applied preliminarily to substance use disorder populations. Replications of these neurobiological findings are needed to determine specificity to different primary contexts of IA as well as generalization to other established addictions.

In terms of genetics, one study reports serotonin transporter genes may play a role in IA (Lee et al. 2008), and others (Li et al. 2014, Vink et al. 2016) show that genetic factors explain between 48% and 66% of the variance in IA. Without a consistent and valid method of classifying IA, however, genetic studies may be premature.

6. Treatments—Only two randomized trials of treatment for IA with more than 25 patients per condition are published. Zhong et al. (2011) reported 3 month post-treatment improvements with a group-based family intervention relative to treatment as usual, but no differences during treatment. Zhu et al. (2012) noted that electroacupuncture reduced IA symptoms, and CBT added to this effect. However, due to concerns about classifications and differences in intensities of the interventions evaluated within studies, results are preliminary.

7. Summary—The literature related to IA, not surprising given its greater heterogeneity, is more mixed than that of IGD. Many assessment instruments for IA do not distinguish gaming from other Internet applications, and because gaming is one of the most common applications with which people develop problems, it is unclear the extent to which some of this research reflects gaming problems and not the broader construct of IA. Although many, and some very large, nationally representative studies of IA exist, prevalence rate vary dramatically, from 0.6% to over 22%. Before this field can advance, consensus must be achieved on its defining features, and reliable and valid instruments to assess problems and harms are needed. If there are few differences between gaming and other Internet applications, then they can and should be considered a similar condition. On the other hand, if data demonstrate unique and/or more pronounced and persistent harms with gaming (or other specific applications), then combining conditions will obscure an understanding of them.

III. Other putative behavioral addictions

The literature on other manifestations of potential behavioral addictions, including sex, shopping, exercise, tanning, and eating, suffers from many of the concerns noted for IGD and IA (see Petry 2013, Starcevic & Khazaal 2017, for review). With the exception of shopping and perhaps eating addiction, which have somewhat accepted criteria and instruments, others have a myriad of methods of assessment, few of which have been subjected to extensive psychometric testing. Limited information is available with respect to rates of these conditions in the general population, and most often prevalence data, when available, are obtained from convenience or high risk samples. Little data exist on these conditions with respect to overlap with other mental health disorders, longitudinal course, or neurobiology. In the case of sex addiction, many of the symptoms appear more aligned with sexual disorders than substance use or behavioral addictions. Likewise, eating addiction may have more similarities with eating disorders than other addictions, and shopping addiction may be more closely associated with hoarding disorder than behavioral addictions. Although APA Workgroups considered these conditions for the DSM-5, insufficient evidence was found to support their inclusion in general, or in relation to addictions in particular.

IV. Recommendations

Overall, it is clear that some persons develop a constellation of symptoms from excessive participation in non-substance behaviors. For the case of gambling disorder, data are clear that it is a unique mental disorder. Criteria are established and function well in distinguishing persons with clinically significant impairment related to gambling from those without. Of course, it is possible that other criteria may better or more accurately classify this condition than those in the DSM-5, and future versions may alter criteria or cut points; indeed, this was the process that led to its changes in the DSM-5 relative to DSM-IV (Petry et al. 2013). Interview and self-report scales, respectively, diagnose and screen for gambling disorder, and although not all have undergone thorough psychometric testing, the items across instruments are more similar than dissimilar in terms of content validity for specific criteria. General population prevalence surveys that employ the DSM criteria yield relatively similar rates, regardless of the instrument applied. Although many people do go in and out

of periods of gambling disorder over the course of their lifetimes, about half persist with problems (Petry et al. 2005). Gambling disorder is unique from other conditions with which it commonly occurs, such as depression and substance use. Given overlap in neurobiological and genetic findings, it appears better aligned with substance use than with other mental disorders. The neurobiology of gambling disorder is still not well understood, but this is the case for most mental disorders. Studies should attempt to isolate unique neurobiological dysfunction leading to and stemming from gambling disorder, as well as their commonalities with other addictions.

Although many randomized treatment trials of fairly large size exist for gambling, the field lacks standardized outcome measures, with some focusing only on quantity/frequency of gambling and others on clinically significant harms, and only a few employing collateral reports to confirm patient self-reports. As more trials are conducted, investigators should consider existing interventions. Rather than developing new versions of CBT, motivational interviewing or feedback, investigating mechanisms of action of promising existing interventions will probably advance the field more rapidly than testing modest adaptations of similar approaches. Considering the literature in psychotherapies generally, trials comparing two active interventions, group versus individual therapy, or longer and shorter interventions of a similar type rarely yield large effect sizes. Randomized trials should be adequately powered and employ long-term follow-ups, as gambling disorder is clearly a condition that waxes and wanes, and few interventions to date have yielded persistent benefits.

In the case of IGD, the proposed DSM-5 criteria require additional study to determine if each adds to classification of a unique condition that results in distress or disability, and whether there are any additional criteria that improve accuracy. Consistent operationalization of the criteria is also important. Even since publication of the DSM-5, different instruments are assessing the same criteria sometimes in markedly different manners (Petry et al. 2014b). Evaluation of the criteria should be conducted, at least in part, with clinical samples. However, because persons who seek treatment tend to have more severe forms of disorders, evaluation in non-treatment seeking individuals is also important. Much of the psychometric work on IGD has focused on non-clinical samples using self-report methods. These samples and methods of assessment add information, but any screening instrument needs to be tested with clinical samples before it can be considered validated.

Once criteria and instruments with good psychometric properties are established, prevalence rates can be determined. Longitudinal studies are needed to ascertain the natural course of the condition and its long term consequences, as well as its association with other mental disorders. Neurobiology and genetic studies ultimately may uncover that IGD is similar– or distinct– from other behavioral addictions or substance use disorders.

Randomized treatment trials for IGD have primarily focused on pharmacotherapies, but it is likely that psychotherapy will also play an important role in treating this condition. Again, assessment issues are paramount, as trials need to employ reliable and valid instruments to detect changes in gaming and IGD symptoms, using an objective indicator if possible. Treatment trials of psychotherapies should include therapy manuals and employ methods to

assess delivery of interventions, and they should evaluate long-term effects. They also need to be adequately powered to detect between group differences.

In terms of IA, a better understanding of what it constitutes is needed, including specific adverse effects. Impairment must go beyond transient cognitions (e.g., feeling like one is "missing out" when not checking devices or sites) to rise to a clinically significant level. Likewise, forgoing household chores or sleep to spend time on the Internet is not a clinically significant manifestation of a mental disorder unless it leads to substantial distress and impairment. Many people check their smartphones multiple times an hour, but this does not mean they have a mental disorder. Lots of people would rather watch television than go to bed, and television viewing is not a mental disorder, even if one loses sleep by doing so.

Related, for activities that are problematic and done on the Internet exclusively or primarily, are the precursors– and consequences– more different or similar across applications? It is likely that excessive pornography viewing on the Internet is distinct from excessive use of social media sites, excessive shopping on the Internet, excessive gambling on the Internet, and excessive gaming, on or off the Internet. In the data available, IA– in at least some of its applications– appears more aligned with other disorders than with substance use disorders.

Although the Internet may present activities in manners that are more likely to lead to problems than traditional formats, does this mean that the Internet is the addiction any more than a needle and a syringe are a vector to obtain more powerful effects from drugs of abuse? Most would argue that a person addicted to intravenous heroin has opioid use disorder while one addicted to cocaine has cocaine use disorder, whether he administers the drug intravenously, intranasally or orally. And, while cocaine and opioid use disorders have many important similarities, they also have some important distinctions biologically. They have unique withdrawal profiles and different efficacious treatment approaches, such as specific pharmacotherapies for opioid use disorders. Our understanding of them would be greatly hindered were they not distinguished nosologically.

Likewise, manifestations of IA, whether they relate to gaming, social networking, information gathering, pornography viewing or other activities, should be studied initially on their own. If substantial overlap exists, then and only then should parallel criteria be applied. Even if similar criteria constitute multiple forms of addictions, prevalence rates, longitudinal courses, comorbidities with other conditions, neurobiology and other risk factors, and treatments may still differ markedly. A primary purpose of classification systems in psychiatry is to carefully and systematically define conditions in a reliable and valid manner so they can be better understood and treated. Balance must be achieved between too restrictive a system that hinders generalizability and too open a system, in which marked heterogeneity obscures knowledge.

As these fields progress, investigators and clinicians should consider other areas of psychiatry (Stein et al. 2010) and closely evaluate the research that predated other conditions added to the DSM-5. Issues that impact consideration of behavioral addictions as a class, or as specific forms of mental disorders, are similar to issues arising in the context of other mental disorders. Hoarding disorder, for example, suffered from some analogous criticisms

as behavioral addictions now do, yet its evidence base developed sufficiently to justify inclusion in the DSM-5. Research has not yet established whether IGD or IA (in any of its potential manifestations) have diagnostic validity or clinical utility on their own, or in regards to differentiation from one another or other mental disorders. Until such data exist, official recognition of these and other forms of behavioral addictions as mental disorders is premature. Indiscriminately lumping together multiple forms of problematic behaviors will likely cloud an understanding of each, and behaviors addictions as a whole. In contrast, reliable and valid data demonstrating similarities in clinically significant symptoms, patterns and outcomes across multiple contexts ultimately may provide convincing evidence of a common underlying behavioral addiction diagnosis.

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Summary Points

1. Substantial debate exists about the existence of behavioral addictions and the recognition of such problems as mental disorders. Currently, the 5th edition of the Diagnostic and Statistical Manual (DSM-5) includes gambling disorder in the Substance-Related and Addictive Disorders section and Internet gaming disorder in the research appendix as a condition requiring further study.
2. Gambling disorder has been studied more than any other behavioral addiction, has well-defined criteria, and can be distinguished from other similar mental disorders. Some research has identified potentially efficacious treatments for gambling disorder but none that reach rigorous empirical standards for evidence-based treatments.
3. Inclusion of Internet gaming disorder (IGD) in the DSM-5 has provided a set of guidelines for defining and studying this condition. Major weaknesses in the research literature on IGD are the lack of psychometrically sound instruments for screening and diagnosis and a lack of sufficient research establishing IGD as a mental disorder unique from other psychiatric conditions.
4. Researchers have not used consistent definitions of Internet addiction, resulting in substantial heterogeneity in definitions and assessment across studies. More research is needed to distinguish Internet addiction from other potential mental disorders, particularly Internet gaming disorder, and to establish a consensus on its criteria and assessment.
5. Other putative behavioral addictions, including sex, shopping, exercise, tanning, and eating, currently lack empirical evidence related to assessment and overlap with established mental disorders. The American Psychiatric Association's workgroups considered each of these potential disorders for inclusion in the DSM-5 but none had sufficient evidence to support their inclusion.

FUTURE ISSUES

1. Determining the neurobiological dysfunctions leading to and stemming from gambling disorder or any of the putative behavioral addictions. Establishing whether these dysfunctions are unique to the specific behavioral addiction or are common to other addictions and mental disorders.
2. Development and validation of measures for behavioral addictions, particularly Internet gaming disorder.
3. For Internet addiction and other putative behavioral addictions, understanding the criteria for each potential disorder and whether associated impairments are clinically significant. Differentiating each of the behavioral disorders from one another and from other already established mental disorders. Evaluating their longitudinal course.
4. Evaluation of mechanisms of action for existing treatments for gambling disorder, using trials that are adequately powered and include long term follow-ups.
5. Development and evaluation of psychotherapy approaches for the treatment of Internet gaming disorder. Such treatment trials should include reliable and valid instruments, approaches to ensure treatment fidelity, adequate sample sizes, and evaluation of long-term effects. Development of treatments for other putative behavioral addictions may be warranted if their diagnostic validity can be demonstrated.

Table 1

Prevalence rates of DSM-based gambling disorder in nationally representative general population surveys of over 3,000 respondents

First author (or study), year	Country	N	Ages	Instrument	%
Bonke, 2006	Denmark	8,153	18-74	National Opinion Research Center Screen	0.1
TNS EMNID, 2011	Germany	15,002	≥ 18	Diagnostic Interview Schedule-IV	0.2
Sproston, 2000	Great Britain	7,680	≥ 16	DSM-IV	0.2
National Council on Problem Gambling, 2015	Singapore	3,000	≥ 18	DSM-IV	0.2
Petry, 2005	USA	42,989	≥ 18	NIAAA Alcohol Use Disorder and Associated Interview Schedule-DSM-IV (AUDADIS-IV)	0.2
Kessler, 2008	USA	3,435	≥ 18	Composite International Diagnostic Interview	0.3
Wardle, 2011	Great Britain	7,756	≥ 16	DSM-IV	0.4
Ólason, 2005	Iceland	5,000	18-70	Diagnostic Interview for Gambling Screen	0.5
Ferris, 2001	Canada	3,120	≥ 18	DSM-IV	0.7

Table 2

Randomized trials for gambling problems that included >25 participants per condition and had a time and attention control condition for at least one experimental condition.

First author, year	Treatments	N	Weeks	Sessions	Gambling outcomes	Significant effects relative to control or other conditions
	Pharmacotherapies					
Grant, 2006	Placebo	51	16	8	PG-YBOCS, CGI	Benefits of nalmafene (25 mg/day) and nalmafene (50 mg/day) vs placebo on PG-YBOCS. Benefits of nalmafene (25 mg/day) vs placebo on CGI.
	Nalmafene (25 mg/day)	52	16	8		
	Nalmafene (50 mg/day)	52	16	8		
	Nalmafene (100 mg/day)	52	16	8		
Grant, 2010	Placebo	74	16	nr	PG-YBOCS, CGI	No differences.
	Nalmafene (20 mg/day)	77	16			
	Nalmafene (40 mg/day)	82	16			
Toneatto, 2009	Placebo	25	11	7	$, Days	No differences.
	Naltrexone (25-250mg/day)	27	11	7		
Kovanen, 2016	Placebo	51	20	8	$, Days, PG-YBOCS	No differences.
	Naltrexone (50mg/day)	50	20	8		
Grant, 2003	Placebo	40	16	6	PC-YBOCS, CGI	No differences.
	Paroxetine (10-60 mg/day)	36	16	6		
Saiz-Ruiz, 2005	Placebo	33	24	nr	CCPGQ, CGI	No differences.
	Sertraline (M = 95 mg/day)	33	24			
	Psychotherapies					
Smith, 2015	Exposure therapy	43	12	12	% Improved and VGS	No differences.
	Cognitive therapy	44	12	12		
LaBrie, 2012	Waitlist	102	12	–	% Abstinent, $, Days	No differences on % Abstinent, $ or Days.
	MI/CB workbook	108	12	–		
	MI/CB workbook + call	105	12	1		
Petry, 2006	GA referral	63	–	1	% Improved, $, Days, SOGS, ASI-G	Benefits of CB therapy on % Improved and $. Benefits of both CB formats on SOGS, ASI-G, Days.
	CB workbook	84	8	8		
	CB therapy (individual)	84	8	8		
Hodgins, 2009	Waitlist	65	6	–	% Improved, $, Days, G-SAS	Benefits of CB workbook + both call conditions on $, Days, and G-SAS but not % Improved.
	CB workbook	82	6	–		

First author, year	Treatments	N	Weeks	Sessions	Gambling outcomes	Significant effects relative to control or other conditions
	CB workbook + MI call	83	6	1		
	CB workbook + MI calls	84	36	7		
Oei, 2010	Waitlist	28	–	–	% Improved, $, Days	No differences on % Improved, $, or Days.
	CB therapy (group)	37	6	6		
	CB therapy (individual)	37	6	6		
Luquiens, 2016	Waitlist	264	6	–	PGSI	No differences.
	Email	293	6	–		
	Email + CB workbook	264	6	–		
	Email, CB workbook & guidance	301	6	–		
Casey, 2017	Waitlist	55	6	–	G-SAS,SOGS	Benefits of CB Internet and Feedback + support over waitlist on G-SAS and SOGS. Benefit of CB Internet vs Feedback + support on SOGS.
	Feedback + support by Internet	59	6	6		
	CB treatment by Internet	60	6	6		
Hodgins, 2001	Waitlist	35	4	–	% Improved, $ and Days	Benefits of CB workbook + MI call on % Improved, $ and Days.
	CB workbook	35	4	–		
	CB workbook + MI call	32	4	1		
Petry, 2008	Assessment	48	–	–	% Improved, $, ASI-G	Benefits of Brief Advice on % Improved, $ and ASI-G.
	Brief advice	37	1	1		
	MI	55	1	1		
	MI + CB therapy	40	4	4		
Petry, 2016a	Brief education	69	1	1	% Improved, $, Days, SOGS	Benefits of Brief Advice on Days. Benefits of MI + CB vs Brief Advice on % Improved, $, SOGS.
	Brief advice	66	1	1		
	MI + CB therapy	82	4	4		
Diskin, 2009	CB workbook + control interview	39	1	1	% Improved, $, Days,	Benefits on $ but not % Improved or Days.
	CB workbook + MI	42	1	1		
Cunning-ham, 2012	Waitlist	69	–	–	$, Days	No differences.
	Partial feedback	70	1	1		
	Full feedback	70	1	1		
Neighbors, 2015	Attention control	128	1	1	$, Days, SOGS	Benefits on $ and SOGS but not Days.
	Feedback via computer	124	1	1		
Martens, 2015	Assessment	109	–	–	$, Days, CPGI	Benefits of Personalized Feedback on $ and CPGI but not Days. Education vs Personalized feedback: no differences.
	Education	113	1	1		

First author, year	Treatments	N	Weeks	Sessions	Gambling outcomes	Significant effects relative to control or other conditions
	Personalized feedback	111	1	1		

Notes: ASI-G = Addiction Severity Index- Gambling scale; CB = Cognitive Behavioral; CCPGQ = Criteria for Control of Pathological Gambling Questionnaire; CGI = Clinical Global Impression Scale; CPGI = Canadian Problem Gambling Inventory; DSM = Diagnostics and Statistical Manual of Mental Disorders (4^{th} ed.) criteria for pathological gambling; GA = Gamblers Anonymous; G-SAS = Gambling Symptom Assessment Scale; MI = Motivational Interviewing; NODS = National Opinion Research Center DSM-IV Screen for Gambling Problems; PGSI = Problem Gambling Severity Index; PG-YBOCS: Yale-Brown Obsessive-Compulsive Scale for Pathological Gambling; SOGS = South Oaks Gambling Screen; VGS = Victorian Gambling Screen harm to self scale; nr = not reported.

Table 3

Prevalence rates of Internet gaming problems in surveys of over 3,000 respondents

First author, year	Country	N	Ages	Instrument	%
Wittek, 2016	Norway	10,081	16-74	Game Addiction Scale	0.3 – 0.5
Rehbein, 2015	Germany	11,003	13-18	Video Game Dependency Scale	1.2
Van Rooij, 2011	Netherlands	4,559	13-16	Compulsive Internet Use Scale	1.5
Muller, 2015	Europe	12,938	14-17	Assessment of Internet and Computer Game Addiction	1.6
Rehbein, 2010	Germany	15,168	Average 15	Video Game Dependency Scale	1.7
Johansson, 2004	Norway	3,237	12-18	Young Internet Addiction scale- revised for gaming	2.7
Festl, 2013	Germany	4,382	14-90	Game Addiction Scale	3.7
Papay, 2013	Hungary	5,045	Average 16	Problematic Online Gaming Questionnaire	4.6
Desai, 2010	USA	4,028	14-18	Impulse Control Disorder- Revised for Gaming Scale	4.9

*Percentages reported reflect people with Internet gaming disorder or a similar condition reflecting relatively severe problems.

Table 4

Randomized trials for Internet Gaming Disorder that included >25 participants per condition.

First author, year	Treatments	N	Weeks	Sessions	Gaming outcomes	Significant effects relative to control or other conditions
	Pharmacotherapies					
Park, 2016	Atomexetine	42	12	–	Young Internet Addiction Scale	No differences.
	Methylphenidate	44	12	–		
Han, 2012	Placebo + education	25	8	–	Young Internet Addiction Scale, time gambling	Benefits of bupropion on both indices.
	Bupropion + education	25	8	–		
Song, 2016	No treatment control	33	6	–	Young Internet Addiction Scale	Benefits of both medications compared to control. Benefits of bupropion compared to escitalopram.
	Bupropion	44	6	–		
	Escitalopram	42	6	–		
	Psychotherapies					
Kim, 2012	Bupropion	33	8	–	Young Internet Addiction Scale, time gaming	Benefit of added CBT on both indices.
	Bupropion + cognitive behavioral therapy (CBT)	32	8	8		
Kim, 2013	General education course	32	8	21	Time gaming	No differences.
	Massive Multiplayer Online Role-Playing Games speaking and writing course	27	8	21		

Table 5

Prevalence rates of Internet addiction in nationally representative surveys of over 3,000 respondents

First author, year	Country	N	Ages	Instrument	%
Kim, 2016	Korea	6510	18-64	Internet Addiction Test	0.6
Bakken, 2009	Norway	3399	16-74	Young Diagnostic Questionnaire	1.0
Rumpf, 2014	Germany	15023	14-64	Compulsive Internet Use Scale	1.0
Tsitsika, 2014	7 European countries *	13284	14-17	Internet Addiction Test	1.2
Mak, 2014	6 Asian countries **	5366	12-18	Internet Addiction Test	1.2-4.9
Johanssson, 2004	Norway	3237	12-18	Young Diagnostic Questionnaire	2.0
Müller, 2017	Germany	9293	12-19	Assessment of Internet and Computer Game Addiction	2.6
Ha, 2014	Korea	56086	12-18	Korean-Internet addiction short form	2.8
Yoo, 2014	Korea	73328	12-19	Internet Addiction Self-Diagnosis Brief Scale	3.0
Macur, 2016	Slovenia	6282	18-95	Problematic Internet Use Questionnaire-Short Form	3.1
Durkee, 2012	11 primarily European countries ***	12395	Mean 15	Young Diagnostic Questionnaire	4.4
Li, 2014	China	24013	7-15	Young Diagnostic Questionnaire	6.3
Wang, 2013	China	95322	13-24	Diagnostic Questionnaire for Internet Addiction	7.5
Mihara, 2016	Japan	100050	12-19	Young Diagnostic Questionnaire	7.9
Cao, 2011	China	17599	10-24	Young Internet Addiction Scale	8.1
Lin, 2011	Taiwan	3616	College	Chen Internet Addiction Scale – Revised	15.3
Ahmadi, 2014	Iran	4342	Mean 16	Young Internet Addiction Scale	22.2

* Countries were: Spain, Romania, Poland, Greece, The Netherlands, Germany, and Iceland.

** Countries were: China, Hong Kong, Japan, South Korea, Malaysia, and Philippines.

*** Countries were: Austria, Estonia, France, Germany, Hungary, Ireland, Israel, Italy, Romania, Slovenia, and Spain.

Table 6

Randomized trials for treatment of Internet addiction that included >25 participants per condition.

Author year	Treatments	N	Weeks	Sessions	Internet use outcomes	Significant effects relative to control or other conditions
Zhong, 2011	Group-based treatment as usual	29	n.r.	n.r	Online Cognition Scale	No between-group statistical test at post-treatment. Benefit of family intervention at 3 months post-treatment.
	Group-based family intervention	28	14	14		
Zhu, 2012	Electroacupuncture (EA)	39	n.r.	20	Young Internet Addiction Test	Benefit of CBT+EA compared to both other groups. Benefit of EA alone compared to CBT alone.
	Cognitive behavioral therapy (CBT)	36	n.r.	10		
	CBT + EA	37	n.r.	30		

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