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Compulsive features in behavioral addictions: the case of pathological gambling

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Abstract

Aims—To describe, in the context of DSM-V, how a focus on addiction and compulsion is emerging in the consideration of pathological gambling (PG).

Methods—A systematic literature review of evidence for the proposed re-classification of PG as an addiction.

Results—Findings include: 1. Phenomenological models of addiction highlighting a motivational shift from impulsivity to compulsivity associated with a protracted withdrawal syndrome and blurring of the ego-syntonic/ego-dystonic dichotomy; 2. Common neurotransmitter (dopamine, serotonin) contributions to PG and substance use disorders (SUDs); 3. Neuroimaging support for shared neurocircuitries between "behavioral" and substance addictions and differences between obsessive-compulsive disorder (OCD), impulse control disorders (ICDs) and SUDs; 4. Genetic findings more closely related to endophenotypic constructs like compulsivity and impulsivity than to psychiatric disorders; 5. Psychological measures such as harm avoidance identifying a closer association between SUDs and PG than with OCD; 6. Community and pharmaco-therapeutic trials data supporting a closer association between SUDs and PG than with OCD. Adapted behavioral therapies, such as exposure therapy appear applicable to OCD, PG, or SUDs, suggesting some commonalities across disorders.

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Concise Statement: The involvement of compulsivity in impulse control disorders (particularly pathological gambling), obsessive-compulsive disorder and substance addictions is examined. While the endophenotypic construct of impulsivity has been investigated and described with respect to these disorders, that of compulsivity has been less well-studied. Neurobiological and clinical implications are discussed.

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Conclusions—PG shares more similarities with SUDs than with OCD. Similar to the investigation of impulsivity, studies of compulsivity hold promising insights concerning the course, differential diagnosis and treatment of PG, SUDs, and OCD.

Keywords

Compulsivity; Impulsivity; Addiction; Pathological Gambling; Endophenotypes

Introduction

Debate exists regarding the appropriateness of considering pathological gambling (PG) as an impulse control, obsessive-compulsive-spectrum or addictive disorder (1;2) as features of impulsivity, compulsivity, and addiction are observed in PG (3). This debate is timely as the *Diagnostic and Statistical Manual of Mental Disorders*

(DSM-5) develops (4;5). Proposed changes include the reclassification of PG from the Impulse Control Disorders (ICDs) category to one of "Addiction and Related Disorders" (1) and obsessive-compulsive disorder (OCD) from the anxiety disorder category to one of obsessive-compulsive spectrum disorders (OCSDs) (6), where ICDs characterized by excessive shopping, internet use, or sexual behaviour could be included (7). Emerging from these proposed changes is an increasing focus on addiction and compulsion in the consideration of ICDs within the new nomenclature. Here we examine the potential overlap of compulsivity and addiction in relation to PG, substance use disorders (SUDs), and OCD along phenomenological and neurobiological lines, and discuss treatment implications.

Commonalities between definitions and criteria

A feature of substance dependence in the DSM-IV-TR is that "use is continued despite knowledge of having a persistent or recurrent physical or psychological problem" (8). The term addiction avoids confusion relating to non-addictive forms of dependence (e.g., as observed in people taking beta-adrenergic antagonists for hypertension). With components related to diminished self-control and craving (9), addiction involves compulsive drug use despite adverse consequences (10), suggesting addictions are not limited to drug use (11;12). Similar to drug addictions, PG can include repeated unsuccessful efforts to control, cut back, or stop gambling; feeling restless or irritable when attempting to cut down or stop gambling; and diminished ability to resist an impulse to gamble despite serious or adverse consequences of the gambling behaviours (8).

Compulsivity in OCD involves performing unpleasantly repetitive acts in a habitual manner to prevent perceived negative consequences, leading to functional impairment (13;14;15). The traditional psychopathology perspective associates compulsive behaviours to obsessions, cognitions which as whole are characterized by unrelenting doubts about one's own perceptions and behaviours, hesitation, feelings of incompleteness and overestimation of risk. Such features are proposed to have their roots in personality, the so-called anankastic trait. The perennial nature of the trait would answer for the recurrent need to repeat specific behaviours to domesticate an eternal subjective disquiet, thus delineating a compulsivity construct (16). Parallels in phenomenology related to OCD, ICDs and substance addictions may involve engagement in seemingly compulsive behaviours to prevent or reduce distress (8), anxiety or stress prior to participation in the behaviours, and relief during and following performance of the behaviours (9).

Phenomenological aspects of compulsivity

a. Is there a motivational shift?

Several models of addiction conceptualize a progression from impulsivity to compulsivity, transitioning from initial positive reinforcement motivations to later negative reinforcement and automaticity mechanisms (9;17–21). A protracted withdrawal syndrome may occur, generating motivational aspects of dependence, through negative emotional states (e.g., dysphoria, anxiety, irritability) when access to the drug or addictive behaviour is prevented. This negative affective state may contribute to compulsivity through negative reinforcement (9;20;22).

b. How distinct is the ego-syntonic/ego-dystonic dichotomy?

While there may be similar compulsive features in PG, OCD, and substance addiction, there are also differences. Substance and behavioural addictions like PG have been described as ego-syntonic, meaning they are often preceded by feelings of "pleasure, gratification, or relief at the time of committing the act" (8). In OCD, compulsive behaviours are often completed to suppress or neutralize thoughts and reduce tension and anxiety related to obsessions (8). These compulsions are typically considered ego-dystonic in nature. Thus, the motivations underlying compulsive behaviours in addictions and OCD may differ. However, addictive behaviours may become less ego-syntonic and more ego-dystonic over time, as the behaviour or effects of the substance becomes less pleasurable and more habitual or compulsive (9;20;22–24). Similarly, reference to the compulsions in OCD as integrally "unpleasant" may not always be the case, as in childhood OCD, or the relief individuals may obtain after "cleaning just right" or the satisfaction attached to arranging until "mission accomplished" (25).

c. Tolerance and Withdrawal

The occurrence of tolerance may be another similarity between substance addiction, PG, and OCD, with a drive to increase the intensity of the repetitive behaviour over time (26;27). An urge or craving while abstaining from the behaviours may have similarity with cravings during drug withdrawal in substance addictions (1). The transition of drug use to addiction has also been considered with respect to neuroplasticity, where with repeated exposure to drugs of abuse an incentive salience state "wanting," linked to compulsive use, replaces a "liking" or hedonic response (28).

Neurobiological underpinnings of compulsivity

a. Neurotransmitters

Multiple neurotransmitter systems contribute to substance addiction and PG, many of which are implicated in OCD; however, data suggest differences in the nature of the involvement of these systems in PG and OCD (23).

Serotonin (5-HT) contributes to behavioural inhibition and dopamine (DA) to learning, motivation, and the salience of stimuli, including rewards (29). Pharmacological challenges of 5-HT and dopamine systems (30–34) suggest differences in the nature of the involvement of these systems in OCD as compared to PG and SUDs. Following a challenge with a serotonergic agonist like *meta*-chlorophenyl piperazine (*m*-CPP), OCD patients report an exacerbation of OC symptoms (33). Individuals with PG are more likely to report a euphoric or "high" response to m-CPP, similar to responses seen in alcohol dependent subjects (31).

b. Neurocircuitry

Neuroimaging data support a shared neurocircuitry of behavioral and substance addictions that appears differentially involved in OCD (20). Frontostriatal circuitry contributes to impulsive choice in substance addiction (18) and PG (35;36). Dysfunction of striato-thalamo-cortical circuitry, implicated in perseverative behaviours, may account for compulsive drug use in addiction (37).

Frontal–striatal circuits are implicated in OCD, ICDs in Parkinson's disease (PD), and cocaine-seeking behaviours (38). In one model (38), a ventral prefrontal system concerned with emotive factors interacts with a dorsal prefrontal executive functioning system. In ICDs in PD, an imbalance between limbic and motor cortical systems, in part related to PD pathology and/or the DA replacement therapies used to treat the disorder, may exist (39). In drug addiction, an imbalance of the ventral and motor systems may be flexible in time, moving from involvement of ventral to dorsal circuitry (40–42).

Cravings in substance and behavioral addictions have been associated with diminished ventral striatal activation (43), similar to findings during reward processing or simulated gambling in PG and alcoholism (44;45). Gambling task participation may elicit greater DA release in the ventral striatum in individuals with PD and PG than in individuals with PD alone (46), a response similar to that elicited by drugs or drug-associated cues in drug-addicted individuals (47) or in PD subjects who excessively take DA replacement drugs (48). Increased activation of frontostriatal circuitry has been observed following cue exposure in OCD (49), whereas diminished activation has been seen in PG (50), highlighting the need for concurrent investigation of PG, OCD, drug dependent and control subjects (23).

Koob and Volkow (9) argue that impulsivity dominates the early stages of addiction, and impulsivity combined with compulsivity dominates the later stages. They propose three stages of the addiction cycle: 'binge/intoxication', 'withdrawal/negative affect', and 'preoccupation/anticipation' (craving). In their model, the ventral tegmental area and ventral striatum contribute substantially to the binge/intoxication stage, the extended amygdala (including regions of amygdala, stria terminalis and nucleus accumbens) contributes substantially to the withdrawal/negative affect stage, and the preoccupation/anticipation stage involves a widely distributed network involving the orbitofrontal cortex–dorsal striatum, prefrontal cortex, basolateral amygdala, and hippocampus. The insula contributes to craving, the cingulate gyrus, dorsolateral prefrontal, and inferior frontal cortices to poor inhibitory control, and a protracted withdrawal syndrome with a negative affect state to compulsivity (9;22).

Consideration of protracted withdrawal in PG is warranted as psychological withdrawal has been reported in PG (1;51). Additionally, gambling in response to emotional dysregulation (24) and coping with stress have been cited as precedents of engaging in PG (52). Similarly, drug-taking in drug addiction and compulsive behaviours in OCD may be performed to reduce distress (8).

Lubman et al. (53) caution, that while there are similarities in clinical features and behavioural deficits associated with inhibitory control in both addiction and OCD, functional activity within inhibitory regions is markedly dissimilar, reflecting differences in core cognitive processes relevant to each disorder (53–56). An under-activity of the inhibitory system in addiction may be associated with limited future regard and diminished ability to resist engaging in drug-related behaviours, whereas in OCD, the system may be over-active, perhaps because individuals are overly concerned about future consequences (53).

c. Genetic vulnerability and endophenotypes

Candidate gene studies of PG suggest links to SUDs and poor inhibitory control (23). Some but not other studies have implicated the Taq-A1 polymorphism of the gene encoding the DA D2 receptor (57–59). Variants of the 5HT transporter gene have been implicated in both OCD and PG, but the nature of the associations differ (23), with the long allele found in association with OCD and the short allele found in association with PG (60;61).

In support of OCSDs, a cluster analysis conducted in patients with OCD identified 3 separate clusters (62). The clusters were termed: reward deficiency (including trichotillomania, Tourette's disorder, pathological gambling, and hypersexual disorder); impulsivity (including compulsive shopping, kleptomania, eating disorders, self-injury, and intermittent explosive disorder); and somatic (including body dysmorphic disorder and hypochondriasis). None were associated with any particular genetic variant studied. Future genetic investigations should consider behavioral dimensions (compulsivity and impulsivity) and endophenotypes (63). Endophenotypes have the potential to measure objective trait markers that are either simpler to assess than complex phenotypic behavioral diseases or may represent constructs more closely aligned with biological underpinnings of psychiatric disorders (64). Because endophenotype research in psychiatry is relatively new, limited data are available (65).

An abnormally reduced activation of several cortical regions, including the orbitofrontal cortex during reversal learning in OCD patients and their clinically unaffected close relatives, has been identified. In a study assessing inhibitory controlprocesses, OCD probands and unaffectedfirst-degree relatives showed cognitiveinflexibility (extradimensional set shifting) and motor impulsivity(stop-signal reaction times). These deficits may represent endophenotypesfor OCD and related conditions (65;66).

In a motor inhibition paradigm (the stop-signal task - SST), both OCD patients and their unaffected first-degree relatives exhibited impaired motor inhibitory control, indexed by prolonged latency of the stop signal reaction time (SSRT), and longer latency was associated with both decreased gray-matter volume in the orbitofrontal cortex and right inferior frontal cortex (areas conventionally associated with OCD and SST activation, respectively) and increased gray-matter volume in areas of the striatum, cingulate, and parietal cortex (67). These results argue for the first structural MRI endophenotype mediating familial, and possibly genetic, risk for OCD-related impulsivity. Data suggest that such an endophenotype may also be relevant to PG and SUDs (24).

Complementary dimensions of compulsivity

a. Psychological measures

Individuals with OCD score high on measures of harm avoidance (68;68), whereas those with PG more closely approximate those with SUDs, scoring high on measures of impulsivity and novelty seeking (20;50;69). However, some individuals with OCD display high levels of cognitive impulsiveness (70), and individuals with PG or OCD have demonstrated high levels of both impulsivity and harm avoidance, suggesting a complex relationship between impulsivity and compulsivity (23;71). Within OCSDs, Hollander and Wong (72) proposed an organizing axis (the Impulsive-Compulsive spectrum) in which psychiatric disorders lie along a spectrum with OCD at the compulsivity extreme and antisocial personality disorder at the impulsive extreme. However, the co-occurrence of impulsivity and compulsivity traits in several addictive disorders challenges this uni-dimensional model. A study of PG and OCD (71) proposed unfolding the Impulsive-Compulsive spectrum into two orthogonal dimensions, yielding three psychopathological

domains: predominantly impulsive, predominantly compulsive (OCD), and impulsive-compulsive (PG).

Decision-making is relevant to PG, OCD, and SUDs (23). Similar differences in decision-making reflecting a propensity to make disadvantageous choices during gambling task performance have been found between control subjects and those with PG (73), OCD (74), and SUDs (75). However, other studies have found decision-making to be intact in OCD despite impairment on other tasks (76;77). The lack of convergence of these findings may reflect the heterogeneity of OCD, and further research is needed investigating compulsivity and decision-making.

b. Co-occurring disorders

Clinical and community samples indicate that PG co-occurs with multiple axis I and II disorders, with particularly strong associations with SUDs (78–81). Unfortunately, diagnostic assessments of OCD have not been consistently obtained. In the St. Louis Epidemiologic Catchment Area (ECA) study, whereas elevated odds ratios (ORs) were observed between problem/pathological gambling and SUDs, a non-elevated OR of 0.6 was observed between problem/pathological gambling and OCD (82).

Although PG and OCD might not have a strong connection, they share comorbidities. In the National Comorbidity Survey Replication, a subsample of 2073 respondents was assessed for OCD (83). More than one quarter of respondents reported experiencing lifetime obsessions or compulsions, but only small proportions of respondents met DSM-IV criteria for lifetime (2.3%) or 12-month (1.2%) OCD. OCD was associated with substantial comorbidity, with the strongest associations with internalizing (anxiety and mood) disorders and elevated odds for ICDs and SUDs. Together, these findings suggest the need for measures of OCD, PG, and other substance and behavioural addictions in population surveys and further investigation of their relationships.

Response to treatment

a. Pharmacotherapies

Although no drug is formally indicated for PG, three main classes have been investigated: opioid antagonists, mood stabilizers, and serotonin reuptake inhibitors (SRIs) (84;85). Opioid antagonists such as naltrexone reduce drinking frequency and likelihood of relapse to heavy drinking (86;87). Opioid antagonists also appear efficacious in the treatment of PG (1;88–90). As response to opioid antagonist treatment appears particularly robust amongst individuals with a family history of alcoholism (91), a treatment-relevant addiction-related endophenotype, perhaps related to craving or urges, is suggested.

The treatment-related similarities between PG and SUDs constrast with OCD findings. Naltrexone does not influence OCD severity (92) and may exacerbate symptoms (93;94). Mood stabilizers like lithium may be helpful in treating PG (95–97) but not OCD (98). Antipsychotic drugs antagonizing DA D2-like receptors (haloperidol, risperidone and olanzapine) have shown efficacy as augmenting agents in OCD (99), but have demonstrated negative findings in placebo-controlled trials in PG (100–102) and increase motivations to gamble in PG (103).

SRIs are indicated for treating OCD (99) but have had mixed results for PG and SUDs (23). Some randomized control trials have found fluvoxamine and paroxetine to be superior to placebo in the treatment of PG (104;105), and others have not (106;107). Differential effects of pharmacotherapy on PG suggest targeting co-occurring disorders, such as anxiety (108),

when treating PG (79;109), and concurrent decreases in both PG and the co-occurring domains have been observed (96;108).

A double-blind, placebo-controlled, counterbalanced study of an atypical stimulant (modafinil) in PG suggested two subgroups (103). Subjects with high impulsivity showed a decrease in motivation to gamble, risky decision-making, impulsivity, and responses to gambling-related lexical stimuli. Those with low impulsivity showed increased scores on all these measures, suggesting a bidirectional effect of modafinil that differentiates between high and low impulsive individuals with PG. This finding suggests heterogeneity in PG, which could explain seemingly conflicting results in clinical trials. Other data suggest that impulsivity may represent an important treatment target in PG (110;111). Emerging data also suggest roles for glutamatergic therapies in the treatment of OCD, PG, and SUDs (99;112;113), possibly through targeting compulsivity-related measures (e.g., cognitive inflexibility) (114), although results should be interpreted cautiously.

b. Behavioural Interventions

Behavioral therapies efficacious in treating SUDs may also be helpful for PG and OCD (115;116). Behavioural and motivational therapies, including Motivational Interviewing (MI) and Cognitive Behaviour Therapy (CBT) have been shown to be effective in treating SUDs and PG (85;117–120). Attendance in Gamblers Anonymous (GA), modeled after Alcoholics Anonymous (AA), has been associated with better outcome for people participating in professional gambling treatment (121). OCD has been typically treated through exposure/response prevention strategies (122;123), and theoretically similar imaginal desensitization approaches have support in PG (124–127).

Summary and Conclusions

Significant overlap exists between PG and SUDs with compulsivity representing a potentially important endophenotype. Although OCD and addictions may share some similarities, they appear neurobiologically different, have lower than expected comorbidity rates and differ with respect to responses to treatments (128). However, like impulsivity, compulsivity as an endophenotypic construct is important to examine in future studies of ICDs, SUDs and OCD (42;129;130).

Regarding the putative behavioural addictions, PG may be the only disorder with enough existing data to progress with classification as an addiction (1). Behavioural addictions represent an important focus of future research. Behavioural addictions may be similar to or different from each other at phenotypical and neurobiological levels with existing data suggesting both (131). It is likely that as with OCD and other psychiatric disorders, each behavioural addiction will represent a heterogeneous disorder (132;133). Such heterogeneity should be recognized while investigating the precise categorizations of the disorders and the development of optimally effective prevention and treatment strategies. Neurobiological advances may help understand heterogeneities and guide treatment development. Cognitive and behavioral approaches mindful of specific symptom clusters and recognizing the symptomatic evolution of the impulsivity-compulsivity constructs may lead to enhanced effectiveness. Recent models of impulsivity suggest the construct is not uni-dimensional (134;135). Compulsivity is likely to be multi-dimensional, with components reflecting motivationally driven, repetitive performance of behaviors. Compulsivity, like impulsivity, may represent an important endophenotype for ICDs, SUDs and OCD (42;129;130. As endophenotype represent intermediary constructs between complex disorders and genotypes, they may track more closely to biological constructs and be improved targets for prevention and treatment interventions.

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