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Current advances in behavioral addictions: From fundamental research to clinical practice

Matthias Brand, Ph.D.[1,2,3], Stephanie Antons, Ph.D.[1,2,3], Beata Bőthe, Ph.D.[4,5], Zsolt Demetrovics, Ph.D.[6,7], Naomi A. Fineberg, MA, MBBS[8,9,10], Susana Jimenez Murcia, Ph.D.[11,12,13,14,15], Daniel L. King, Ph.D.[16], Gemma Mestre-Bach, Ph.D.[17], Tania Moretta, Ph.D.[18], Astrid Müller, M.D., Ph.D.[19], Elisa Wegmann, Ph.D.[1,2], Marc N. Potenza, M.D., Ph.D.[20,21,22,23]

[1] General Psychology: Cognition, Faculty of Computer Science, University of Duisburg-Essen, Germany

[2] Center for Behavioral Addiction Research (CeBAR), Center for Translational Neuro- and Behavioral Sciences, University Hospital Essen, University of Duisburg-Essen, Germany

[3] Erwin L. Hahn Institute for Magnetic Resonance Imaging, Essen, Germany

[4] Département de psychologie, Université de Montréal, Montréal, Canada

[5] Centre de recherche interdisciplinaire sur les problèmes conjugaux et les agressions sexuelles (CRIPCAS), Canada

[6] Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary

[7] Centre of Excellence in Responsible Gaming, University of Gibraltar, Gibraltar, Gibraltar

[8] School of Life and Medical Sciences, University of Hertfordshire, Hatfield, UK

[9] Hertfordshire Partnership University NHS Foundation Trust, Welwyn Garden City, UK

[10] University of Cambridge School of Clinical Medicine, Cambridge, UK

[11] Department of Clinical Psychology, Bellvitge University Hospital, Bellvitge Biomedical Research Institute (IDIBELL), Barcelona, Spain

[12] Ciber Physiopathology of Obesity and Nutrition (CIBERObn), Instituto de Salud Carlos III, Barcelona, Spain

[13] Psychoneurobiology of Eating and Addictive Behaviors Group, Neurosciences Programme, Bellvitge Biomedical Research Institute (IDIBELL), Barcelona, Spain

[14] Department of Clinical Sciences, School of Medicine and Health Sciences, University of Barcelona, Barcelona, Spain

[15] Psychology Services of the University of Barcelona, Barcelona, Spain

[16] College of Education, Psychology & Social Work, Flinders University, Adelaide, Australia

[17] Instituto de Investigación, Transferencia e Innovación, Universidad Internacional de La Rioja, La Rioja, Spain

[18] Department of General Psychology, University of Padova, Italy

[19] Department of Psychosomatic Medicine and Psychotherapy, Hannover Medical School, Hanover, Germany

[20] Departments of Psychiatry, Neuroscience and Child Study, Yale University School of Medicine, New Haven, USA

[21] Connecticut Council on Problem Gambling, Wethersfield, USA

[22] Connecticut Mental Health Center, New Haven, USA

[23] Wu Tsai Institute, Yale University, New Haven, USA

Corresponding authors:

Prof. Dr. Matthias Brand
General Psychology: Cognition
and Center for Behavioral Addiction Research
and Erwin L. Hahn Institute for Magnetic Resonance Imaging
University of Duisburg-Essen
Forsthausweg 2, 47057 Duisburg
Germany
Tel: ++49-203-3792541 Fax: ++49-203-3791846
E-mail: matthias.brand@uni-due.de; matthias.brand@cognition-ude.de

Prof. Dr. Marc N. Potenza
Departments of Psychiatry, Neuroscience and Child Study
Yale University School of Medicine
1 Church Street, Room 726
New Haven CT 06510
USA
Tel: ++1- 203-737-3553 Fax: ++1- 203-737-3591
E-mail: marc.potenza@yale.edu

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Abstract

Objective: Gambling disorder is currently the only behavioral addiction recognized as a clinical disorder in the DSM-5, and internet gaming disorder is included as a condition requiring further research. The ICD-11 categorizes gambling and gaming disorders as disorders due to addictive behaviors. Additional behavioral addictions may include compulsive sexual behavior disorder, compulsive buying-shopping disorder, and problematic use of social media. This review summarizes the current state of knowledge regarding these five (potential) disorders due to addictive behaviors.

Methods: Narrative review.

Results: All five (potential) disorders due to addictive behaviors are clinically relevant and prevalent. Behavioral addictions frequently co-occur with other mental and behavioral problems, such as depression, anxiety, and attention-deficit/hyperactivity disorder. Validated diagnostic instruments exist, with empirical support varying across conditions. No medications have approved indications from regulatory bodies for behavioral addictions, with cognitive-behavioral therapy having the most empirical support for efficacious treatment.

Conclusion: Behavioral addictions are prevalent conditions that may often go undiagnosed and untreated. Given frequent co-occurrence with psychiatric disorders and links to poorer treatment outcomes, active screening and treatment is indicated. Public health considerations should be expanded, and impacts of modern technologies should be investigated more intensively. Treatment optimization involving pharmacotherapy, psychotherapy, neuromodulation, and their combinations warrant additional investigation.

1. Definitions and classification of behavioral addictions

Behavioral addictions involve functional impairments and/or significant distress generated by excessive engagement in non-substance behaviors that are perceived as rewarding and/or relieving, but which are difficult for the affected individual to control. These behaviors receive increasing priority in everyday life and are continued despite negative consequences.

The Diagnostic and Statistical Manual of Mental Disorders, fifth edition, text revision (DSM-5 TR) (1) includes gambling disorder as a standalone behavioral addiction within the category of substance-related and addictive disorders. Internet gaming disorder is included in section III of the DSM-5 TR, a section intended for research but not clinical purposes. In contrast, in the International Classification of Diseases, eleventh revision (ICD-11) (2), both gambling and gaming disorder are recognized as disorders due to addictive behaviors. In addition, another condition in the category of impulse control disorders, compulsive sexual behavior disorder (CSexBD) is included. Other potential conditions including compulsive buying/shopping disorder (CBuy-ShopD) or problematic use of social media (PUSM) have been conceptualized within addiction frameworks and may be diagnosed using the ICD-11 designation of “other specified disorders due to addictive behaviors” (3). Importantly, behavioral addictions frequently co-occur with other psychiatric disorders, often go undiagnosed and untreated and have been perhaps thusly linked to poor treatment outcomes (4, 5). Here, we consider the following five concerns as behavioral addictions deserving more clinical and public health attention: gambling disorder, (internet) gaming disorder, CSexBD (which may include problematic pornography use; PPU), CBuy-ShopD, and PUSM. The terminologies and current classifications are summarized in Table 1.

- Insert Table 1 about here -

In the literature, compulsive sexual behavior disorder is frequently abbreviated with CSBD, and compulsive buying-shopping disorder with CBSD. In this article, however, we use the abbreviations CSexBD and CBuy-ShopD to clearly distinguish the two conditions. The term “compulsive” in the name of these two (potential) behavioral addictions remains debated as it may promote confusion regarding relationships with obsessive-compulsive disorder. Even though compulsivity may contribute to behavioral addictions (see section on psychological and neurobiological mechanisms), it may operate differently across disorders. For example, behavioral addictions may be less characterized by high harm avoidance as compared to obsessive-compulsive disorder (6). The terminologies could be reconsidered in the future and may focus on the problematic behavior itself (as in gambling disorder and gaming disorder), perhaps without using other descriptions of (transdiagnostic) features or underlying processes.

All five (potential) behavioral addictions discussed in this article have frequent co-occurring or mental conditions including depression, anxiety, and substance use (see below). Regarding substance use, stimulants (cocaine, amphetamines) have been linked to frequent and high-risk sexual behaviors (7), with shared genetic factors contributing to the co-occurrence of gambling and stimulant use disorders in men (8). Systematic investigations of potential promoting effects of stimulants and related disorders on the development of behavioral addictions remain largely missing, as do investigations of other behaviors and disorders.

2. Psychological and neurobiological mechanisms

Three interacting mechanisms may be particularly relevant for the development and maintenance of behavioral addictions, paralleling mechanisms in substance use disorders (SUDs): 1) positive and negative reinforcement of behaviors resulting in urges and desires when confronted with addiction-related stimuli (cue reactivity and craving), 2) seemingly compulsive motivations and habitual behaviors, and 3) poor self-control (cf. 9). One current theoretical model to explain the development and maintenance of addictive behaviors is the Interaction of Person-Affect-Cognition-Execution model (I-PACE) (10). The I-PACE integrates theories of SUDs, in particular dual-process models of addiction (11), the incentive sensitization theory (12), the impaired response inhibition and salience attribution model (13), the reward deficiency syndrome theory (14), and stress-related cognitive and emotional regulation models (15). In addition, the I-PACE considers attentional biases and implicit cognitions (16). Relevant affective and cognitive processes involved in behavioral addictions include cue reactivity and craving, cognitive/attentional biases, approach-avoidance tendencies, behavior-specific expectancies, risky decision-making, and poor executive functioning and inhibitory control. Regarding involvement of these processes, most evidence exists for gambling and gaming disorders, followed by CSexBD/PPU, CBuy-ShopD and PUSM (see sections below). For urges and desires, the ventral striatum and related neural circuits including the prefrontal cortex contribute importantly (e.g., 17), paralleling findings regarding neural correlates of cue reactivity and craving in SUDs.

Impulsivity and compulsivity are considered transdiagnostic features (18), with compulsivity having received less research attention regarding behavioral addictions (19). In possible transitions from impulsive to compulsive behavioral engagement, the precise roles of habits in drug-taking and addictive behaviors has been debated (20).

A dichotomous perspective that behaviors are guided either by external stimuli or by internal goals has been criticized (e.g., 21), and more comprehensive approaches, including the involvement of goals (and reduced control over goal activation) in explaining seemingly habitual behaviors, are currently being considered (22). In later stages of behavioral addictions, behaviors may seem habitual but may be defined more precisely as compulsivity-related and may still be goal-directed, but the goals may shift from being reward/relief-oriented to performing the behavior in a more rigid manner. Neurally, the (additional) involvement of compulsive motivations may be reflected by activities in the dorsal striatum and related fronto-striatal loops (e.g., 17), similar to SUDs and obsessive-compulsive disorder. The psychological and neurobiological mechanisms of behavioral addictions may, at their core, involve interactions between paths related to reinforcement/ventral striatum (“feels better”) and compulsivity/dorsal striatum (“must do”) in conjunction with reduced prefrontal self-control (“stop now”) processes (9).

Dopamine has often been described as promoting behavioral addictions, although its role in specific behavioral addictions (e.g., gambling disorder) has also been questioned (23-25). Dopamine signaling in the midbrain has been linked to reward prediction and further reward-related (and punishment-related) processes (26). In patients with Parkinson’s disease (a condition characterized by severe dopamine-related pathology), dopamine agonists have been associated with addictive/impulsive behaviors (e.g., 27). Additionally, other personal (e.g., family history of gambling, smoking cigarettes) and environmental (e.g., being unmarried) factors have been independently associated with addictive/impulsive behaviors in Parkinson’s disease (28). Thus, while dopamine may contribute to some aspects of behavioral addictions in specific populations, such effects should be considered in the context of other neurobiological and psycho-social factors (25).

3. Clinical presentations of behavioral addictions: Prevalence, clinical characteristics, diagnostic assessments, treatment

Gambling disorder

Factors associated with the development and maintenance of gambling disorder include being male, young, single or married for less than 5 years, living alone, having low levels of education, and experiencing financial difficulties (29). Other implicated factors include familial and social problems, poor quality of life, alexithymia, and other psychopathologies including SUDs, depression, anxiety, schizophrenia, and bipolar disorder, among others (29).

Internationally, the prevalence of gambling disorder ranges from 0.1% to 5.8%. However, only 0.23% of the general population seeks treatment for gambling disorder, with treatment-seeking increasing with symptom severity (30).

Diagnostic criteria for gambling disorder are defined in the DSM-5 and ICD-11 and mainly comprise diminished control over gambling behaviors, increasing priority given to gambling (accompanied by decreased interests in other activities), continuation or escalation of gambling patterns despite experiencing gambling-related negative consequences that include functional impairment and/or marked distress. Over 30 screening instruments for gambling disorder have been developed, with three demonstrating sufficient methodological quality to be included in a systematic review (31): the South Oaks Gambling Screen, the Massachusetts Gambling Screen, and the Problem Gambling Severity Index. These three instruments are widely used globally. They have, however, some methodological limitations. In particular, the clinical validity and diagnostic accuracy as well as the sensitivity to detect gambling disorder versus at-risk gambling and the utility in assessing treatment response have been questioned.

In a recent systematic review and meta-analysis (32), the National Opinion Research Center Diagnostic Screen for Gambling Disorders – Loss of Control, Lying and Preoccupation (NODS-CLiP) was presented as one short instrument with high diagnostic accuracy for both at-risk gambling and gambling disorder and therefore recommended for use in research and clinical practice. Other instruments, such as the short South Oaks Gambling Screen, also demonstrated good diagnostic accuracy. Even though the aforementioned scales are also used for assessing treatment responses, their utility in this context has been questioned and there remains a need for a standard multi-dimensional instrument measuring treatment outcome on multiple domains (33).

Currently, no pharmacological interventions exist with formal indications for gambling disorder treatment. Data from randomized controlled trials have yielded some promising results for opioid antagonists like naltrexone and nalmefene (34). Serotonin-reuptake inhibitors, mood-stabilizing medications including lithium and topiramate, and n-acetylcysteine may also be considered, particularly for patients with co-occurring disorders, such as anxiety, bipolar and tobacco-use disorders, respectively (34). However, in a recent network meta-analysis (35), only naltrexone and nalmefene demonstrated efficacy in treating gambling disorder and it has been argued that mood-stabilizers may only be appropriate in treating patients with gambling disorder and co-occurring bipolar disorder.

Among behavioral interventions, cognitive and behavioral therapies, motivational interviewing, brief psychological interventions, imaginal desensitization, self-help and mutual-support interventions, and internet-based therapies have support, particularly in the shorter-term (36).

(Internet) gaming disorder

Video gaming is not only popular as a recreational but also increasingly as a professional activity (e.g., esports, streaming, and promotions). However, there is increasing scholarly attention to and research on the negative consequences associated with excessive gaming. The more extreme forms of compulsive gaming have been conceptualized and studied as 'gaming disorder', an addictive disorder with similar defining criteria to gambling disorder and SUDs. Gaming disorder as a diagnosis has been controversial and not universally accepted across nomenclatural systems. In 2013, 'internet gaming disorder' was included as a condition for further study, not as an official clinical diagnosis. However, in 2019, 'gaming disorder' was officially recognized as a mental disorder in the ICD-11 (37). The clinical characteristics of gaming disorder as described in the ICD-11 are comparable to those of gambling disorder and include: poor control over playing online or offline games; over-prioritization of gaming activities; and continuation or escalation of gaming behavior despite negative consequences. In addition, functional impairment and/or marked distress must be present. Additional clinical features include urges and craving for gaming activities, tolerance-like behaviors, and dysphoria and/or aggression upon cessation or reduction of gaming.

Gaming disorder shows frequent co-occurrence with other mental and behavioral problems, primarily anxiety disorders, mood disorders (38), attention-deficit/hyperactivity disorder (39), and other substance-related and behavioral addictions. Due to differing measurement approaches, sample characteristics, and cultural differences (40), the prevalence estimates of gaming disorder have varied. Studies mostly conducted in Europe and East Asia suggest that 2-3% of people

experience gaming disorder, with males having two- to three-fold elevated odds (41, 42).

There is no accepted gold standard screening or diagnostic tool for gaming disorder, but several interview protocols and numerous screening tools have been developed and used in major addiction facilities. Regarding treatment evidence, the field has steadily accumulated clinical studies, including some randomized controlled trials, evaluating different treatment types and modalities. Cognitive-behavioral therapy is regarded as having a more established evidence base than other therapies, but it is difficult to make definitive statements regarding its long-term benefits (43).

Other specified disorders due to addictive behaviors

Compulsive sexual behavior disorder (CSexBD) and problematic pornography use (PPU)

Recent studies using ICD-11 criteria for CSexBD suggest prevalence estimates of 8.2% in men, 2.4% in women, and 6.5% in gender-diverse individuals across 42 countries, with possible cultural differences (44). With varying operationalization, prevalence estimates range from 1-10% (men: 3–10%, women: 1-7%) for PPU, a common manifestation of CSexBD (45).

CSexBD and PPU commonly co-occur with paraphilic, mood, anxiety, substance use and personality disorders (46). Co-occurring disorders may predispose to and/or result from CSexBD/PPU symptomatology. Regarding differential diagnosis, if distress is completely related to moral judgments of sexual behaviors or impulses, individuals should not be diagnosed with CSexBD/PPU (47). Alterations within dopaminergic pathways and ventral striatum reactivity as related to reward processing, cue-reactivity, and craving have been implicated as neurobiological correlates of CSexBD and PPU (48). This may be comparable to or distinct from the processes

implicated in other behavioral addictions (see section on psychological and neurobiological mechanisms), and may be particularly robust given that sexual stimuli may act as natural reinforcers and deliver rewards rather than acting as cues that indicate potential rewards (49).

The CSexBD Scale (50), its short version (44) and the CSexBD Diagnostic Inventory (51) have been validated in multiple languages and countries with cut-off scores based on ICD-11 criteria for CSexBD. Other well-validated scales for CSexBD and PPU only partly assess ICD-11 criteria (46).

Based on preliminary evidence, cognitive-behavioral therapy is recommended as a first choice of treatment for CSexBD and PPU, with limited support for pharmacological treatment (e.g., naltrexone) (45, 46). Further, as most data are from male heterosexual samples from Western, industrialized countries, how culture, sex/gender, sexual orientations, and other factors may influence CSexBD/PPU warrant additional study.

Compulsive buying/shopping disorder (CBuy-ShopD)

CBuy-ShopD has an estimated point prevalence of 5% (52). Most population-based surveys suggest that women are at higher risk for CBuy-ShopD than men and that CBuy-ShopD is particularly prevalent in early and middle adulthood (52, 53). Clinical characteristics include intense preoccupation with consumer goods and diminished control over buying/shopping (54). Individuals with CBuy-ShopD often use buying/shopping to experience immediate pleasure and to relieve negative emotions (9, 55). Repeated inappropriate spending often leads to negative consequences (e.g., distress, indebtedness) and impairments in important areas of functioning (e.g., family discord, job loss). To continue shopping despite financial and social problems, many

individuals with CBuy-ShopD develop socially undesirable (e.g., lying) or delinquent (e.g., fraud) behaviors.

Co-occurring mental disorders/behaviors are frequent, including depression, anxiety, hoarding, eating disorders, SUDs, non-CBuy-ShopD behavioral addictions and personality disorders (53). In conjunction with massive growth in e-commerce, CBuy-ShopD often involves the internet, where it interferes more with other everyday interests and responsibilities than in-store CBuy-ShopD, perhaps because of the potential of seemingly unlimited searches for consumer goods, easy access and ever-evolving e-marketing (e.g., social marketing, attractive payment options) (56).

There are psychometrically sound self-rating instruments that may be used to screen for CBuy-ShopD, e.g., the Bergen Shopping Addiction Scale (57) and Pathological Buying Screener (58). The recently proposed diagnostic criteria, which are based on consensus-building among international experts, are helpful in diagnosing CBuy-ShopD (54). Systematic reviews indicate that group cognitive-behavioral therapy as compared to a waitlist condition is effective in reducing symptoms, while placebo-controlled pharmacological studies have failed to show drug effects (59, 60).

Problematic use of social media (PUSM)

PUSM appears multifaceted with features typically involving compensatory/rewarding motivations that lead to continued use of social media despite negative consequences (61). PUSM prevalence worldwide is estimated to be 5%-25% in the general population (62). The variation in prevalence estimates may reflect varying criteria used for identifying individuals with PUSM and potential cultural differences, with lower rates in studies adopting strict thresholds and from individualist vs. collectivist regions (62). Significant gaps exist in understanding clinical features of PUSM, although cue

reactivity/craving, sensitivity to social-media–related rewards, impaired inhibitory control, and limited emotion regulation appear common. Biologically, striatal-prefrontal pathways, insular morphology, and structural integrity of the corpus callosum have been implicated in PUSM (63). PUSM may be related to several mental disorders (e.g., depression, social anxiety), but also to eating disorders and body-dissatisfaction, including related problems such as cyberbullying (64).

Given the absence of formal diagnostic criteria, different self-report instruments have been developed to assess PUSM. Among the instruments, most are based on addiction frameworks and reflect similarities between PUSM and internet gaming disorder (65). However, concerns have been raised given that existing instruments do not account for differences in media content or passive versus active engagement or distinguish between intense but non-problematic use (66).

Of note, the absence of a uniform operational definition for PUSM hinders the development and testing of effective treatments. Existing data derive from studies testing cognitive-behavioral-therapy-based abstinence interventions (67), contingency management, automated notifications of application use, and selection of alternative activities (68). Overall, current research efforts and evidence for efficacious treatments are limited.

4. Current challenges and future directions

Convergences across behavioral addictions

The boundaries between non-substance addictive behaviors seem to be blurring, especially in online environments. This has been investigated relatively intensively regarding gaming and gambling (69). Specifically, loot boxes/crates contain randomly generated items that may upgrade an avatar or adorn weaponry in either game-

enhancing or non-game-enhancing manners, with loot-box/-crate contents often released only upon payment. Loot boxes/crates may operate as gateways from gaming to gambling, and longitudinal studies are needed to identify risk factors and mechanisms underlying transitions to gaming or gambling disorders (cf. 70).

Other convergences between gaming and gambling may involve daily fantasy sports (not legally considered gambling) and sports gambling. This relationship is particularly relevant given changes in sports gambling regulation including in the US where most states have legalized sports gambling since a Supreme Court decision in 2018. In conjunction with easy availability on the internet and legislative changes, gambling helplines are seeing increased volumes of help-seeking calls. Other convergences between gambling and gaming involve competitive gaming (e-sports) that may involve “in-real-life” gambling or gambling on “skins” (e.g., items that adorn gaming weaponry) that may have high values in gaming environments or in real life.

Other convergences may involve social media. For example, social casino games that may be accessed via social media platforms may have gambling-like elements (e.g., simulated electronic gambling (“slot”) machines that have points rather than monetary wagers). Micro-transactions (paying to extend time on free games or to advance to additional levels) on these apps have also linked gaming and gambling. Social media platforms may also induce shopping/buying with domains like Facebook Marketplace. Further, pornography use and gaming may link to one another, with data suggesting that when the Fortnite server crashed, “gamers” on Pornhub increased by 10% and searches for Fortnite-related pornography increased by 60% (71).

In clinical contexts, however, it is important to ask individuals not only about their first-choice application, but also for which purposes the applications are typically being used. This may help understand individual motivations which could be targeted by interventions. This is not only valid for gaming and gambling, but also for other online

applications. For example, using social media excessively may be motivated by receiving likes and positive comments or to reduce fear of missing out, which may be driving factors in developing PUSM. Using social media for seeing advertisements of new products or for seeing how people engage with specific brands and products may be related to CBuy-ShopD. Future research should investigate the clinical relevance of convergences across behavioral addictions via cross-cohorts and longitudinal studies to understand if technological developments may promote transitions of behavioral addictions not only from offline to online environments, but also from one specific addictive behavior to other or more generalized online addictive behaviors.

Public health considerations

The five (potential) behavioral addictions described here are each related to multi-billion-dollar global industries, which may require specific public health considerations. Regarding many behaviors, there exists a balance between individual civil liberties and governmental efforts to promote the public health through regulation. Regulation of some potentially addictive behaviors has long histories, with US restrictions on gambling loosening with lottery and casino expansion over the past 60 years. More recently, the internet has undergone dramatic changes resulting in changes in how many people engage in potentially addictive behaviors. In this context, many jurisdictions (North America, Europe) are proposing and enacting changes at governmental levels that include how social media companies may operate with respect to sharing information, the gambling industry may advertise, and pornography and other internet-based communication groups may operate. In these efforts, the impacts on youth are being prominently considered. For example, the US Surgeon General has released an advisory on social media use and youth mental health (72) and many states' Attorneys General are involved in litigation with social media

platforms regarding alleged harms to youth (73). In the current environment, many stakeholders may have roles in addressing concerns including governments, industries, community groups, parents, at-risk and affected individuals, researchers and healthcare providers, among others (69, 74). In the absence of conclusive information, guidance and recommendations are available to help prevent multiple types of problematic use of the internet (75).

Optimizing interventions

The efficacy of cognitive-behavioral therapy, particularly in group settings and in the shorter-term, has been demonstrated for behavioral addictions (see above). Currently, no pharmacological treatments have formal indications from regulatory bodies (like the US Food and Drug Administration) for the treatment of behavioral addictions. There is, however, some evidence for the efficacy of opioid antagonists (e.g., naltrexone), (selective) serotonin-reuptake inhibitors, and mood stabilizers in the treatment of gambling disorder (and to a lesser extent CSexBD), although findings are mixed. Similarly, (selective) serotonin-reuptake inhibitors and buproprion may help individuals with gaming disorder, although support is limited. A further promising field of new interventions is non-invasive neuromodulation, particularly transcranial direct current stimulation targeting the bilateral dorsolateral prefrontal cortex, as has been particularly demonstrated for gambling and gaming disorders (76). Mindfulness-based interventions may (additionally) be helpful in reducing symptoms of behavioral addictions and underlying mechanisms (e.g., craving) (77), although existing data are weak and heterogeneous (78).

Considering that three conditions (gambling disorder, gaming disorder, and CSexBD) discussed here are recognized as separate entities in ICD-11 (plus CBuy-ShopD is mentioned as an example in the coding tool, and there is increasing evidence

in the scientific literature of the existence of a social media use disorder), few high-quality systematic randomized clinical trials and meta-analyses exist on the efficacy of specific types of therapy and less on implementation to test effectiveness. An urgent challenge for future research is to establish a solid data base of high-quality treatment studies that test the efficacy and specificity of specific therapeutical approaches. A further challenge for research aiming to optimize treatment of behavioral addictions is the systematic investigation of interactions between multiple treatment approaches, for example, involving the combination of specific pharmacological, psychotherapeutic and neuromodulatory approaches, including less well tested approaches involving psychedelics. Lastly, a further important challenge is to understand individual factors that may affect the responsiveness to and the outcome of specific treatments (and their combinations) to individualize and optimize treatments. For these studies to be conducted, sufficient support is needed from funding agencies. Historically, the research and treatment of behavioral addictions has received insufficient funding. However, the recognition of gambling and gaming disorders as disorders due to addictive behaviors in the ICD-11 together with recent legislations (e.g., 79) may help remedy this situation if proposed bills are passed in multiple jurisdictions.

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