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Gambling Disorder and Other Behavioral Addictions: Recognition and Treatment

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Abstract

Addiction professionals and the public are recognizing that certain nonsubstance behaviors—such as gambling, Internet use, video-game playing, sex, eating, and shopping—bear resemblance to alcohol and drug dependence. Growing evidence suggests that these behaviors warrant consideration as nonsubstance or “behavioral” addictions and has led to the newly introduced diagnostic category “Substance-Related and Addictive Disorders” in DSM-5. At present, only gambling disorder has been placed in this category, with insufficient data for other proposed behavioral addictions to justify their inclusion. This review summarizes recent advances in our understanding of behavioral addictions, describes treatment considerations, and addresses future directions. Current evidence points to overlaps between behavioral and substance-related addictions in phenomenology, epidemiology, comorbidity, neurobiological mechanisms, genetic contributions, responses to treatments, and prevention efforts. Differences also exist. Recognizing behavioral addictions and developing appropriate diagnostic criteria are important in order to increase awareness of these disorders and to further prevention and treatment strategies.

Keywords

behavioral addiction; diagnosis; disordered gambling; Internet gaming disorder; neurobiology

Addiction has been proposed to have several defining components: (1) continued engagement in a behavior despite adverse consequences, (2) diminished self-control over engagement in the behavior, (3) compulsive engagement in the behavior, and (4) an appetitive urge or craving state prior to engaging in the behavior.^{1–3} Although, for a period of time, the term *addiction* was almost exclusively used to refer to excessive and interfering patterns of alcohol and drug use, the Latin word (*addicere*) from which it derived did not originally have this import.⁴ Researchers and others have recently recognized that certain behaviors resemble alcohol and drug dependence, and they have developed data indicating

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that these behaviors warrant consideration as nonsubstance or “behavioral” addictions.^{1,5,6} The concept remains controversial. Excessive engagement in behaviors such as gambling, Internet use, video-game playing, sex, eating, and shopping may represent addictions.⁷ A significant minority of individuals who show such excessive behavior display habitual or compulsive engagement.^{8,9}

Several converging lines of evidence show an overlap between these conditions and substance dependence in terms of clinical expression (e.g., craving, tolerance, withdrawal symptoms), comorbidity, neurobiological profile, heritability, and treatment.^{9,10} Moreover, behavioral and substance addictions share many features in natural history, phenomenology, and adverse consequences. Both forms of addiction typically have onsets in adolescence or young adulthood, with higher rates observed in these age groups than among older adults.¹¹ Both forms of addiction have natural histories that may exhibit chronic and relapsing patterns, and in both forms, many people recover on their own without formal treatment.¹²

Much remains to be understood, however, in the relatively novel field of behavioral addictions. Additionally, wide gaps exist between research advances and their application in practice or public policy settings. This lag is due, in part, to the public perception of behavioral addictions. Whereas drug abuse has well-known and severe negative consequences, those associated with behavioral addictions (e.g., dysfunction within the family unit,^{13,14} incarceration,¹⁵ early school dropouts,¹⁶ financial troubles^{17,18}) are often overlooked despite tremendous implications for public health. Moreover, because engagement in some behaviors with addictive potential is normative and adaptive, individuals who transition to maladaptive patterns of engagement may be considered weak willed and be stigmatized. Thus, research, prevention, and treatment efforts must be furthered, and educational efforts enhanced.

DSM-5 CONSIDERATIONS

Establishing nomenclature and criteria for behavioral addictions will enhance our capacity to recognize and define their presence. In the recently released fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5),¹⁹ a major modification is the reclassification of pathological gambling (renamed “disordered gambling”) from the “Impulse Control Disorders Not Elsewhere Classified” category into the new “Substance-Related and Addictive Disorders” category. The new term and category, and their location in the new manual, lend additional credence to the concept of behavioral addictions; people may be compulsively and dysfunctionally engaged in behaviors that do not involve exogenous drug administration, and these behaviors can be conceptualized within an addiction framework as different expressions of the same underlying syndrome.² Although disordered gambling is the only addictive disorder that is included in the main section of DSM-5, several other conditions have been included in Section III—the part of DSM-5 in which conditions that require further study are located. In particular, the DSM-5 work group has flagged “Internet gaming disorder” as a possible candidate for future inclusion in the addictions category. Although the inclusion of this disorder in the provisional diagnosis section of DSM-5 represents an important advance, the conflation of problematic Internet use and problematic gaming may prove unhelpful; the result may be gaps in research on

problematic Internet use that is unrelated to gaming (e.g., social networking) or on problematic gaming that is unrelated to Internet use.²⁰

This review will highlight the recent neurobiological, genetic, and treatment findings on behavioral addictions. An emphasis will be placed on disordered gambling since it is arguably the best-studied behavioral addiction to date. Other behavioral addictions, despite being less well studied, have been receiving considerable attention from researchers and clinicians and will also be discussed in this review. We will then discuss the similarities and differences between behavioral and substance-related addictions.

METHODS

A literature search was conducted using the PubMed database for articles in English pertaining to behavioral addictions. Case reports and studies with insufficient statistical information were excluded from this review. Because of the overlapping terms used to describe each condition, search items included the many different names found in the literature. For example, searches were made for “Internet addiction,” “compulsive Internet use,” and “problematic Internet use.” It is noteworthy that the sample sizes in most of the studies cited in this review are small and that the criteria used to define diagnoses vary between studies. These methodological differences should be considered when interpreting the findings.

PHENOMENOLOGY AND EPIDEMIOLOGY

Disordered gambling can include frequent preoccupations with gambling, gambling with greater amounts of money to receive the same level of desired experience (tolerance), repeated unsuccessful efforts to control or stop gambling, restlessness or irritability when trying to stop gambling (withdrawal), and the interference of gambling in major areas of life functioning. Criteria also include gambling to escape from a dysphoric state, gambling to regain recent gambling-related losses (“chasing” losses), lying in significant relationships about gambling, and relying on others to fund gambling. One major change in the DSM-5’s clinical description of gambling disorders is that it eliminated the requirement that a person engage in illegal activities to finance gambling.¹⁹ Additionally, the threshold of inclusionary criteria was reduced from 5 of 10 to 4 of 9; this new threshold is thought to improve the classification accuracy and reduce the rate of false negatives. However, the contrast in the thresholds for gambling disorder (4 of 9 criteria) and substance use disorders (SUDs; 2 of 11 criteria) will likely underestimate the relative prevalence and impact of gambling disorder. Epidemiological studies that have employed screening instruments like the South Oaks Gambling Screen²¹ have frequently generated higher prevalence estimates than have those employing DSM criteria.^{20,22,23} Meta-analytic data suggest that prevalence of past-year adult disordered gambling is between 0.1% to 2.7%.²⁴ The estimated proportion of disordered gamblers among college students appears higher, estimated in one study at 7.89%.²⁵

Definitions of other behavioral addictions have often used DSM criteria for disordered gambling as a blueprint.^{26,27} For example, Young’s Diagnostic Questionnaire²⁸ proposes

the following criteria for Internet addiction: withdrawal, tolerance, preoccupation with the Internet, longer than intended time spent on the Internet, risk to significant relationships or employment relating to Internet use, lying about Internet use, and repeated, unsuccessful attempts to stop Internet use. However, sample and measurement differences, coupled with the lack of universally agreed-upon diagnostic criteria, may contribute to variable prevalence estimates for Internet addiction. Estimates for adolescents have ranged from 4.0% to 19.1%, and for adults, from 0.7% to 18.3%.²⁹ Similarly, a range of prevalence estimates (with criteria mostly based on those for disordered gambling) have been reported for problematic video-game playing among adolescent populations (4.2%–20.0%), with adult estimates (11.9%) also falling in that range.²⁹

CO-OCCURRING DISORDERS

Data from the U.S. National Comorbidity Survey Replication—a U.S.-based community survey with 9282 respondents—reported that 0.6% of respondents met criteria for lifetime disordered gambling (2.3% reported at least one inclusionary criterion); of those, 96% met criteria for at least one other lifetime psychiatric diagnosis, and 49% had been treated for another mental illness.³⁰ High co-occurrence rates between behavioral and substance addictions have been observed; a recent meta-analysis suggest a mean co-occurrence of 57.5% between disordered gambling and substance addiction.²⁴ Among individuals with SUDs, the odds of disordered gambling were elevated almost threefold.³¹ Conversely, the odds for an alcohol use disorder increased roughly fourfold when disordered gambling was present.³² Clinical samples of other behavioral addictions suggest that co-occurrence with SUDs is common.³³ In a study of 2453 college students, individuals meeting the criteria for Internet addiction were roughly twice as likely to report harmful alcohol use, after controlling for gender, age, and depression.³⁴ Taken together, these findings suggest that behavioral addictions may share a common pathophysiology with SUDs.¹⁰

Disordered gambling also frequently co-occurs with various psychiatric conditions, including impulse-control, mood, anxiety, and personality disorders.^{8,23,35,36} It has been suggested that mood and anxiety disorders precede gambling problems,³⁰ which may manifest as a maladaptive coping mechanism.³⁷ Longitudinal studies suggest, however, that disordered gambling is associated with incident (new onset) mood disorders, anxiety disorders, and SUDs,³⁸ with incident SUDs being moderated by gender.³⁹ Additionally, both incident medical disorders and incident mental health disorders are related to disordered gambling, particularly among older adults.^{39,40} The presence or absence of specific co-occurring conditions is important to consider when selecting treatment strategies.⁴¹

DATA LINKING BEHAVIORAL AND SUBSTANCE ADDICTIONS

Especially relevant to addictions are aspects of motivation, reward processing, and decision making.^{42–44} These features represent potential endophenotypes, or intermediate phenotypes, that could be pursued in biological investigations across a spectrum of substance- and non-substance-related addictive disorders and may serve as possible markers for prevention and treatment efforts.⁴⁵

Personality

Individuals with behavioral and substance addictions score high on self-report measures of impulsivity and sensation seeking, and generally low on measures of harm avoidance.^{46,47} Some data indicate, however, that individuals with Internet addiction, problematic video-game playing, or disordered gambling may exhibit high levels of harm avoidance,^{29,48} suggesting important individual differences among people with addictions. The extent to which behavioral tendencies like harm avoidance may shift (e.g., over time) or differ (e.g., according to geographic region or other factors) warrants additional research.

Other research suggests that aspects of compulsivity are typically higher among individuals with behavioral addictions.^{31,49} Consequently, some conceptualize behavioral addictions along an impulsive-compulsive spectrum.⁵⁰ Compulsivity represents a tendency to repeatedly perform acts in a habitual manner to prevent perceived negative consequences, though the act itself can lead to negative consequences.⁵¹ While both impulsivity and compulsivity imply impaired impulse control, recent data suggest a more complex relationship between these two constructs as they relate to obsessive-compulsive disorders (OCDs) and behavioral addictions. For example, although groups with disordered gambling or with OCD both score highly on measures of compulsivity, among disordered gamblers these impairments appear limited to poor control over mental activities and to urges and worries about losing control over motor behaviors.⁵² By contrast, OCD subjects tend to score poorly across most domains.⁵³

Neurocognition

Neurocognitive measures of disinhibition and decision making have been positively associated with the severity of problem gambling⁵⁴ and may predict relapse of disordered gambling.⁵⁵ Similar to individuals with SUDs, individuals with disordered gambling have displayed impairments in risky decision making and in reflection impulsivity in comparison to matched control subjects.⁵⁶ Disadvantageous performance on the Iowa Gambling Task, which assesses risk/reward decision making, has been observed among individuals with disordered gambling and alcohol dependence.⁵⁷ In contrast, a study of individuals with Internet addiction did not demonstrate such deficits in decision making on the Iowa Gambling Task.⁵⁸

Attempts to control or eliminate addictive behaviors may be motivated by immediate reward or the delayed negative consequences of use—that is, temporal or delay discounting. This process may be mediated via diminished top-down control of the prefrontal cortex over subcortical processes promoting motivations to engage in addictive behavior.⁵⁹ Individuals with disordered gambling and SUDs display rapid temporal discounting of rewards; in other words, they are more prone to select smaller, earlier rewards than larger ones that come later.^{60,61} Although some data suggest that abstinent individuals with SUDs perform better (display less delay discounting) than do individuals with current SUDs, other data suggest no significant differences.⁶⁰ A recent study suggests that delay discounting did not differ in individuals with disordered gambling pretreatment and one-year posttreatment.⁶²

Neurochemistry

Dopamine has been implicated in learning, motivation, salience attribution, and the processing of rewards and losses (including their anticipation [reward prediction] and the representation of their values).⁶³ Given the importance of dopaminergic projections in reward circuits—including projections from the ventral tegmental area to ventral striatum in SUDs⁶³—studies on behavioral addictions and related behaviors have focused on investigating dopamine transmission. A recent single-photon emission computed tomography study suggests that dopamine release in the ventral striatum during a motorbike-riding computer game⁶⁴ is comparable to that induced by psychostimulant drugs such as amphetamine⁶⁵ and methylphenidate.⁶⁶ In one small study using positron emission tomography with the tracer [¹¹C]raclopride, dopamine release in the ventral striatum was associated positively with Iowa Gambling Task performance in healthy control subjects but negatively in individuals with disordered gambling,⁶⁷ suggesting that dopamine release may be involved in both adaptive and maladaptive decision making. Although a gambling task induced no differences in the magnitude (i.e., [¹¹C]raclopride displacement) between disordered gamblers and controls, among disordered gamblers dopamine release correlated positively with problem-gambling severity⁶⁸ and with subjective excitement.⁶⁹

Similar to individuals with SUDs,⁷⁰ reduced D2/D3 receptor availability in the striatum has been observed in individuals with Internet addiction⁷¹ and in humans⁷² and mice^{73,74} with obesity. For example, obese rats (but not lean rats) had downregulated D2 receptors, and their consumption of palatable food was resistant to disruption by an aversive or punishing condition stimulus.⁷⁵ The same study also found that lentivirus-mediated knockdown of striatal D2 receptors accelerated the development of addiction-like reward deficits and the onset of compulsive-like food seeking in rats with access to palatable food,⁷⁶ which is suggestive of reward hyposensitivity. Several recent studies have examined this marker among disordered gamblers.^{69,77,78} While no significant between-group differences in D2/D3 receptor availability at resting state was observed, among disordered gamblers dopamine receptor availability was negatively correlated with mood-related impulsivity (“urgency”) within the striatum⁷⁷ and positively correlated with problem-gambling severity within the dorsal striatum.⁷⁸ The precise role for dopamine in gambling disorder continues to be debated,⁷⁹ but a model based on studies in rats and humans suggests different roles for D2, D3, and D4 dopamine receptors, with D3 receptors in the substantia nigra correlating with problem-gambling severity and impulsivity, and linked to greater dopamine release in the dorsal striatum.^{78,80–82}

Dopamine receptor agonist medications have been associated with disordered gambling and other behavioral addictions in patients with Parkinson’s disease.^{83–85} However, other factors (including age at Parkinson’s onset, marital status, and geographic location) independently contribute to the associations between behavioral addictions and Parkinson’s disease, suggesting multiple etiologically contributing domains.⁸³ Furthermore, drugs with dopamine antagonist properties have not demonstrated efficacy in the treatment of disordered gambling.^{86,87} These findings, in conjunction with those showing the induction of gambling urges by drugs promoting and blocking D2-like dopamine receptor activity,^{88,89} have raised questions regarding the centrality of dopamine to disordered gambling.⁷⁹ Nonetheless,

recent data suggest that dissecting the inputs from D2, D3, and D4 receptors might elucidate dopamine's role in the pathophysiology of disordered gambling.^{80,82}

Evidence exists for serotonergic involvement in behavioral addictions. Serotonin is implicated in emotions, motivation, decision making, behavioral control, and inhibition of behavior. Dysregulated serotonin functioning may mediate behavioral inhibition and impulsivity in disordered gambling.^{8,67,69} Disordered gambling has been associated with reduced levels of the serotonin metabolite 5-hydroxyindoleacetic acid (5-HIAA) in cerebrospinal fluid.⁹⁰ Low levels of platelet monoamine oxidase (MAO) activity (considered a peripheral marker of serotonin activity) among males with disordered gambling^{91,92} has provided additional support for serotonergic dysfunction. Striatal binding of a ligand with high affinity for the serotonin 1B receptor correlated with problem-gambling severity among individuals with disordered gambling.⁹³ These findings are consistent with those from challenge studies using meta-chlorophenylpiperazine (m-CPP), a partial agonist with high affinity for the serotonin 1B receptor. These studies observe different biological and behavioral responses in individuals with behavioral or substance addictions (compared to those without) in response to m-CPP.⁴⁷

Less is known about the integrity of other neurotransmitter systems in behavioral addictions. A dysregulated hypothalamic-pituitary-adrenal axis and increased levels of noradrenergic moieties have been observed in disordered gambling.⁹⁴ Noradrenaline may be involved in the peripheral arousal associated with gambling.^{95,96} Opioid antagonists (e.g., naltrexone, nalmefene) have demonstrated superiority over placebo in multiple randomized clinical trials.^{41,97,98}

Neural systems

Neuroimaging studies suggest shared neurocircuitry (particularly involving frontal and striatal regions) between behavioral and substance addictions. Studies using reward-processing and decision-making tasks have identified important contributions from subcortical (e.g., striatum) and frontal cortical areas, particularly the ventromedial prefrontal cortex (vmPFC). Among disordered gamblers, versus healthy controls, both decreased^{99–102} and increased vmPFC activity¹⁰³ has been reported during simulated gambling and decision-making tasks. Similarly, gambling stimuli has been reported to be associated with both decreased¹⁰⁴ and increased^{105,106} vmPFC activity in disordered gamblers. The findings from these studies may have been influenced by the specific tasks used, the populations studied, or other factors.^{99,107,108} Relatively greater activation of other frontal and basal ganglia areas, including the amygdala, during high-risk gambling decision making in the Iowa Gambling Task has been observed among disordered gamblers.¹⁰³ While data are relatively limited for other behavior addictions, several recent cue-induction studies have demonstrated activation of brain regions associated with drug-cue exposure. Individuals playing World of Warcraft (a massive, multiplayer, online role-playing game) more than 30 hours per week, compared to nonheavy players (playing less than 2 hours per day) displayed significantly greater orbitofrontal, dorsolateral prefrontal, anterior cingulate, and nucleus accumbens activation when exposed to game cues.¹⁰⁹ In a separate study, activation in the

medial orbitofrontal cortex, anterior cingulate, and amygdala in response to anticipated receipt of food was positively correlated with food addiction scores.¹¹⁰

As mentioned previously, the mesolimbic pathway (frequently referred to as the “reward pathway”) from the ventral tegmental area to the nucleus accumbens has been implicated in both substance and behavioral addictions.^{111,112} Relatively decreased ventral striatal activation has been reported in disordered gamblers during monetary reward anticipation^{99,100} and simulated gambling.¹⁰¹ In gambling cue-exposure tasks, disordered gamblers exhibited decreased activation in the ventral¹¹³ and dorsal¹¹⁴ striatum compared to healthy controls. Moreover, both ventral striatal and vmPFC activity was inversely correlated with problem-gambling severity in problem-gambling subjects during simulated gambling.¹⁰¹ In seeming contrast to these findings in disordered gambling, a recent functional magnetic resonance imaging study found stronger nucleus accumbens activity among compulsive shoppers (versus controls) during the initial product presentation phase of a multiphase purchasing task.¹¹⁵

Unlike findings from patients with SUDs,¹¹⁶ studies involving small samples of disordered gamblers did not display significant volumetric differences in white or gray matter from controls,^{117,118} suggesting that volumetric differences observed in SUDs may represent possible neurotoxic sequelae of chronic drug use. More recent data using larger samples, however, show smaller amygdalar and hippocampal volumes in individuals with disordered gambling, similar to findings in SUDs.¹¹⁹ Diffusion tensor imaging findings suggest reduced fractional anisotropy values—indicating reduced white matter integrity—in regions including the corpus callosum in disordered gamblers versus controls.^{118,120} Research has demonstrated both widespread reduction of fractional anisotropy in major white-matter pathways and abnormal white-matter structure in Internet addiction.¹²¹ However, negative results have also been observed for Internet addiction¹²² and hypersexual disorder.¹²³

Genetics and Family History

Twin studies suggest that genetic factors may contribute more than environmental factors to the overall variance of risk for developing disordered gambling.^{124,125} Data from the all-male Vietnam Era Twin Registry estimate the heritability of disordered gambling to be 50%–60%,^{126,127} a statistic comparable to the percentages for substance addictions.¹²⁸ A follow-up study of female twins estimated that the proportion of variability in liability for disordered gambling was similar in women and men.^{124,129} Small family studies of probands with disordered gambling,¹³⁰ hypersexual disorder,¹³¹ and compulsive shopping behavior¹³² have found that first-degree relatives of the probands had significantly higher lifetime rates of SUDs, depression, and other psychiatric disorders, suggesting genetic relationships among these conditions.

Few molecular genetic studies of behavioral addictions have been conducted. Genetic polymorphisms putatively related to dopamine transmission (e.g., *DRD2* Taq1A1, which is in linkage disequilibrium with *AnkK1*) have been associated with disordered gambling^{133,134} and problematic video-game playing.¹³⁵ Other research implicates allelic variant in serotonin transmission genes (e.g., *5HTTLPR* and *MAO-A*) in disordered gambling^{92,136} and Internet addiction disorder.¹³⁷ These studies, however, typically involved relatively

small samples and did not account for potential confounds (e.g., those relating to racial and ethnic differences between groups). A recent genome-wide association study reported that no single nucleotide polymorphism reached genome-wide significance for disordered gambling.¹³⁸ Further research is needed to investigate genes and gene-environment interactions that relate to behavioral addictions, with intermediate phenotypes like impulsivity perhaps representing important targets.^{45,128}

Addiction Versus Addictions

The current literature indicates many overlaps between behavioral and substance-related addictions in the domains mentioned above, suggesting that the two sets of disorders may represent different expressions of one “addiction” entity. Nonetheless, differences are also apparent. Although the concept of behavioral addiction appears to be increasingly prominent in the literature, the scientific and empirical evidence remains insufficient for these disorders to be treated as part of one comprehensive, homogenous group. The gaps in our knowledge need to be addressed in order to determine whether behavioral and substance-related addictions represent two different addictions or whether they are different expressions of a core addiction syndrome. Furthermore, separate diagnoses can be clinically useful since individuals may present to practitioners with concerns in specific addiction domains. Nonetheless, the overlaps between the disorders suggest that specific treatments for SUDs may also be beneficial for behavioral addictions.

TREATMENTS

Treatments for addiction may be divided into three phases. First, a detoxification phase aims to achieve sustained abstinence in a safe manner that reduces immediate withdrawal symptoms (e.g., anxiety, irritability, and emotional instability, which may be present in both behavioral and substance addictions). This first phase may involve medications to assist the transition. The second phase is one of recovery, with emphasis on developing sustained motivation to avoid relapse, learning strategies to cope with cravings, and developing new, healthy patterns of behavior to replace addictive behavior. This phase may involve medications and behavioral treatments. Third, relapse prevention aims to sustain abstinence in the long term. This last phase is perhaps the most difficult to achieve, with waning motivation, the revival of associated learning cues linking hedonic experience to addictive behavior, and temptations that may threaten the recovery process, originating from external (e.g., people, places) and internal (e.g., resumed engagement, stress, interpersonal conflict, symptoms of comorbid mental conditions) cues. Most clinical trials for behavioral addictions have focused on short-term outcomes.

Psychopharmacological Interventions

No medication has received regulatory approval in the United States as a treatment for disordered gambling. However, multiple double-blind, placebo-controlled trials of various pharmacological agents have demonstrated the superiority of active drugs to placebo.^{41,139}

At present, the medications with the strongest empirical support are the opioid receptor antagonists (e.g., naltrexone, nalmefene). These medications have been used in the clinical

management of drug- (particularly opiate-) and alcohol-dependent patients for several decades^{140,141} and have more recently been evaluated for treating disordered gambling and other behavioral addictions. One double-blind study suggested the efficacy of naltrexone in reducing the intensity of urges to gamble, gambling thoughts, and gambling behavior; in particular, individuals reporting higher intensity of gambling urges responded preferentially to treatment.⁹⁷ These findings have been replicated in larger, longer studies,¹⁴² and maintenance of positive effects may persist after naltrexone discontinuation.¹⁴³ Medication dosage may be an important consideration in achieving improvement. High doses (100–200 mg/day) of naltrexone successfully reduced symptoms of hypersexual disorder and compulsive shopping disorder;^{144–146} they recurred, however, following discontinuation.¹⁴⁴ In two large, multicenter trials using double-blind, placebo-controlled designs, only the higher doses of nalmefene (40 mg/day) showing statistically significant differences from placebo in treatment outcome for disordered gambling.^{98,147} Other data suggest, however, that lower doses (e.g., 50 mg of naltrexone) are sufficient and associated with fewer adverse effects.^{142,147} Importantly, intensity of pretreatment gambling urges and a familial history of alcoholism have been linked to opioid antagonist treatment outcomes in disordered gambling (with stronger urges at treatment onset and a positive family history of alcoholism each associated with better treatment outcome to naltrexone or nalmefene), suggesting important individual differences with respect to treatment response.¹⁴⁸ The extent to which treatment response might link to specific genetic factors—as has been suggested for alcohol treatment response to naltrexone¹⁴⁹—warrants additional study.

With respect to food, preclinical research suggested that high doses of the opiate antagonist naloxone increased sugar consumption and opiate-like withdrawal symptoms—including elevated plus maze anxiety, teeth chattering, and head shakes—in sugar-binging rats following a period of abstinence.^{150–152} These results were not replicated among rats on high-fat diets.¹⁵³ The efficacy of opioid antagonists like naltrexone in treating food addiction has yet to be explored in human subjects but merits research attention.

Although selective serotonin reuptake inhibitors (SSRIs) were one of the first medications that were used to treat disordered gambling, controlled clinical trials assessing SSRIs have demonstrated mixed results for both behavioral and substance addictions.⁴⁹ Fluvoxamine and paroxetine were reported to be superior to placebo in several trials^{154,155} but not in others.^{156,157} Efficacy may differ among behavioral addictions. Citalopram, another SSRI, was found effective in reducing hypersexual disorder symptoms among homosexual and bisexual men¹⁵⁸ but, among individuals with Internet addiction disorder, did not reduce the number of hours spent online or improve global functioning.¹⁵⁹ SSRI treatments remain an active area of investigation,^{8,41} and further research is needed to assess the potential clinical utilization of SSRIs for disordered gambling and other behavioral addictions.

Glutamatergic treatments have shown mixed promise in small controlled trials. N-acetyl cysteine has shown preliminary efficacy both as a stand-alone agent¹⁶⁰ and in conjunction with behavioral treatment.¹⁶¹ Topiramate, however, did not show any differences to placebo in treating disordered gambling.¹⁶² Additionally, the results from these and most other pharmacotherapy trials of behavioral addictions are limited because of the trials' small sample sizes and short-term treatment durations.

Behavioral Treatments

Meta-analyses of psychotherapeutic and behavioral treatment approaches for disordered gambling suggest that they can result in significant improvements. Positive effects can be retained (though to a lesser degree) over follow-ups of up to two years.¹⁶³

One approach that has gained empirical support from randomized trials is cognitive behavioral therapy (CBT). This semistructured, problem-oriented approach focuses, in part, on challenging the irrational thought processes and beliefs that are thought to maintain compulsive behaviors. During therapy, patients learn and then implement skills and strategies to change those patterns and interrupt addictive behaviors.^{164,165} Therapists facilitate the replacement of dysfunctional emotions, behaviors, and cognitive processes through engagement in alternative behaviors and a series of goal-orientated, explicit, systematic procedures. CBT is multifaceted but typically involves keeping a diary of significant events and associated feelings, thoughts, and behaviors; recording cognitions, assumptions, evaluations, and beliefs that may be maladaptive; trying new ways of behaving and reacting (e.g., replacing video-game playing with outdoor activities); and, in the cases of disordered gambling and compulsive shopping, learning techniques to properly manage finances.¹⁶⁶ Such factors are important for initial abstinence but are also essential for relapse prevention. The particular therapeutic techniques that are employed may vary according to the particular type of patient or issue. For example, patients who are having trouble controlling cravings may utilize modules that teach coping strategies specifically for managing cravings. CBT approaches have the strongest evidence base of any of the psychotherapeutic approaches,¹⁶⁷ with a meta-analysis of randomized, controlled trials demonstrating improvement in gambling-related variables after treatment and at follow-ups in problem gamblers.¹⁶³ In individuals with Internet addiction, CBT has demonstrated efficacy in reducing time spent online, improving social relationships, increasing engagement in offline activities, and increasing the ability to abstain from problematic Internet use.¹⁶⁸

In addition to psychotherapeutic treatments such as CBT, self-help options are available. Although such options have been found to be beneficial for a range of individuals, they may be especially attractive to those people who do not meet diagnostic criteria for disordered gambling and who find psychotherapeutic intervention too costly or intensive.¹⁶⁹ A recent study suggests that Internet-based programs may help reduce disordered gambling symptoms, including at a three-year follow-up.¹⁷⁰ A popular self-help group based on mutual support is Gambler's Anonymous (GA). Based on the 12-step model of Alcoholics Anonymous, GA stresses commitment to abstinence, which is facilitated by a support network of more experienced group members ("sponsors"). The steps involve admitting loss of control over gambling behavior; recognizing a higher power that can give strength; examining past errors (with the help of a sponsor or experienced member) and making amends; learning to live a new life with a new code of behavior; and helping and carrying the message to other problem gamblers.¹⁷¹ Interestingly, individuals with (vs. without) a history of GA attendance were more likely to display higher disordered gambling severity, more years of gambling problems, and larger debts at intake to (other) treatment.¹⁷² GA has been shown to have beneficial effects for attendees with varying degrees of gambling

severity;¹⁷³ however, attrition rates are often high.¹⁷⁴ The benefits of GA may be increased with adjunctive personalized therapy, and these two approaches, when combined, may be mutually beneficial in promoting continuation of treatment.¹⁷⁵ Meta-analyses indicate other self-help interventions (e.g., self-help workbooks and audiotapes) also demonstrate beneficial effects in disordered gambling and are superior to no treatment or placebo. The positive effects, however, are typically not as strong as those of other empirically tested psychotherapeutic approaches.¹⁶³

Brief motivational interviewing or enhancement—even as little as a 15-minute telephone consultation—has not only been demonstrated to be effective but in several studies has been shown to be more effective than other lengthier and more intensive approaches.¹⁷⁶ Motivational interventions center on exploring and resolving a patients' ambivalence toward change, with the aim of facilitating intrinsic motivation and self-efficacy through dealing with problem behaviors. Such interventions could provide a cost-effective, resource-conserving approach and could be particularly useful in individuals reluctant to engage in prolonged therapy on account of stigma, shame, or financial concerns.

Although the precise neural mechanisms mediating the effects of behavioral and pharmacological treatments are unclear, an improved understanding of them could provide insight into the mechanisms underlying specific therapies and assist in treatment development and in matching treatments and individuals. Many promising facets of treatment have yet to be examined in the context of behavioral addictions. For example, positive family involvement has been shown to be beneficial in the treatment of SUDs¹⁷⁷ and may be similarly helpful in treating behavioral addictions. Additionally, phenotypic heterogeneity exists within each behavioral addiction, and identifying clinically relevant subgroups remains an important endeavor. Testing specific, well-defined behavioral therapies in randomized, controlled trials is also important in validating treatment approaches. Neurocircuitry relating to specific behavioral therapies has been proposed.¹⁷⁸ The incorporation of pre- and posttreatment neuroimaging assessments into clinical trials represents an important next step for testing these hypotheses.

Combined Approaches

While much progress has been made in identifying and developing effective pharmacological and behavioral therapies, no existing treatment is completely effective on its own. Combining complementary treatments may help to address weaknesses in either therapy and may thereby catalyze beneficial treatment outcomes. Initial trials using combined approaches have yielded mixed results, with some positive results reported for disordered gambling.¹⁶¹

Natural Recovery

Repeated failed attempts to control gambling constitute a diagnostic feature of disordered gambling, which has typically been taken to imply that gambling disorder may be chronic and associated with multiple relapses. New data are challenging this notion, however, as they indicate variability in the trajectories of gambling problems, indicating a more transient, episodic pattern.^{1,12,179} Formal treatment is uncommon (less than 10%) of

individuals who meet criteria for disordered gambling seek formal treatment),^{180,181} the reasons cited for not seeking treatment include denial, shame, and the desire to handle the problem independently.¹⁸² Very little longitudinal research is available on the natural course of disordered gambling, and still less for other behavioral addictions. Some evidence suggests that young adults frequently move in and out of gambling problems.¹⁸³ Although few direct, long-term studies of gambling relapse have been conducted, it is reasonable to hypothesize that treatment may be essential for sustained abstinence.

Prevention Strategies

Prevention interventions are important in curbing addictive behaviors. The cost to society of such behaviors could be reduced by introducing and implementing effective educational campaigns that promote community awareness about these behaviors' potentially deleterious health effects and that alert the medical community to the importance of evaluating and treating behavioral addictions. Policies should promote responsible engagement in these behaviors and improve treatment access. Given the high prevalence of behavioral addictions among youth,¹⁸⁴ school-based prevention programs may be especially beneficial.

OTHER CONSIDERATIONS

Addictions vary. Social acceptability, a substance's availability, and a behavior's pervasiveness may represent important considerations for treatment. Each behavioral addiction may represent a heterogeneous construct, with specific subtypes potentially relating differently to psychological processes. Different forms of gambling (e.g., strategic versus nonstrategic, sports betting) and different locations (e.g., casino) may present different risks for developing disordered gambling.^{185,186} Similarly, different genres of game playing (e.g., massive, multiplayer online role playing, puzzle and strategy, action), different forms of Internet use (e.g., social networking, email, blogging), and different types of food (e.g., sugar, fat) may possess different addictive potentials and engage cognitive, behavioral, and affective systems in distinct manners. Such differences are important to consider, and warrant further research.

CONCLUDING REMARKS

Despite significant advances in research, behavioral addictions remain poorly understood. Our understanding of efficacious, well-tolerated pharmacological and behavioral strategies for behavioral addictions lags significantly behind our understanding of treatments for other major neuropsychiatric disorders. Given the health burden and social impact of these behavioral conditions (e.g., the estimated lifetime cost of disordered gambling in the United States is \$53.8 billion),¹⁸⁷ the development and improvement of prevention and treatment strategies are important. The development of health screens and formal diagnostic instruments to assess a full range of behavioral addictions may help reduce the public health burden of these conditions. Additional study in clinical trials of pharmacological and behavioral therapies for behavioral addictions is needed. Continued research may also help identify novel targets for treatment and may assist in identifying relevant individual differences that may be used to guide the selection of therapies. Despite differences, the overlaps between behavioral and substance addictions suggest that comprehensive research

on the latter may inform an understanding of the former. Through targeted research efforts based on substance addiction findings, the etiology, treatment, and prevention and policy efforts relating to behavioral addictions will potentially move forward rapidly—reducing, in turn, the public health costs and human impact of these conditions.

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