Exploring the effects of mindfulness practice and trait mindfulness on gambling symptoms in women:
A combined clinical and community-based assessment

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Abstract

The etiology of gambling disorder (GD) differs in men and women, with high levels of comorbid mood and anxiety disorders, late onset and rapid escalation to severe symptoms, and gambling to cope as prominent features of female gamblers. Mindfulness-based interventions (MBI) have been proposed for a range of mood-related disorders and for addictions like alcohol use disorder. Given the prominent mood-related symptomatology in women with GD, MBI may be especially helpful for these individuals. Trait Mindfulness (focus on current experience, nonjudgmental appraisal, non-reactive response to stress) is antithetical to escape-based behaviors, like gambling to cope with distress. As such, Trait Mindfulness could influence risk for GD in women who gamble. This project assessed the relationship between Trait Mindfulness and other possible determinants of GD, like mood disorder, childhood neglect/maltreatment, and distress tolerance in a community sample of women who gamble (n = 20). The effects of a 10-week group MBI on gambling symptoms were assessed in a separate sample of treatment-seeking women with GD (n = 9). The two samples differed on all measures of psychopathology, aside from anxiety. In contrast, treatment-seeking women did not differ from the community sample in Trait Mindfulness or self-reported distress tolerance. Behavioral distress tolerance, operationally defined by persistence on challenging cognitive tasks, was not reliably affected by MBI. However, attention to negative affective stimuli was more consistently observed (p = .05) on an emotional Stroop task after vs. before treatment. Interestingly, this cognitive shift coincided with a significant decrease in symptoms on the Beck Depression Inventory from pre-to post treatment. Most notably, scores on the Yale-Brown Obsessive-Compulsive Scale for Pathological Gambling declined significantly over the course of MBI treatment (p = .045). Scores on the Gambling Craving Scale also declined significantly with treatment. These data provide initial empirical support for the value of MBI to reduce gambling symptoms in women with GD. Future research should assess their reliability in a larger randomized controlled trial of MBI, with refinements informed by this pilot study.

Key words: Women, gender, mindfulness, Stroop, negative affect

Introduction

Literature Review

The current diagnostic manual of the American Psychiatric Association, DSM-5, lists Gambling Disorder (GD) alongside substance use disorders (SUDs), a change from previous editions of the DSM. (A.P.A., 2013). This change was initiated in part by emerging evidence of commonalities in the neuropathology of GD and substance dependence and associated addictive-compulsive profile of behaviour in these syndromes (Leeman & Potenza, 2012). GD and SUD share many commonalities, including their predisposing factors (genetic, personality-based) and etiology (Frascella, Potenza, Brown, & Childress, 2010). Heterogeneity is recognized in the etiology of GD and SUD, and gender is a factor that consistently influences the trajectory to severe pathology in both syndromes (Grant & Kim, 2002; Greenfield, Back, Lawson, & Brady, 2010). Overall, males are more likely than females to develop GD; and gambling tends to start earlier and to coincide with risky or excessive behaviours, including substance abuse in males (Kessler et al., 2008). In contrast, gambling begins later but progresses to problematic levels more rapidly in females, a pattern referred to as 'telescoping' (Grant, Odlaug, & Mooney, 2012). Whereas men gamble as part of a constellation of excessive behaviours, women appear more inclined to gamble for the purpose of affect regulation – i.e., to cope with a range of negative emotional states (Stewart & Zack, 2008). In light of these gender differences in etiology and motives to gamble clinicians have proposed that treatments for GD may be more effective if they were targeted to the specific determinants of gambling in men and women (Crisp et al., 2004; Martins, Tavares, da Silva Lobo, Galetti, & Gentil, 2004). The present project adopted this approach to investigate the potential benefits of a mindfulness-based group intervention for women with GD. A concurrent study examined the relationship between trait mindfulness and gambling-related behaviours in an Internet-based questionnaire study of women not preselected for GD.

Rationale for Mindfulness Intervention

Mindfulness is a therapeutic approach derived from the Buddhist meditative practice of vipassana (insight) yoga (Kabat-Zinn, 1990). Mindfulness-based interventions (MBIs) were first systematically applied to the treatment of chronic pain in the 1990s and have since been utilized to treat wide range of chronic disorders where stress plays an important role. A large empirical literature has developed supporting the value of MBI and isolating the elements that are especially important to its therapeutic effects (Garland, Gaylord, Boettigerc, & Howard, 2010; Hoppes, 2006; Zgierska et al., 2009). Two core features of MBI are the emphasis on cultivating full awareness of the present moment and the adoption of a nonjudgmental perspective towards the thoughts and feelings observed. Development of these skills through meditative practice helps to reduce non-productive emotional or cognitive patterns along with ill-conceived or reactive behaviours. Repeated covert exposure to distressing thoughts combined with a neutral, non-reactive stance helps to build tolerance for these states along with new more 'skillful' (effective) approaches to goal-directed or inter-personal behaviour (Soler et al., 2012).

The emphasis on observation ('being') rather than action ('doing') is antithetical to the compulsive seeking behaviour at the core of addiction. For this reason, mindfulness has been advocated for the treatment of SUDs and particularly for relapse prevention which is often precipitated by stress or involuntary responses to conditioned cues for drugs or alcohol (Witkiewitz & Marlatt, 2007). A number of MBI protocols have been validated for SUDs (Chiesa & Serretti, 2013). Given the close parallels between GD and SUDs, it is not surprising that MBIs have been recommended for the treatment of GD as well (de Lisle, Dowling, & Allen, 2011). Mindfulness principles and strategies have been incorporated into pre-existing GD interventions (de Lisle et al., 2011; Lakey, Campbell, Brown, & Goodie, 2007; Riley, 2012). However, targeted application of MBI to women with GD for whom emotional reactivity and coping-oriented gambling are prominent issues has yet to be specifically investigated.

Developmental Factors

Disturbances in childhood attachment (neglect, abuse, trauma) have been implicated in the development of addictive disorders including GD (Hodgins et al., 2010; Konkoly Thege et al., 2017; Petry & Steinberg, 2005). Neurological circuitry that is shaped during early childhood is profoundly affected by parent-child interactions(Duncan et al., 2015; Sinai et al., 2014). Tolerance for distress, interpersonal sensitivity and self-concept are just some of the many fundamental and lasting characteristics that arise from these interactions. Trait mindfulness (TM) encompasses all these traits, with high TM denoting high distress tolerance, nonreactive interpersonal relations and a compassionate nonjudgmental attitude to oneself (Brown & Ryan, 2003). Stability of these features across situations and over time distinguishes TM from state mindfulness, which may vary with situational factors like presence of a stressor. Although research has found deficits in TM in people with GD (Lakey et al., 2007), the link between childhood attachment-related events, TM and gambling symptoms in treatment-seeking women with GD remains unclear.

Research Questions

1. Does a manual-based standardized group MBI reduce GD symptoms in women who meet DSM criteria for GD? (Study 1)
2. Do trait factors (e.g., TM, Distress Tolerance, childhood maltreatment) predict response to MBI treatment? (Study 1)
3. What is the relationship between TM and GD symptoms in a general sample of non-treatment seeking women who gamble? (Study 2)
4. How do the trait scores and GD symptom profile in the treatment-seeking sample compare with those of the general sample? (Study 1 and 2)

Relation to MGRP Research Priorities

Study 1 addresses Priority #16 (Examine which treatment modalities and approaches offer the most potential for effectively addressing problem gambling) and Priority #14 (Examine which types of at-risk and problem gamblers could benefit from various brief interventions).

Study 2 addresses Priority # 13 (Examine the relationship between co-occurring disorders and at-risk/problem gambling and explore the implications for treatment. In this case, co-occurring disorders were assessed dimensionally rather than by DSM criteria, using validated self-report scales (e.g., for Borderline Personality Disorder, Depression, etc.).

Significance of Topic

The efficacy of MBI for a range of psychiatric, emotional and stress-related disorders has been established through rigorous empirical testing. Initial evidence supports the benefits of MBI for substance addiction as well. To date, empirical data on the therapeutic potential of MBI for GD is scant. Furthermore, the benefits of this approach for specific issues (childhood maltreatment, distress tolerance, gambling to cope with negative affect) of women who gamble are especially important to determine in light of emerging evidence that the etiology of GD is different for men vs. women.

The practical goal of this project is to obtain pilot data to support a future clinical trial if initial findings warrant, in a larger sample. As such, effect size information can be valuable even in the absence of statistically significant effects, to estimate the required sample size for a future clinical trial.

Method

Participants

The target sample for Study 1 was 32. The target sample for Study 2, an internet-based questionnaire study, was 100. The final sample for Study 1 was n = 9. The final sample for Study 2 was n = 20.

The most important challenge to recruitment was advertising. Response rates for both studies were exceedingly low when recruitment was restricted to electronic media (Kijiji). However, advertisements in print media (Now Magazine or Metro – daily free transit newspaper) yielded much greater response and were ultimately responsible for recruiting the Toronto sample. The cost of advertising in print media was prohibitive in light of the modest budget of this small-grant study. This is an important lesson learned for recruitment of participants in a study (Study 1) where the treatment has not been validated (and therefore cannot be offered through clinical services or clinician referral), or where the incentive to participate is largely monetary (Study 2). Participants in Study 1 received a $200 gift card to a store of their choice, and were reimbursed for parking or transit costs. Participants in Study 2 received a $20 gift card to Tim Horton's

The primary inclusion criteria for Study 1 were age (>18), female gender, and NODS $\geq$ 5 (Hodgins, 2004). The primary exclusion criteria were DSM thought disorder (schizophrenia or bipolar disorder) or substance use disorder (other than nicotine dependence). A cut-off of 12 standard drinks/week was originally set in Study 1, but loosened to 20 drinks/week (moderate consumption; Wilkinson & LeBreton, 1986) due to the very slow recruitment rate. Similarly, cut-off scores were increased from 9 (DSM-III 'abuse') to 13 (25th percentile) on the Alcohol Dependence Scale (Skinner & Horn, 1984); and from 4 (no abuse) to 6 (recommended for screening psychiatric outpatients) on the Drug Abuse Screening Test (DAST)(Cocco & Carey, 1998). No participant in Study 1 was taking medication that had not been stabilized before enrollment.

Data Collection Instruments

The same questionnaires were administered in both studies, with the following exceptions: The National Opinion Research Center DSM Screen for Gambling Problems (NODS; Hodgins, 2004) was used to assess GD status via telephone screen for inclusion in Study 1. The Yale-Brown Obsessive-Compulsive Scale – Pathological Gambling version (PG-YBOCS; Pallanti, DeCaria, Grant, Urpe, & Hollander, 2005), a clinician-administered tool, was used to evaluate GD symptoms at intervals over the course of treatment in Study 1. The Gambling Cravings Scale (GCS; Young & Wohl, 2009) assessed transient cravings during testing and average craving intensity between treatment sessions in Study 1. The Childhood Experiences of Violence Questionnaire (CEVQ; Walsh, MacMillan, Trocmé, Jamieson, & Boyle, 2008) was used to assess childhood trauma in both studies.

The Structured Clinical Interview for DSM-IV (SCID-IFirst, Spitzer, Gibbon, & Williams, 1995) assessed mood, anxiety, thought and substance use disorders at intake. The Canadian Problem Gambling Research Index (CPGI; el-Guebaly et al., 2006) was originally included in the questionnaire battery but was dropped due to excessive time commitment during piloting of the protocol. The South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) was substituted for the CPGI. The Borderline Personality Questionnaire (based on DSM-IV; Poreh et al., 2006) was originally proposed to assess this syndrome but was dropped in favour of the short version of the Borderline Symptom List (BSL-23; Bohus et al., 2007). The Positive and Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988) assessed mood states during the course of the treatment trial.

Scales Use in Both Studies

Gambling Timeline Followback (G-TLFB; Weinstock, Whelan, & Meyers, 2004)measured gambling behaviour in preceding 90 days; The Gamblers' Beliefs Questionnaire (GBQ; Steenbergh, Meyers,

May, & Whelan, 2002)assessed gambling-related cognitive distortions; the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) measured TM. The Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1963) assessed Extraversion and Neuroticism and the Lie scale measured the tendency to dissimulate (fake 'good'). The Parental Bonding Instrument (PBI; Parker, 1989), UPPS-P Impulsive Behavior Scale (Cyders, 2013), Distress Tolerance Scale (DTS; Simons & Gaher, 2005), Beck Depression Inventory-short form (BDI; A. T. Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) , Beck Anxiety Inventory (BAI; A.T. Beck, Epstein, Brown, & Steer, 1988), Toronto Alexithymia Scale (TAS; Kooimana, Spinhovena, & Trijsburg, 2002) and Alcohol Timeline Followback (A-TLFB; Sobell & Sobell, 1992) assessed their respective constructs.

Aside from PG-YBOCS, PANAS and GCS in hard copy, all scales were administered on a laptop using Checkboxx® software.

Manual

We originally proposed to use a published MBI protocol developed for alcohol use disorder. However, the author demanded that we attend a workshop to train our personnel to assess adherence at their clinic in the USA, which was not financially feasible. We therefore developed our manual and protocol from a published document and homework exercises from a mindfulness manual for social anxiety created by a clinical psychologist at Wilfrid Laurier University (Dr. Nancy Kocovski) who was a former graduate student of one of the investigators (Dr. McMain). To modify the manual to address the specific concerns of people with GD, the Study Coordinator, (Jan van der Tempel) met with CAMH clinicians who had used mindfulness- based approaches as part of their therapy with clients at the CAMH problem gambling service. The final product was a manual that incorporated the general principles of MBI along with elements geared specifically to GD. The group facilitator for the first two groups of clients (Dr. Farah Jindani) had worked on the problem gambling service and was very knowledgeable and sensitive to the needs of people with GD. This helped to futher ensure that the intervention was conducive to the needs of women with GD. The manual is provided in Appendix A.

Cognitive Tasks (Study 1 only)

Mirror-Tracing Persistence Task (MTPT; Quinn, Brandon, & Copeland, 1996) and Paced Auditory Serial Addition Task (PASAT; Gronwall, 1977) assessed distress tolerance, in both cases, operationally defined as total time on task. In the MTPT, participants had to trace a series of shapes (e.g., circle, star) with the mouse when the movement of the mouse was reverse-mapped onto the movement of the icon on the screen (i.e., mirror tracing). When the icon went outside the boundaries of the shape for more than 2 seconds, a loud buzz sounded and the icon returned to the beginning of the shape. To proceed to the next shape the participant either had to complete the current shape without deviating from it for more than 2 seconds or opt to pass on completing that shape and go on to the next one (Bornovalova, Matusiewicz, & Rojas, 2012).

In the PASAT, participants earned points for successfully reporting the sum of consecutive numbers (from 0 to 20) when the numbers were presented at progressively faster rates. The initial inter-item interval was 5 seconds. For each correct answer the rate of presentation increased by 0.5 seconds, whereas each incorrect answer decreased the rate of presentation by 0.5 seconds. This phase lasted 2 minutes before the next phase began, in which the inter-item latency was the mean of phase 1. After that, two additional 1-minute phases occurred where the inter-item latency was half the mean latency of phase 1. At any point during the task the participant had the option to quit the task by pressing a designated button.

The Stroop Task (Williams, Mathews, & MacLeod, 1996) required participants to name, as quickly as possible, the colour of incongruent colour-words (e.g., GREEN printed in red), coloured control stimuli (XXXX), clinically relevant words (e.g., WAGER) and neutral control words (e.g., WINDOW) presented

on a computer screen. Stimuli were presented individually with items and categories randomized over trials. Response latency and accuracy were the key dependent measures. The difference in response time to control XXXX vs. incongruent colour words measured 'interference' on the classic version of the task, with smaller difference scores indicating better inhibitory control of attention. The same principle applied for the relative response time to clinically relevant vs. neutral words.

The Stop-Signal Task (Logan, Schachar, & Tannock, 1997), originally proposed to measure psychomotor inhibition, was omitted due to excessive time demands during piloting of the protocol.

The cognitive tasks were programmed in C++ and administered on an HP laptop.

Procedures

Study 1

Participants were recruited by advertisements on Kijiji and print media (METRO newspaper, Now magazine). They were screened against preliminary inclusion/exclusion criteria during a telephone interview (with verbal assurance of confidentiality). Potentially eligible responders were then invited to an on-site interview, where they heard an overview of the study, signed an informed consent form, underwent the SCID, completed the self-report scales and the cognitive tasks.

Those who were eligible after the interview attended a second pre-treatment session to re-evaluate their GD symptoms and cognitive performance. The interval between the two baseline sessions was random and provided an opportunity to assess any changes in clinical or cognitive status due solely to the passage of time. This served as a partial control for the effects of time alone, during the active treatment sessions.

Treatment involved attending 10 weekly 90-min MBI sessions. The topics and activities were delivered in a standardized manner as specified in the manual. Between sessions, participants were encouraged to meditate daily for increasing durations, and to keep a record of their moods (PANAS) and gambling cravings (GCS) during the intervening days.

Study 2

Participants were recruited via Kijiji or by local print media in free newspapers. They were screened against inclusion criteria by telephone (with verbal assurance of confidentiality) and those who were eligible were provided with a PIN to access the questionnaires. Upon entering the website, participants read a consent form and signed electronically before proceeding to the questionnaires. They did not have to answer all the questionnaires in a single session and could re-access the site as often as they wished to complete the battery.

Analyses

The original application proposed more extensive statistical analyses to examine possible mediating and moderating pathways between TM, GD and other key trait factors (Distress Tolerance, Parental Bonding). A comparison of the pattern of associations for the two samples was also proposed. These analyses are not feasible due to the small sample size. Instead, bivariate correlations among the different trait scales were performed within each sample, with Bonferroni correction for multiple comparisons. Pre-treatment mean scores on trait scales in study 1 were compared with corresponding scores from study 2 using independent samples t-tests.

In study 1, treatment effects were examined with multi-session repeated measures analyses of variance (ANOVA) of GD symptoms (PG-YBOCS) and cravings (GCS). Pre-post treatment

comparisons were also conducted for trait factors using paired t-tests or repeated measures ANOVA for multi-scale indices (e.g., GMQ, UPPS-P) as appropriate. Effect sizes were also computed to provide a basis for power analysis and sample size estimation in future studies.

Ethics Review

Study 1 underwent ethics review by the Research Ethics Board (REB) at CAMH and Study 2 underwent ethics review by the REB at the University of Manitoba. Annual review and renewal were conducted through the REBs at the respective institutions.

Limitations

The primary limitation in both studies was sample size. The reliability of the present findings is therefore a critical issue to confirm in future investigations. Open ended feedback from the facilitators in Study 1 indicated that an audiotape might have been beneficial to guide clients' meditative practice between treatment sessions. Both of these limitations are readily addressed.

Results

Managing Missing Data

Less than 5% of all data points were missing from the final data set. To maintain power in repeated measures analyses with a small sample, individual missing data points were replaced with the sample mean (Treatment Sample).

Table 1 (please see next page) reports the mean (SE) trait scale scores for participants in the two studies. Scores for study 1 are reported for pre- and post-treatment. Significant (p < .05) between-group (baseline study 1 vs. study 2) and within-group (pre- vs. post-treatment, study 1) differences are indicated by different superscripts. NODS scores, assessed in the treatment-seeking sample only, ranged from 10 to 16, mean (SE) = 12.67 (0.76), indicating considerable gambling symptom severity.

Two demographic variables were recorded in the treatment sample: *Annual Income*: Above $50,000 (*n* = 4), $10-49,000 (*n* = 4), below $10,000 (*n* = 1); and *Marital Status*: Married (*n* = 1), Separated (*n* = 1), Divorced (*n* = 2), Single (n = 5). A total of 12 women completed intake and attended at least one treatment session. Three dropped out during treatment.

Table 1 shows that the treatment sample was older, and reported higher levels of alcohol dependence (sub-set of 5 participants only); extraversion, neuroticism, and tendency to 'fake good' (Lie scale) on Eysenck Personality Inventory; along with higher levels of care and overprotection from both parents on the Parental Bonding Instrument. Scores on the Childhood Experiences of Violence Questionnaire were also significantly higher in the treatment sample than the general population sample.

As would be expected, scores on the Gambling Timeline Followback indicated that the treatment sample spent significantly (~60%) more time and (300%) more money on gambling in the preceding 6 months than the population sample did. The groups did not differ in trait mindfulness on the MAAS. Treatment-seeking women displayed higher South Oaks Gambling Screen scores, which correspond closely to the normative mean (μ = 11) for treatment seeking gamblers on this scale. GMQ scores indicate that treatment-seeking women were more likely to gamble to enhance a positive mood and to cope with a negative mood than women from the general population, whereas the groups did not differ in the tendency to gamble for social reasons. The treatment sample also reported more cognitive distortions on the Gamblers Beliefs Questionnaire.

Although the groups did not differ on the Beck Anxiety Inventory, treatment-seeking women scored higher on the Beck Depression Inventory. Notably, *the Beck Depression Inventory was the only scale on which scores declined significantly from pre- to post-treatment in the treatment sample.* A follow-up

2 (Session: Pre/Post-Treatment) ANCOVA controlling for EPI-Lie scores, found no significant effects involving the covariate, p > .58, confirming that this result was not mediated by self-presentation bias. The general population sample reported significantly higher scores on the Self-Compassion Scale and significantly lower levels of Negative Urgency, Positive Urgency, and Sensation-Seeking on the Impulsive Behavior Scale. On the latter index, the population sample scored higher on Premedation and equal to the treatment-seeking scale on Perseverance. Unexpectedly, the groups did not differ on reported Distress Tolerance, but the treatment seeking group did display the expected elevations on the Toronto Alexithymia Scale and on the Borderline Symptom Checklist.

Participant Characteristics

Table 1: Mean (SE) background characteristics for women from general population (Winnipeg; n = 20; study 2) and women with gambling problems from group mindfulness trial (Toronto; n = 9; study 1). Different superscripts indicate a significant (p < .05) difference between corresponding means.

	Winnipeg	Toronto Baseline	Toronto Post-Treatment
Age	42.3 (2.70) [a]	56.2 (1.84) [b]	
ADS	2.35 (0.72) [a]	25.40 (0.40; n = 5) [b]	---
EPI-E	5.83 (0.68) [a]	9.67 (1.25) [b]	---
EPI-N	11.58 (1.29) [a]	15.78 (1.51) [b]	---
EPI-L	1.79 (0.15) [a]	6.11 (0.54) [b]	---
PBI-MC	7.80 (0.94) [a]	31.22 (2.82) [b]	---
PBI-MO	11.68 (1.09) [a]	34.67 (3.12) [b]	---
PBI-FC	8.85 (1.22) [a]	30.44 (3.16) [b]	---
PBI-FO	11.55 (1.20) [a]	39.22 (2.30) [b]	---
CEVQ	6.20 (0.78) [a]	22.67 (5.42) [b]	---
G-TLFB (hrs)	34.85 (9.95) [a]	55.49 (9.61) [b]	---
G-TLFB ($)	2,278.15 (1190.98) [a]	6,903.00 (1671.07) [b]	---
MAAS	4.43 (0.17) [a]	4.04 (0.25) [a]	4.28 (0.14) [a]
SOGS	3.30 (0.74) [a]	11.56 (1.30) [b]	10.38 (1.00) [b]
GMQ-E	10.75 (0.88) [a]	13.33 (1.34) [b]	10.88 (0.82) [b]
GMQ-S	8.45 (0.58) [a]	8.67 (0.87) [a]	8.13 (1.03) [a]
GMQ-C	7.50 (0.78) [a]	13.22 (1.10) [b]	11.25 (1.02) [b]
GBQ	45.30 (2.64) [a]	108.78 (6.32) [b]	114.25 (10.81) [b]
BAI	28.75 (2.01) [a]	33.11 (2.67) [a]	30.38 (1.65) [a]
BDI	6.20 (0.99) [a]	21.44 (1.52) [b]	17.13 (1.17) [c]
SCS	34.75 (2.04) [a]	3.04 (0.28) [b]	2.93 (0.34) [b]
UPPS-NU	2.27 (0.12) [a]	2.68 (0.18) [b]	2.50 (0.14) [b]
UPPS-PU	1.81 (0.07) [a]	2.94 (0.23) [b]	3.11 (0.18) [b]
UPPS-PR	2.09 (0.09) [a]	1.83 (0.11) [b]	1.89 (0.11) [b]
UPPS-PE	2.03 (0.10) [a]	2.12 (0.14) [a]	2.23 (0.06) [a]
UPPS-SS	2.17 (0.12) [a]	2.68 (0.19) [b]	2.86 (0.15) [b]
DTS	50.85 (2.29) [a]	51.22 (2.28) [a]	49.63 (3.58) [a]
TAS-Total	43.26 (1.68) [a]	48.44 (3.11) [b]	46.88 (3.70) [b]
BSL-Total	6.30 (2.14) [a]	11.22 (0.28) [b]	11.13 (0.13) [b]

ADS: Alcohol Dependence Scale; EPI-E : Eysenck Personality Inventory-Extraversion Scale; EPI-N : Eysenck Personality Inventory-Neuroticism Scale; EPI-L: Eysenck Personality Inventory-Lie Scale; PBI-MC: Parental Bonding Instrument –Mother Care; PBI-MO: Parental Bonding Instrument-Mother Overprotection; PBI-FC: Parental Bonding Instrument-Father Care; PBI-FO: Parental Bonding Instrument-Father Overprotection; CEVQ: Childhood Experiences of Violence Questionnaire; G-TLFB (hrs) total time spent gambling in past 6 months; G-TLFB ($): total expenditure on gambling in past 6 months. MAAS: Mindful Attention Awareness Scale; SOGS: South Oaks Gambling Screen; UPPS-NU: Impulsive Behavior Scale–Negative Urgency; UPPS-PU: Impulsive Behavior Scale–Positive Urgency; UPPS-PR: Impulsive Behavior Scale–Premedation; UPPS-PE: Impulsive Behavior Scale–Perseverance; UPPS-SS: Impulsive Behavior Scale–Sensation Seeking; DTS: Distress Tolerance Scale; TAS: Toronto Alexithymia Scale; BSL: Borderline Symptom Checklist.

Correlational Analyses

There were no significant (Bonferroni corrected) bivariate correlations between any of the scales in the general population sample, nor were any of the a priori correlations between trait mindfulness and gambling symptoms or behaviour significant (alpha = .05). The same was true for the treatment sample, who also displayed no significant correlations between self-report scales and performance on the distress tolerance (Mirror Tracing, Paced Serial Addition) or attention-inhibition (Stroop) tasks.
Cognitive Tasks: Distress Tolerance and Attention-Inhibition

The MTPT, PASAT and Stroop tasks were administered in the same sequence on 3 sessions: Intake, Pre-Treatment (1-4 weeks after Intake) and Post-Treatment.

A 3 (Session) ANOVA of MTPT scores (mean time on task) found no significant effects, $p > .67$. Figure 1 shows that mean trial time declined somewhat from Intake to Pre-Treatment and remained stable from Pre- to Post-Treatment. Thus, neither the waiting period from Intake to Pre-Treatment, nor the 10-week Treatment was associated with significant change in persistence on the MTPT
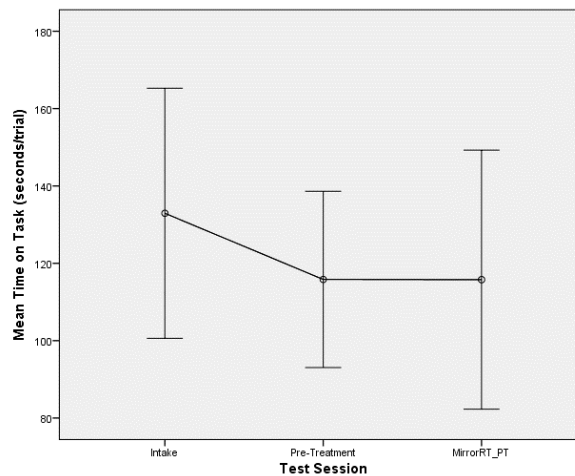

Figure 1. Mean (SE) time per trial (shape) on Mirror Tracing Persistence Task in treatment-seeking women with gambling problems (n = 9) at intake, pre-treatment (1-4 weeks later) and after 10 weekly group mindfulness treatment sessions.

Figure 2. Mean (SE) total time on Paced Serial Addition Task in treatment-seeking women with gambling problems (n = 9) at intake, pre-treatment (1-4 weeks later) and after 10 weekly group mindfulness treatment sessions.

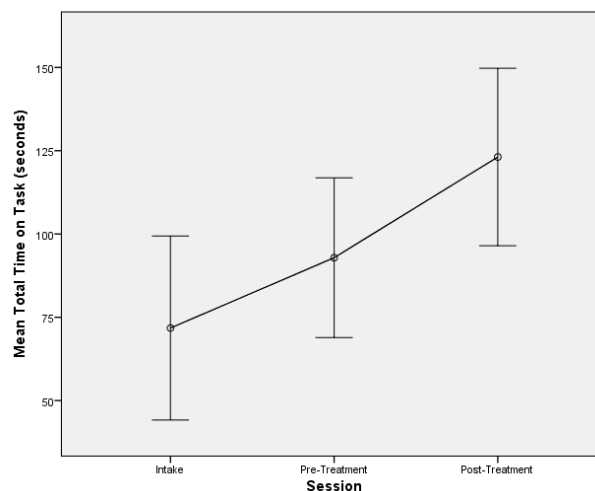A 3 (Session) ANOVA of scores on the PASAT yielded no significant effects, $p > .14$. Figure 2 (above) shows the scores for the 3 sessions and reveals a linear trend of increasing time on task from Intake through Pre-Treatment to Post-Treatment.

A 3 (Session) x 5 (Word Type) ANCOVA assessed colour-naming response time to Gambling, Alcohol, Positive Affect, Negative Affect and Neutral words on the emotional Stroop task, controlling for individual differences and repetition priming of response time to semantically meaningless (XXXX) control stimuli at Intake, Pre-Treatment and Post-Treatment. The ANCOVA yielded a significant Session x Word Type interaction, $F_{(8, 40)} = 2.36$, $p = .035$.

Simple effects analyses revealed that the interaction involved scores for Negative Affect vs. Neutral words, which did not differ at Intake but differed significantly at Post-Treatment, $F_{(1, 5)} = 6.29$, $p = .05$. Figure 3 plots these scores and indicates that the emergence of significance reflected a decline in error variability for Negative Affect and Neutral Words from Intake to Post-Treatment, rather than a change in the mean difference in response time to these two types of words at Intake vs. Post-Treatment.
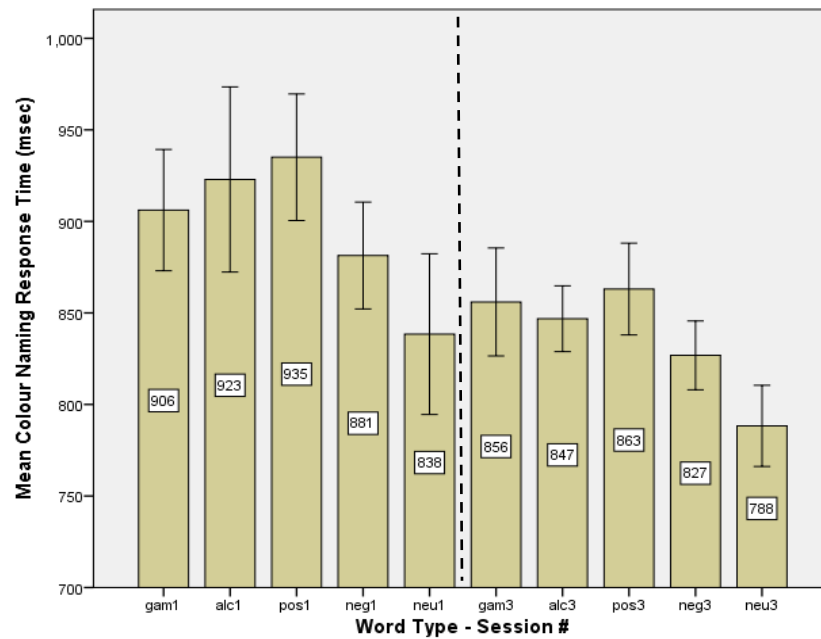

Figure 3 Mean (SE) colour-naming response time (msec) to Gambling, Alcohol, Positive Affect, Negative Affect and Neutral words on emotional Stroop task in treatment-seeking women with gambling problems (n = 9) at Intake and Post-Treatment.

Subjective Effects of Cognitive Tasks

Craving

To assess the effects of a cognitive challenge on desire to gamble, GCS scores were assessed in a 3 (Session: Intake, Pre-Treatment, Post-Treatment) x 2 (Time: Pre/Post Tasks) ANOVA. The analysis yielded a significant main effect of Time, $F_{(1, 8)} = 21.85$, $p = .002$, and no other significant effects, $p > .08$. A follow-up ANCOVA including EPI-Lie scores as the covariate yielded no significant effects involving the covariate, $p > .54$. Therefore, this result was not mediated by self-presentation bias.

Figure 4 displays these scores and reveals that the main effect of Time reflected a consistent decline in craving from pre- to post-task on each test session. The lack of other significant effects arose because the change in pre-post decline across sessions was not large enough to reach significance.
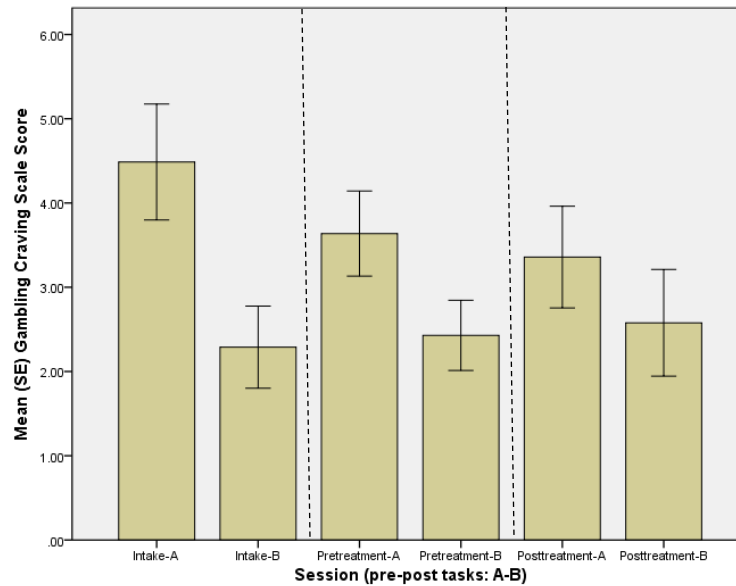
Figure 4. Mean (SE) scores on the Gambling Craving Scale before/after performing distress tolerance and attention-inhibition tasks in treatment seeking women (n = 9) with gambling problems at Intake, Pre-Treatment and Post-Treatment follow-up.

Mood State

A 2 (Subscale) x 3 (Session) x 2 (Time) ANOVA of positive and negative subscale scores on the PANAS before and after the cognitive tasks at Intake, Pre-treatment and Post-treatment yielded a Subscale x Time interaction, $F (1, 8) = 5.32$, $p = .05$, no main effect of Session, $p > .30$, and no other interactions, $p > .10$. Figure 5 shows that this effect denoted a consistent decline in negative (right panel) subscale scores after performing the tasks across all test sessions but no change or a slight increase in positive (left panel) subscale scores after the task on all sessions.
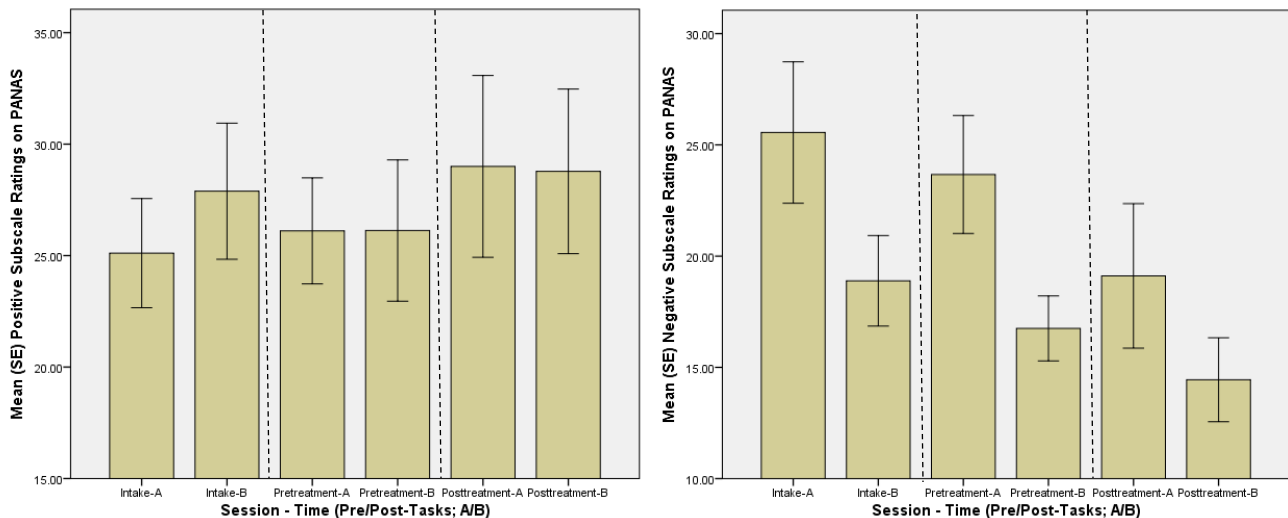
Figure 5. Mean (SE) scores on the Positive (left) and Negative (right) subscales of the PANAS before/after performing distress tolerance and attention-inhibition tasks in treatment seeking women (n = 9) with gambling problems at Intake, Pre-Treatment and Post-Treatment follow-up.

However, a follow-up ANCOVA including EPI-Lie scale scores as a covariate yielded a significant interaction of Time x Covariate, $F (1,7) = 9.60$, $p = .017$. Thus, self-presentation bias appeared to mediate the change in self-reported mood state at pre- vs. post-task on the test sessions.

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Clinical Response

Gambling Symptoms

The PG-YBOCS measured gambling symptom severity at Intake, Pre-treatment, on alternate sessions during treatment and at Post-Treatment. These scores are depicted in Figure 6.

Figure 6 Mean (SE) scores on the Yale-Brown Obsessive-Compulsive Scale for Pathological Gambling (PG-YBOCS) in treatment-seeking women with gambling problems (n = 9) on alternate weekly mindfulness treatment sessions.

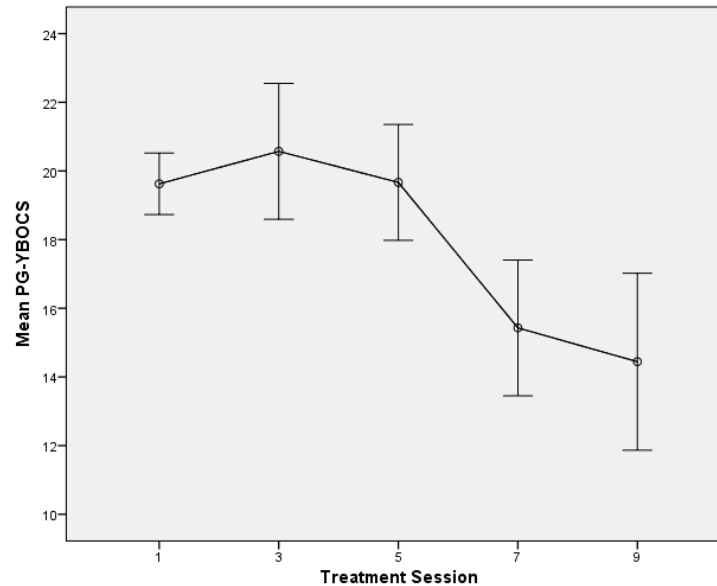To isolate treatment effects from variability during times when participants were not undergoing treatment, t-tests compared the scores for Intake vs. Pre-treatment and for the end of Treatment vs. Post-Treatment follow-up; a 5 (Session) ANOVA assessed scores from alternate sessions (which is when the scale was administered) during treatment.

The t-tests found no significant differences between Intake (M = 20.67; SE = 2.91) and Pre-treatment (M = 19.22; SE = 2.30) or between the final treatment assessment (M = 14.44; SE = 2.58) and Post-treatment follow-up (M = 15.89; SE = 3.98), p's > .66.

The ANOVA yielded a significant main effect of Session, $F (4, 32) = 2.75$, $p = .045$. Inspection of Figure 6 shows that this effect reflected a significant decrease in scores over sessions. Simple effects analyses found a significant difference in mean PG-YBOCS scores for the first vs. final session, $t (8) = 3.06$, $p < .05$. A follow-up ANCOVA including EPI-Lie scores as the covariate obtained no significant effects involving the covariate, $p > .075$. Therefore, the significant decline in PG-YBOCS scores over the course of treatment was not mediated by self-presentation bias.

Craving to Gamble between Treatment Sessions

The GCS measured gambling cravings based on daily ratings for the intervening weeks during the 10-week treatment phase. Figure 7 shows a general downward trend in scores as treatment progressed.
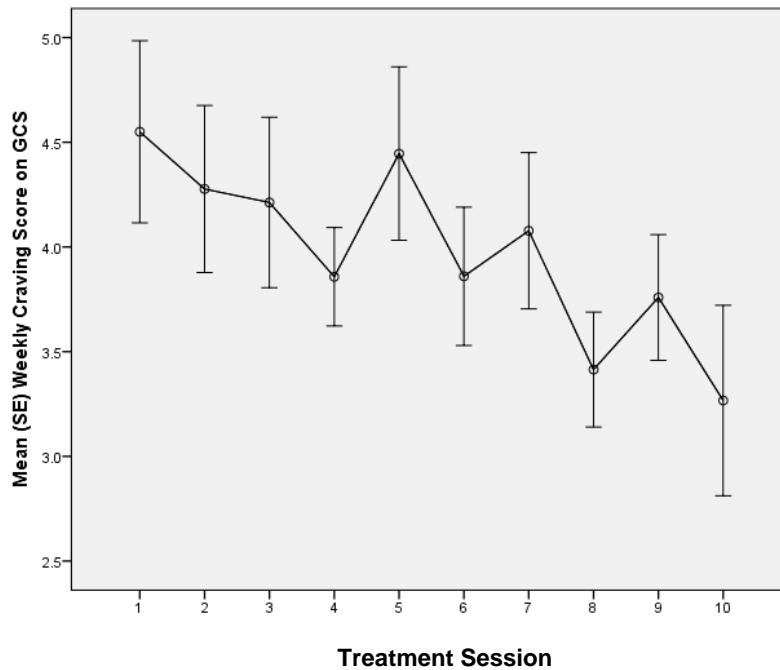
Figure 7 Mean (SE) scores on the Gambling Craving Scale in treatment-seeking women with gambling problems (n = 9) reflecting the average daily craving on days between sessions for 10 weekly mindfulness treatment sessions.

A 10 (Session) ANOVA of GCS scores yielded a marginally significant effect of Session, $F_{(9, 72)}$ = 1.99, p = .053. Simple effects analyses confirmed that the mean difference in scores for the first vs. final weeks was significant, $t_{(8)}$ = 4.29, p < .01. In contrast to the PG-YBOCS, the ANCOVA of GCS scores controlling for EPI-Lie found no significant or marginal effects, p > .86. Therefore, the decline in craving to gamble over the course of treatment was not mediated by self-presentation bias.

Mood State during Treatment

A 2 (Subscale: Positive, Negative) x 10 (Session) ANOVA of scores on the PANAS, based on average ratings for the days between treatment sessions, yielded no significant effects, p > .14. Inspection of the scores revealed no clear trends: Mean positive subscale ratings ranged from 21.3 to 27.5; mean negative subscale ratings ranged from 17.1 to 21.0. Therefore, neither positive nor negative mood state changed in a consistent manner during days between treatment sessions over the 10-week trial.
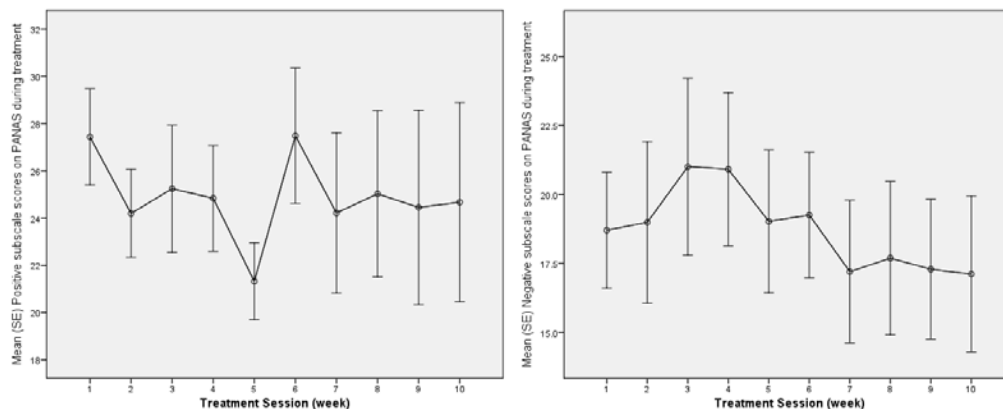

Figure 8. Mean (SE) scores on the Positive (left) and Negative (right) subscales of the PANAS averaged over days between weekly mindfulness sessions in treatment seeking women (n = 9) with gambling problems.

Participant Characteristics

This project provided novel data on trait and state measures of GD pathology, along with measures of symptom severity and cognitive performance under stress in women with gambling problems and a comparison sample of women who gamble from the general population. Data from the latter group were collected by an Internet-based questionnaire battery.

The sample size in each study arm of the project was much smaller than originally proposed. As such, the findings are provisional and tempered by the lack of statistical power.

The community sample of women gamblers differed on almost all trait measures of psychopathology, gambling-specific pathology, and risk factors for GD such as childhood experiences of violence and parental bonding. Interestingly, the groups did not differ on two putative mediators of GD pathology, Trait Mindfulness and self-reported Distress Tolerance. The comparable scores on these scales were not mediated by self-presentation bias based on follow-up ANCOVAs of the MAAS and DTS, controlling for EPI-Lie scores (results not shown). These results indicate that treatment-seeking women who meet DSM-IV criteria for PG on the NODS display a pervasive pattern of psychological dysfunction and developmental disturbance relative to women gamblers from the general community.

The assumption that treatment seeking women would exhibit lower trait mindfulness and distress tolerance than women gamblers from the community was not supported. The similarity in group mean scores on the MAAS and DTS suggested that this was not a Type II error due to insufficient power. This suggests that treatment seeking women with gambling problems do not necessarily lack insight into factors that may be contributing to their gambling behaviour, nor are they inherently more sensitive to stressful life circumstances than non-treatment seeking, non-GD women who gamble.

Distress Tolerance/Attention-Inhibition Tasks

The cognitive tasks yielded a mixed pattern of effects on the two Distress-Tolerance tasks of more rapid quit times across sessions on the MTPT and more persistent (slower) quit times across sessions on the PASAT. Differences in the difficulty of the two tasks may account for this difference such that participants may simply have learned on the first test session that good performance on the MTPT was virtually impossible and opted not to waste their time attempting to do so on later sessions.

The data from the Stroop task indicated that gambling, alcohol, positive affect and negative affect words were all more salient than neutral words at intake and this did not change appreciably at pre-treatment a short time later (1-4 weeks). Treatment was not associated with changes in the salience of gambling, alcohol or positive affect words. However, negative affect words became more salient after treatment because of a more consistent pattern of response to these words (decreased standard error), rather than an increase in mean response time to these words vs. neutral words at post-treatment. This is an unexpected result that suggests that mindfulness treatment is associated with increased attention to negative affective stimuli in women with GD. Given that mindfulness encourages nonjudgmental acceptance of involuntary responses, including conscious negative thoughts, the decrease in variability of response to negative affective words may reflect a common increase in willingness to attend to potentially distressing negative affective stimuli.

Subjective Effects of Cognitive Tasks

GCS scores revealed a consistent decline from before vs. after performing the cognitive tasks. Intuitively, exposure to stressful tasks might be expected to coincide with an increase in craving to gamble. However, the consistent decline in cravings, although counterintuitive, aligns with previous

findings for non-treatment seeking men with GD who underwent a stress manipulation in a previous study in our lab (Steinberg, Tremblay, Zack, Busto, & Zawertailo, 2011). In that case, participants reported a significant decrease in Desire to Gamble ratings on a visual analogue scale relative to a neutral control manipulation. We interpreted the findings as suggestive of a possible homeostatic effect of stress on gambling motivation in men with GD. A similar homeostatic effect could be involved in the present results for women with GD.

Scores on the PANAS before and after the cognitive tasks appeared to support the possibility that participants experienced a decrease rather than an increase in negative affect after performing the tasks. However, the significant Time x EPI-Lie scale interaction in the ANCOVA suggested that self-presentation bias (tendency to 'fake good') mediated this effect. Taken together, the results suggest that the cognitive tasks were subjectively distressing and that the reported decline in negative mood ratings partly reflected bravado or unwillingness to acknowledge distress in some participants.

Clinical Effects

A significant decline in gambling symptoms from the beginning to the end of treatment emerged on the PG-YBOCS, and this decline survived correction for EPI-Lie scores. Therefore, a 10-week trial of group mindfulness treatment is associated with a significant decrease in the severity of gambling symptoms in treatment seeking women with GD.

A comparison of scores between Intake and Pre-treatment showed that repeated testing and the passage of time (1-4 weeks) alone did not reliably alter PG-YBOCS scores. Similarly, the change from final treatment score to post-treatment was not significant.

Average craving ratings on the GCS for the days between treatment sessions also decreased significantly over the course of treatment and this effect was not mediated by self-presentation bias.

There was no significant change on the PANAS over the course of treatment sessions. However, BDI depression scores did decrease significantly, and self-presentation bias did not mediate this effect. Thus, whereas mindfulness treatment was not associated with a significant change in overall affective state, this intervention did coincide with a significant reduction in clinically relevant symptoms of mood disorder in women with GD.

Conclusions and Future Directions

The findings from this pilot study indicate that treatment-seeking women with GD differ on multiple aspects of psychopathology and adverse developmental history from community recruited women who gamble. The results from the treatment trial indicate a congruent decline in GD symptom severity, gambling cravings and mood disorder symptoms, consistent with the reported linkage of these dimensions in the clinical and epidemiological literature. The increase in the uniformity of attentional responses to negative affective word cues on the emotional Stroop task from pre- to post-treatment is also noteworthy: It suggests that negative cue salience *per se* is not necessarily pathological if individuals have learned to adopt a nonjudgmental, compassionate response to involuntary cognitions. Thus, by encouraging awareness and acceptance of one's thoughts and feelings, mindfulness may defuse the emotional charge of intrusive thoughts or other cognitive biases in women with GD.

As noted under Limitations above, these results are based on a very small sample size. Therefore, the interpretation and conclusions drawn from the findings are strictly provisional and must await confirmation in a randomized controlled trial with a large enough sample to rule out Type II (and Type I) errors. Future research should also compare men vs. women with GD to inform matching strategies.

Specific considerations for this future research are outlined below.

Debriefing with the therapists who facilitated the mindfulness sessions suggested that participants expressed great appreciation for the time and care extended to them. Open-ended reports during treatment sessions revealed very high levels of shame and self-loathing among participants. If treatment enabled them to adopt a more objective view of their behaviour and more compassionate view of themselves, one important source of distress would have been reduced. Insofar as gambling is a strategy for coping with negative affect, mindfulness may have partly defused motivation to gamble. The significant decline in BDI depression scores supports this possibility. To further enhance the benefits of the intervention, participants said they would appreciate a CD or other audio resource to help guide their home meditation practice.

It should be noted that group settings can provide inherent therapeutic benefits through a sense of shared perspective, empathy and support. Similarly, a strong therapeutic alliance with a clinician can provide a basis for optimism and commitment to behaviour change. Neither of these features is specific to mindfulness-based interventions. Future research can incorporate scales to objectively evaluate the role of these factors in therapeutic response, apart from the benefits of MBI.

Although the present findings suggest that mindfulness-based interventions may be beneficial for women with GD, their reliability is unclear. Similarly, determination of the specific factors that mediated the decline in GD symptoms must await future research with a larger sample. Based on our experience in both arms of the project, on-line recruitment of research participants is not an efficient way to secure a large sample. In contrast, print media, especially daily free newspapers geared to job seekers (e.g., transit-based media like Metro), do appear to reach women who gamble and were a successful means of recruitment, based on our limited experience. Note: Because the treatment had not been validated, it was not ethical to recruit via the CAMH gambling treatment service, as this could have conveyed an impression of efficacy that had not yet been established. Thus, recruitment through print media appears to be the preferred approach for research that seeks to validate mindfulness as a treatment for women with GD. In light of this, future investigators are strongly encouraged to allocate ample funds to print advertising to ensure timely recruitment of participants in such a trial.

The present results provide data to guide sample size estimates for future clinical trials. Effect sizes were generally large by Cohen's standards (e.g., $d = 1.68$ for the decline in PG-YBOCS; $d = 1.43$ for the decline in GCS). Given the recognized differences in the etiology of GD in men and women, and associated calls for gender-based interventions, this study offers new, empirical support for the potential benefits of mindfulness-based interventions for women with GD.

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