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More is Better: A Meta-Analysis of Dose and Efficacy in Face-to-Face Psychological Treatments for Gambling Disorder

Rory A. Pfund

MORE IS BETTER: A META-ANALYSIS OF DOSE AND EFFICACY IN FACE-TO-FACE PSYCHOLOGICAL TREATMENTS FOR GAMBLING DISORDER

by

Rory A. Pfund

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Abstract

The dose-response relation is a well-established finding in the general psychotherapy literature. Investigators from this literature define the dose-response relation as how much face-to-face treatment is needed to realize a statistically reliable improvement in psychological symptoms. However, there is presently mixed evidence on the presence of a dose-response relation in the literature on face-to-face psychological treatment for gambling disorder. In the present study, meta-regression was employed to synthesize results from past studies on the efficacy of psychological treatment for gambling disorder to determine the possible presence of a dose-response relation in those treatments. The hypothesis was that there was no dose-response relation in face-to-face psychological treatments for gambling disorder. This meta-analysis included 8 studies representing varying treatment doses and 592 clients. Across the 8 studies, the results of a meta-regression indicated that there was a dose-response relation in psychological treatments for gambling disorder. The results suggest that clinicians should retain clients in these treatments as long as possible to maximize therapeutic benefit. Future research would benefit from high-quality randomized controlled trials designed to test treatment efficacy at doses larger than six sessions.

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Introduction

Investigators of studies from the general psychotherapy literature suggest that there is a dose-response relation in face-to-face psychological treatments. However, there is mixed evidence for the presence of a dose-response relation in face-to-face treatments for gambling disorder. Comprehensive reviews have supported the efficacy of cognitive-behavioral therapy (CBT) and motivational interventions for gambling disorder (e.g., Cowlishaw et al., 2012; Petry, Ginley, & Rash, 2017; Yakovenko, Quigley, Hemmelgarn, Hodgins, & Ronksley, 2015). In randomized controlled trials of head-to-head comparisons, several investigators have found that one session of these treatments is as efficacious as multiple sessions (e.g., Larimer et al., 2012; Petry, Weinstock, Morasco, & Ledgerwood, 2009; Toneatto, 2016). By contrast, other investigators have suggested that a greater number of sessions may relate to enhanced therapeutic outcome (e.g., Pfund, Peter, Whelan, & Meyers, 2018; Shaffer, LaBrie, LaPlante, Kidman, & Donato, 2005; Smith, Battersby, Harvey, Pols, & Ladouceur, 2015). Taken together, there is mixed evidence on whether there is a dose-response relation in psychological treatments for gambling disorder. In the present study, meta-analysis was used to synthesize results from past studies and to determine the possible presence of a dose-response relation in psychological treatments for gambling disorder.

In the general psychotherapy literature, there is a dose-response relation in face-to-face psychological treatments (Howard, Kopta, Krause, & Orlinsky, 1986). The dose-response relation is defined as how much treatment is needed to realize a statistically reliable improvement in psychological symptoms. Authors of the studies attesting to the dose-response relation define dose as a session of face-to-face treatment and define response as the measured changed on a standardized outcome measure. Hansen, Lambert, and Forman (2002) indicated

that between 13-18 sessions were required for 50% of clients to demonstrate change in their psychological symptoms. The rate of change within psychotherapy is not linear (Baldwin, Berkeljon, Atkins, Olsen, & Nielsen, 2009; Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2011), as the rate significantly varies based on factors such as outcome variables (Owen, Adelson, Budge, Kopta, & Reese, 2016) and treatment settings (Falkenström, Josefsson, Berggren, & Holmqvist, 2016). Studies on the dose-response relation in the general psychotherapy literature capture many presenting complaints, such as depression and anxiety, but it would be important to understand whether there is a dose-response relation in psychological treatments for gambling disorder. If there is a dose-response relation in psychological treatment for gambling disorder, then clinicians would be aided in determining what constitutes an adequate dose of treatment.

Gambling disorder has been characterized by persistent and recurrent betting that results in financial, psychological, relational, and vocational difficulties (American Psychiatric Association, 2013). Across the globe, between 0.2% and 2.1% of adults develop gambling disorder (Stucki & Rihs-Middel, 2007). An additional 0.5% to 4.0% of adults experience some symptoms of gambling disorder, but do not reach a diagnosable level (Stucki & Rihs-Middel, 2007). Higher rates of these symptoms have been found in specific populations including but not limited to college students (10%; Nowak & Aloe, 2014), and substance use disorder treatment populations (20%; Cowlishaw, Merkouris, Chapman, & Radermacher, 2014).

Although a variety of psychological treatments have been employed for gambling disorder and its subclinical symptoms, CBT and motivational interventions (e.g., motivational interviewing, motivational enhancement therapy) have received the greatest evidence for efficacy (Cowlishaw et al., 2012; Petry et al., 2017; Yakovenko et al., 2015). These treatments

have been conducted predominately face-to-face over varying treatment lengths or doses (e.g., Carlbring, Jonsson, Josephson, & Forsberg, 2010; Petry et al., 2016) and have been conducted with individuals, groups, couples, and families. Authors of meta-analyses have found substantially larger posttreatment effect sizes when comparing multi-session treatments to no treatment controls (d = 2.01; Pallesen, Mitsem, Kvale, Johnsen, & Molde, 2005) than for single-session treatments to no treatment controls (d = 0.20; Peter et al., 2019).

Some evidence supports the presence of a dose-response relation in psychological treatments for gambling disorder (Pfund et al., 2018; Shaffer et al., 2005; Smith et al., 2015). For example, in a randomized controlled trial, Smith and colleagues (2015) compared outcomes between treatment dropouts and treatment completers across 12-sessions of cognitive therapy and exposure therapy and found that treatment completers evidenced significantly greater symptom improvement than treatment dropouts. Those results would indicate that there is a positive dose-response relation in psychological treatment for gambling disorder. That is, attending a greater number of sessions enhances therapeutic outcomes.

Other evidence does not support the presence of a dose-response relation in psychological treatments for gambling disorder. Several investigators have suggested that therapeutic outcomes are equivalent between single-session treatments and multi-session treatments (e.g., Larimer et al., 2012; Petry et al., 2009; Toneatto, 2016). For example, Petry and colleagues (2009) found equivalent posttreatment outcomes among participants who were randomly assigned to one session of brief advice, one session of motivational enhancement therapy, or one session of motivational enhancement therapy plus three sessions of CBT (four sessions total). However, it is important to note that investigators of these studies based their conclusions on a prescribed/offered dose rather than the actual dose that participants received or attended. All

participants (100%) who were assigned to brief advice or motivational enhancement therapy in the study by Petry and colleagues (2009) actually received the full one session dose, but only 33% of participants who were assigned to motivational enhancement therapy plus CBT received the full four session dose. In other words, the investigators of these past studies did not examine the relation between the number of sessions that participants actually received/attended and therapeutic outcome.

Given the mixed evidence on the presence of a dose-response relation in the psychological treatment for gambling disorder, a meta-analysis was conducted to provide a quantiative synthesis of the results from past randomized controlled trials. Specifically, a meta-analysis was performed on the received treatment dose (i.e., the average number of treatment sessions that participants actually attended) and efficacy from these trials. Meta-regression was used to identify the possible relation between the received treatment dose and treatment efficacy. The hypothesis was that there was no dose-response relation in psychological treatment for gambling disorder. Methodological limitations of the randomized controlled trials included in this meta-analytic review may impact the overall conclusions about the dose-response relation. Thus, an assessment of study quality was conducted using the Cochrane risk of bias tool (Higgins & Green, 2011) to evaluate the validity of conclusions.

Method

This review included studies published through June 2018 and used PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). Searches were performed in PsychINFO and PUBMED with the following combination of search terms: (“therapy” OR “treatment” OR “intervention”) AND (“gambl*”). Secondary reference searching was conducted on all studies yielded from the initial search. That secondary reference searching included a Cochrane review

of psychological treatments for gambling disorder (Cowlishaw et al., 2012) and the most recent systematic review of psychological treatments for gambling disorder (Petry et al., 2017).

Inclusion and Exclusion Criteria

Studies were included in this review if they (1) were published in the English language, (2) involved a face-to-face psychological intervention with a therapist (3) used no treatment/waitlist, referral to Gamblers Anonymous (GA), or nonspecific treatment components as control groups; (4) consisted of participants who met diagnosis for gambling disorder or its subclinical symptoms according to an empirically validated assessment strategy; and (5) used random assignment to two or more conditions. Studies were excluded if they (1) involved pharmacotherapy as a study treatment condition; (2) involved telephone, Internet/computer, and self-help/workbooks because these modes of treatment delivery were designed specifically for individuals who have difficulty accessing accessing face-to-face treatments (Ginley, Rash, & Petry, 2019); (3) did not assess gambling frequency, gambling intensity, gambling duration, or gambling disorder symptom severity as outcomes variables; (4) did not report sufficient information to calculate an effect size for treatment dose; (5) did not report sufficient information to calculate an effect size for treatment efficacy; and (6) were review articles or descriptions of planned study protocols. See Appendix A for a table of the studies that were reviewed at the full-text level and the reasons for their exclusion. Appendix B includes a comprehensive list of references for those studies.

Literature Search Procedure

The search of the literature and identification of relevant studies was conducted in two stages. In stage 1, one reviewer independently determined if articles met inclusion/exclusion criteria at the abstract level. In stage 2, two reviewers independently determined if articles met

inclusion/exclusion criteria at the full-text level. Decisions for inclusion/exclusion were informed using a codebook. All discrepancies were resolved through consensus, and when needed, discussion with a third reviewer. Figure 1 displays the flowchart of this process.

The initial search yielded a total of 1,312 articles with 386 additional articles identified through other sources. After the removal of duplicates, 1,522 articles underwent initial screening at the stage 1 abstract level. Based on the stage 1 screening, 99 articles were identified for possible inclusion and were then reviewed at the stage 2 full-text level. A total of 8 independent articles were included in the systematic review and meta-analysis. Inter-rater agreement between the two independent reviewers in the stage 2 full-text review was 97.0%.

Data Extraction and Quality Assessment

Descriptive information, sample characteristics, and treatment features were extracted from each included study. Descriptive information that was extracted included study title, reference, year of publication, and number of participants per condition. We extracted the following sample characteristics: study location, description of study sample, mean age in years, gender (% male), and race/ethnicity (% Caucasian). The treatment features we extracted were treatment modality, treatment format (i.e., individual vs. group), control condition type, treatment duration in weeks, and the offered treatment dose in number of sessions.

Descriptive information, sample characteristics, and treatment features were extracted from each included study. Descriptive information that was extracted included study title, reference, study location, and year of publication. The following sample characteristics were extracted: description of how the study sample was recruited, the number of participants per experimental condition, the participants' mean age in years, gender (% male), and race/ethnicity (% Caucasian). The treatment features extracted were treatment modality (e.g., CBT or

motivational intervention), treatment format (i.e., individual vs. group), control condition type, offered treatment dose in number of sessions, the received treatment dose, and when the posttreatment assessment occurred.

Given a lack of standardized outcome measure for assessing the efficacy of psychological treatments for gambling disorder, a variety of outcome indicators at posttreatment were extracted. The following outcome indicators were considered: gambling frequency (e.g., number of times gambled during past 30 days), gambling intensity (e.g., money wagered/spent on gambling during the past 30 days), and gambling duration (e.g., minutes/hours gambled during the past 30 days), and gambling disorder severity. The indicators of gambling disorder severity were the gambling subscale of the Addiction Severity Index (ASI-G; Lesieur & Blume, 1992), the Gambling Symptom Assessment Scale (G-SAS; Kim, Grant, Potenza, Blanco, & Hollander, 2009), the pathological gambling adaptation of the Yale-Brown Obsessive-Compulsive Scale (PG-YBOCS; Pallanti, DeCaria, Grant, Urpe, & Hollander, 2005), National Opinion Research Center DSM-IV screen for gambling problems (NODS; Gerstein et al. 1999), the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), and some measure of DSM symptoms. The interrater agreement for data extraction of outcome was 90.3%.

The Cochrane risk of bias tool was used to assess for possible bias in the randomized controlled trials that were included in this review (Higgins & Green, 2011). Four criteria were used to assess study quality, including the assessment of random sequence generation, allocation concealment, masking of outcome assessors, and analysis of intention to treat data/incomplete outcome data. Selective outcome reporting was not rated because selective outcome reporting is often conflated with nonreporting (Page & Higgins, 2016) and because most psychotherapy trials are still not prospectively registered (Bradley, Rucklidge, & Mudler, 2017). Each risk of bias

criteria was denoted with a high risk of bias, a low risk of bias, or an unclear risk of bias. For the criterion about the masking of outcome assessors, studies that used entirely self-report measurement were denoted. The assessment of validity for each study was conducted by two independent reviewers and disagreements were resolved through discussion. The interrater agreement between the two independent reviewers was 93.1%.

Data Analysis Plan

When information needed to conduct a meta-analysis was not reported in the original publication, authors were contacted with requests for their data. A total of 14 studies could not be included because they did not report sufficient statistical information to calculate an effect size for dose or efficacy and because the authors of those studies could not fulfill data requests.

Comprehensive Meta-Analysis version 3.3070 was used to perform effect size calculations. To meta-analyze received treatment dose, the weighted mean number of sessions that participants attended for each face-to-face psychological treatment was calculated. To meta-analyze efficacy, between-group effect sizes were computed for each included study. Hedges' *g* was used because some studies had relatively small sample sizes. Using weights, effect sizes were corrected for sampling bias (Hedges & Olkin, 1985). If there were multiple indicators of outcome, the effect size for each indicator was extracted, summarized into one effect size, and divided by the number of indicators (Borenstein, Hedges, Higgins, & Rothstein, 2009).

A random effects analysis was employed because considerable heterogeneity among the studies was expected. There were a wide range of studies encompassing various treatment modalities and comprising different samples included in this review. Heterogeneity was tested with the *Q*-statistic to determine whether individual study effect sizes varied significantly around the mean overall summary effect size of all studies (Hedges & Olkin, 1985). The magnitude of

the variability or proportion of variance accounted for by true differences between studies was then estimated with the I^2 index and interpreted with the conventions of small (≤ 25%), medium (≤ 50%), and large (≤ 75%; Higgins, Thompson, Deeks, & Altman, 2003). Significant heterogeneity suggests that a random effects analysis is most appropriate and that between effect size differences may be explained by moderators.

To determine the presence of a dose-response relation, random effects model meta regression was performed. The mean number of treatment sessions attended (i.e., received treatment dose) for each treatment was regressed onto the Hedges' *g* values for each treatment-control group comparison. Each study's dropout rate was included in the meta-regression as a control variable.

Separate meta-regressions were conducted for to test for other potential associations with treatment efficacy. The publication date and participant demographics (i.e., age, percentage male, and percentage Caucasian) for each study were regressed onto the Hedges' *g* values for each treatment-control group comparison.

Using several categorical variables, moderator analyses were performed to determine differences in treatment efficacy. The categorical variables were study location, the type of study sample used, and study quality (i.e., low or high quality studies). A random effects model and the *Q*-statistic were used to test for potential moderators. A significant *Q*-value indicated a difference between groups of the categorical variables for treatment efficacy. Because a total of eight possible variables were tested in separate meta-regressions and subgroup analyses, a Bonferroni-corrected alpha of .006 was used to indicate statistical significance.

Results

Study and Sample Characteristics

Table 1 displays the 8 studies that were included in this review. Across the 8 studies, a total of 592 participants were allocated to groups comprising 14 treatment-control post-treatment comparisons. The sample sizes of the 8 studies ranged from 29 to 180 (M = 77.6, SD = 51.6, median = 68.5). Most studies were conducted in Canada (k = 4, 50%), with the remaining studies conducted in the United States (k = 3, 38%), and Australia (k = 1, 12%). The publication dates of the 11 studies ranged from 1997 to 2016. The mean age of study participants ranged from 20.3 to 47.9 years (M = 39.5, SD = 8.7, median = 42.4). The percentage of males in the studies ranged from 0% to 96% (M = 59.8, SD = 30.7, median = 59.5). The mean percentage of participants who identified their race/ethnicity as Caucasian was 81.8% (SD = 16.3, median = 87.0), but it should be noted that three studies did not report participants' identified race/ethnicity.

Of the 14 treatment conditions across the 8 studies, the most frequently employed treatment modality was CBT (37%), followed by some kind of motivational intervention (21%), a combination of a motivational intervention and CBT (14%), brief advice (14%), cognitive therapy, and twelve-step facilitation (7%). Seventy-one percent of the treatments were conducted in individual format and 29% in group format. The 8 control conditions for the 14 treatment conditions were either waitlists (62%) or an assessment only (38%). The posttreatment assessments occurred between 0 to 12 weeks after the final treatment session.

Offered and Received Treatment Dose

Of the 14 treatments, the mean offered treatment dose was 9.4 sessions (SD = 9.0, median = 8.0, range = 1 to 30). The weighted mean received treatment dose was 6.7 sessions (SD = 0.9), 95% CI [4.8, 8.6].

Efficacy

The overall Hedges' *g* value of the 14 treatment-control comparisons at posttreatment was 0.64, 95% CI [0.39, 0.90], $p < .001$. Figure 2 displays a Forrest plot of the effect sizes for face-to-face treatments versus control at posttreatment with all outcomes combined. The treatments included in this meta-analysis were found to be highly heterogeneous in their effect sizes, $Q(13) = 35.96$, $p = .001$, $I^2 = 63.85$, with Hedges *g* values ranging from .14 to 1.82. The high degree of heterogeneity indicates that the overall Hedges' *g* value may not be the most appropriate estimate for all treatments and that the effect sizes may differ depending on moderators and covariates.

Meta Regressions

A meta-regression of Hedges' *g* values was performed on the number of treatment sessions attended to test the dose-response relation (Table 3). The meta regression was statistically significant even when controlling for study dropout rates, $p < .001$. Figure 3 displays a simple scatter plot of the regression of Hedges's *g* values on the number of treatment sessions attended. The regression line was relatively linear, indicating that as treatment dose increased, treatment efficacy also increased.

Separate meta-regressions of treatment efficacy were also performed on the study's publication date, average age, the percentage of the sample that identified as male, and percentage of the sample that identified as Caucasian. None of these meta-regressions were statistically significant (Table 3).

Moderators of Treatment Efficacy

Comparisons were made to test differences in treatment efficacy when studies were grouped by the sample used, study location, and study quality (Table 4). The only variable that

significantly moderated treatment efficacy was study quality, where higher study quality was indicative of lower treatment efficacy.

Assessment of Study Quality

Using the Cochrane Risk of Bias tool, it was determined that the quality of studies included in this meta-analysis varied (Table 5). Three studies reported an adequate randomization sequence generation while five did not. Two of the 8 studies reported an adequate method of allocation concealment to study conditions. The allocation concealment of the remaining six studies was unclear. Three studies adequately masked assessors who performed evaluations of treatment outcome, while four had unclear procedures for masking assessors and one used entirely self-report measurements. Five of the 8 studies reported complete outcome data/employed intent-to-treat analyses, while three studies did not. Three studies met all four or three study quality criteria and five met one or no study quality criteria.

Discussion

The aim of the present meta-analysis was to examine the relation between the received treatment dose and efficacy in face-to-face psychological treatments for gambling disorder. A total of 8 studies comprising 14 dose-efficacy comparisons across 592 participants were identified. The results were inconsistent with the hypothesis that there was no dose-response relation. Rather, the results of a meta-regression supported the presence of a dose-response relation in face-to-face psychological treatments for gambling disorder. An examination of the simple scatterplot revealed a positive, linear relation, in which treatment efficacy increased as the number of treatment sessions attended increased. These results are consistent with the literature on psychotherapy in general (Howard et al., 1986) and a limited number of studies on the treatment of gambling disorder (Pfund et al., 2018; Shaffer et al., 2005; Smith et al., 2015). Thus,

it is recommended that clinicians retain individuals in face-to-face psychological treatment for gambling disorder as long as possible to maximize the possibility of a positive outcome.

The results of the present meta-analysis indicated that the weighted mean treatment dose across face-to-face psychological treatments was 6.7 sessions. That treatment dose corresponded to a treatment efficacy of .64 at 0-12 weeks posttreatment, which translates to a medium-sized effect. That medium-sized effect is consistent with other meta-analyses of treatment-control comparisons for psychological treatments of gambling disorder (Cowlishaw et al., 2012).

Unlike the general psychotherapy literature, there is presently no adequate treatment dose for psychological treatment for gambling disorder. Petry and colleagues (2017) recently recommended 6-8 sessions of CBT that integrates motivational interventions, but their recommendation was informed by the overall quality of evidence rather than quantitative indicators. The quantitative results supplied in this meta-analysis would suggest that individuals would benefit from a greater dose than the 6-8 session dose recommended by Petry and colleagues (2017). Future outcome studies should focus on what constitutes an adequate dose of psychological treatment for gambling disorder while considering studies from the general psychotherapy literature as examples. In the general psychotherapy literature, multiple variables moderate the dose-response relation, such as outcome variables (Owen et al., 2016) and treatment settings (Falkenström et al., 2016). Those future studies might bring data to bear on the linearity of the dose-response relation in psychological treatment for gambling disorder.

The assessment of study quality indicated that there were few high-quality randomized controlled trials on the psychological treatment for gambling disorder, so the present meta-analytic findings on the dose-response relation should be interpreted with caution. At the time this article was written, no institute at the National Institute of Health (e.g., National Institute of

Alcohol Abuse and Alcoholism, National Institute on Drug Abuse) incorporates gambling disorder within its research mandate. Thus, research on the treatment of gambling disorder is rarely funded at the federal level. In the United States, the National Center for Responsible Gaming (NCRG) serves as the primary funding organization of gambling research. The lack of federal funding for research on the psychological treatment of gambling disorder has resulted in calls to action from researchers requesting funding from the National Institute of Health, as well as the placement of gambling disorder within their institutes' research mandates (Weinstock, 2018). Without well-funded research, it is likely that advancements in the treatment of gambling disorder will be limited.

There are multiple limitations of the present meta-analysis that should be considered when interpreting the results. One limitation is that the correlational results prohibit causal conclusions about the relation between dose and efficacy in face-to-face psychological treatment for gambling disorder. Randomized controlled trials, in which participants are randomly assigned to varying doses of treatment would provide stronger evidence than the present meta-analysis that increasing treatment doses cause better treatment responses. However, most of these studies offered participants treatment doses between 1-6 sessions, which is smaller than the average dose found in the present meta-analysis (Larimer et al., 2012; Petry et al., 2009; Toneatto, 2016). Future research would benefit from high-quality randomized controlled trials designed to test the efficacy of psychological treatment for gambling disorder at doses larger than six sessions.

Another limitation of this study is that the relation between dose and long-term response could not be determined. Currently, few studies on the psychological treatment for gambling disorder provide outcomes beyond the short-term posttreatment time frame (Petry et al., 2017). Investigators have found some evidence for the reduction of gambling-related symptoms at 9-24

months posttreatment (Diskin & Hodgins, 2009; Petry et al., 2006; Petry et al., 2008; Petry et al., 2016), but more work must be done to test the relation between dose and long-term response of psychological treatment for gambling disorder.

Despite the limitations of this meta-analysis, the results of this review can be used to offer several recommendations for researchers and practicing clinicians. For researchers, it would be advantageous to include the mean and standard deviation for the number of treatment sessions attended in all treatment arms. Authors typically report dropout rates for treatment studies, but those rates significantly vary depending on the measurement strategy (Pfund et al., 2018; Swift, Callahan, & Levine, 2009; Swift & Greenberg, 2012;). Thus, the number of treatment sessions attended may prove more informative than dropout rates.

For clinicians, CBT with or without MI is recommended for individuals with gambling disorder. Clinicians should retain individuals in these treatments as long as possible, given that the results of the meta-regression of dose on outcome suggested positive outcomes do not ceiling out. To retain individuals in treatment, clinicians should consult the multiple empirically supported strategies for preventing dropout from psychotherapy in general (Swift, Greenberg, Whipple, & Kominiak, 2012). These strategies include, but are not limited to, fostering the therapeutic alliance (Spencer, Goode, Penix, Trusty, & Swift, 2019), educating clients about adequate treatment duration (Swift & Callahan, 2011), tailoring treatment to clients' preferences (Swift, Callahan, Cooper, & Parkin, 2018), and discussing expectations regarding roles and behaviors in therapy (Reis & Brown, 2006). These strategies should be employed from the first session, when clients in psychological treatment for gambling disorder are at the highest risk to discontinue treatment (Pfund et al., 2018).

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Table 1.

Description of Studies Included in the Meta-Analysis of Dose and Efficacy in Psychological Treatments for Gambling Disorder

Study	Study location	Study sample	Mean age (years)	% male	% White	Relevant study conditions	*N* per group	Offered treatment dose (# of sessions)	When posttreatment assessment occurred[a]
						MI	42	1	3-12
Diskin & Hodgins (2009)	CAN	Community	45.0	57	nr	Assessment only	39	-	-
						Individual CBT	14	12	0
						Group CBT	17	12	0
Dowling et al. (2007)	AUS	Community	43.4	0	nr	Waitlist	25	-	-
		Internet				Group CBT	16	12	0
Harris & Mazmanian (2016)	USA	gamblers	34.2	53	72	Waitlist	16	-	-
						Cognitive therapy	35	≤ 20	0
Ladouceur et al. (2001)	CAN	Community	42.1	83	nr	Waitlist	29	-	-
						Group CBT	15	16	0
						TSF	11	16	0
Marceaux & Melville (2011)	USA	Community	47.9	40	87	Waitlist	7	-	-
						MET + CBT	40	4	2
						MET	55	1	5
						Brief advice	37	1	5
Petry et al. (2008)	USA	Community	42.7	62	59	Assessment	48	-	-
						MET + CBT	21	4	2
						MET	30	1	5
		College				Brief advice	32	1	5
Petry et al. (2009)	USA	students	20.3	87	91	Assessment	34	-	-
						CBT	14	≤ 30	0
Sylvain et al. (1997)	CAN	Community	40.1	96	100	Waitlist	15	-	-

Notes. AUS = Australia; CAN = Canada; CBT = cognitive-behavioral therapy; GA = Gamblers' Anonymous; MET = motivational enhancement therapy; MI = motivational interviewing; nr = not reported; TSF = twelve-step facilitation; UK = United Kingdom; USA = United States of America; [a]Values represent the number of weeks since the last session of treatment.

Table 2.

Treatment Dose and Treatment Efficacy of Face-to-Face Psychological Treatments for Gambling Disorder

Study	Treatment type (*n*)	*M* (*SD*) of treatment sessions attended (received dose)	% of offered dose received	Posttreatment effect size (*g*)	Outcomes in effect size calculation
Diskin & Hodgins (2009)	MI (42)	1.0 (0)	100	.26	Gx frequency Gx intensity
	CBT (14)	12.0 (0)	100	.68	Gx frequency Gx intensity
Dowling et al. (2007)	Group CBT (17)	10.1 (1.6)	84	.61	Gx duration DSM-IV-TR
Harris & Mazmanian (2016)	Group CBT (16)	6.8 (3.2)	85	1.21	Gx frequency DSM-IV
Ladouceur et al. (2001)	Cognitive therapy (35)	11.0 (5.2)	55	1.17	Gx frequency Gx intensity Gx duration DSM-IV
Marceaux & Melville (2011)	Group CBT (18)	14.9 (1.8)	93	1.73	Gx frequency
	TSF (11)	14.7 (1.7)	92	1.62	Gx intensity
	MET + CBT (40)	2.1 (1.5)	52	.25	
	MET (55)	.94 (.23)	94	.20	ASI-G
Petry et al. (2008)	Brief advice (37)	1.0 (0)	100	.39	Gx intensity
	MET + CBT (21)	2.3 (1.4)	58	.14	ASI-G
	MET (30)	1.0 (0)	100	.41	Gx intensity
Petry et al. (2009)	Brief advice (32)	1.0 (0)	100	.36	Gx frequency DSM-III SOGS
Sylvain et al. (1997)	CBT (14)	16.7 (5.7)	56	1.82	Gx frequency Gx intensity Gx duration

Notes. ASI-G = Gambling Scale of the Addiction Severity Index; CBT = cognitive-behavioral therapy; DSM = Diagnostic and Statistical Manual of Mental Disorders; GA = Gamblers' Anonymous; Gx = gambling; MET = motivational enhancement therapy; MI = motivational interviewing; SOGS = South Oaks Gambling Screen; TSF = twelve-step facilitation

Table 3.

Results from Meta-Regressions of Dose, Publication Date, Age, Gender, and Race on Treatment Efficacy

Variable (# of treatments)	Point estimate	95% CI	*Z*-value	*p*-value
Dose (14)				
Slope	.08	.05, .12	5.34	< .001
Dropout	-.00	-.01, .00	-.39	.70
Intercept	.20	-.01, .41	1.85	.06
Publication date (14)				
Slope	-.02	-.11, .06	-.53	.60
Intercept	46.80	-123.44, 217.03	.54	.59
Age (14)				
Slope	.02	-.01, .06	1.46	.14
Intercept	-.15	-1.31, 1.01	-.25	.80
Gender: % Male (14)				
Slope (Male vs. female)	-.01	-.03, .01	-1.04	.30
Intercept	1.40	-.01, 2.81	1.95	.05
Race: % White (10)				
Slope (White vs. non-White)	.01	-.00, .04	1.53	.13
Intercept	-.61	-2.27, 1.05	-.72	.47

Table 4.

Results from Subgroup Analyses of Study Location, Study Sample, and Study Quality Moderators on Treatment Efficacy

Moderator (# of treatments)	Hedges' *g*	95% CI	*Q*-value	*p*-value
Study location (14)			3.11	.21
Australia (2)	.64	.16, 1.12		
Canada (4)	1.06	.38, 1.74		
United States (8)	.43	.17, .69		
Study sample (14)			6.74	.03
College students (3)	.31	.02, .60		
Community (10)	.74	.40, 1.07		
Internet gamblers (1)	1.21	.46, 1.96		
Study quality[a] (14)			20.12	< .001
Low (7)	1.14	.82, 1.52		
High (7)	.29	.12, .45		

[a]Studies were considered "low" quality if they had two or fewer indicators of low risk of bias (+), whereas studies were considered high quality if they had three or more indicators of low risk of bias.

Table 5.

Assessment of Study Quality for the 8 Studies Included in the Meta-Analysis

Study	Randomization Sequence Generation	Allocation Concealment	Masking of Assessors	Complete Outcome Data
Diskin & Hodgins (2009)	+	?	+	+
Dowling et al. (2007)	?	?	?	+
Harris & Mazmanian (2016)	-	?	- (sr)	+
Ladouceur et al. (2001)	?	?	?	-
Marceaux & Melville (2011)	?	?	?	-
Petry et al. (2008)	+	+	+	+
Petry et al. (2009)	+	+	+	+
Sylvain et al. (1997)	?	?	?	-

Notes. + = low risk of bias; – = high risk of bias; ? = unclear risk of bias; sr = the study employed self-report measures only

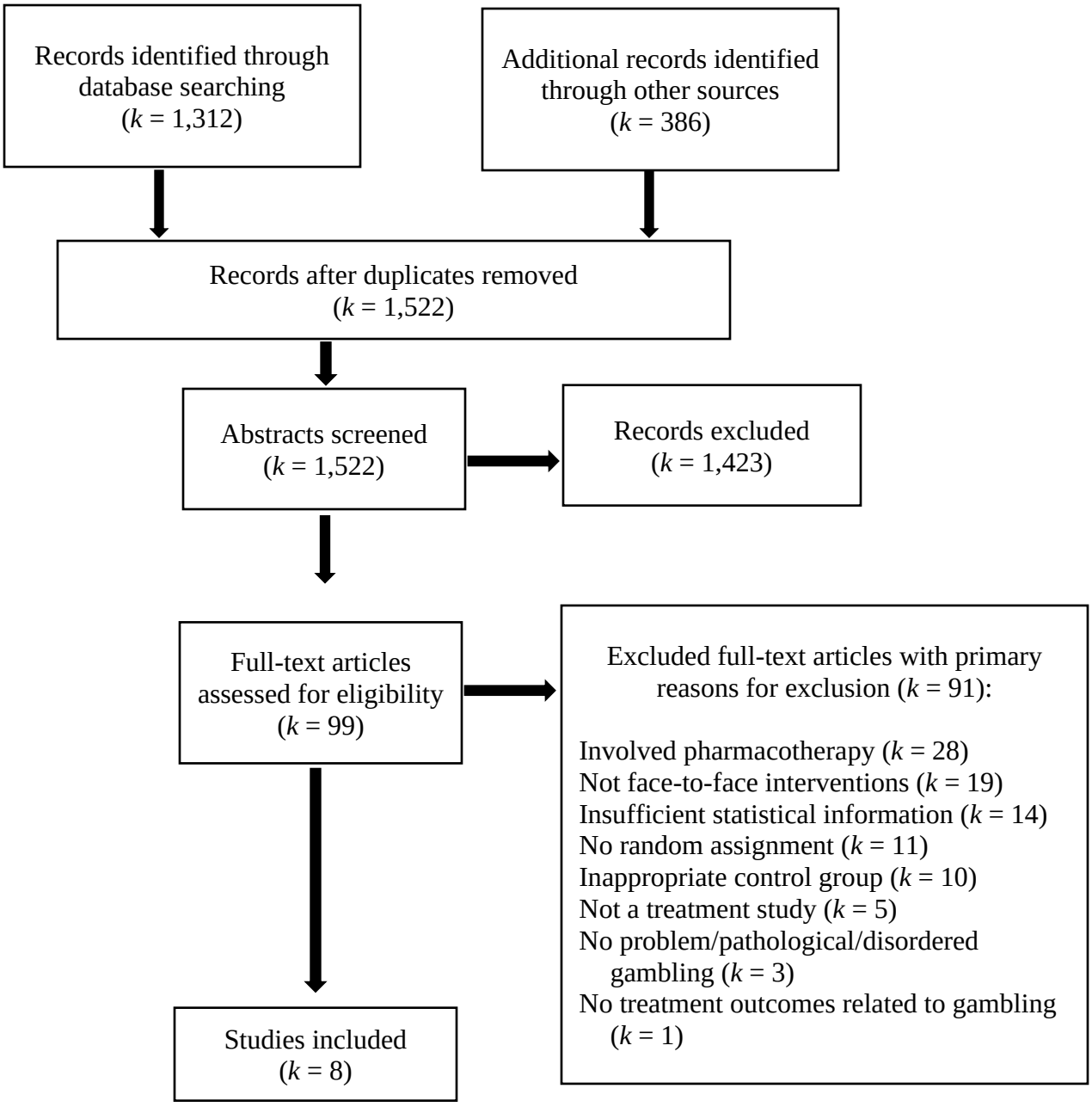

Figure 1.

Study flowchart for identification of studies to be included in this review.

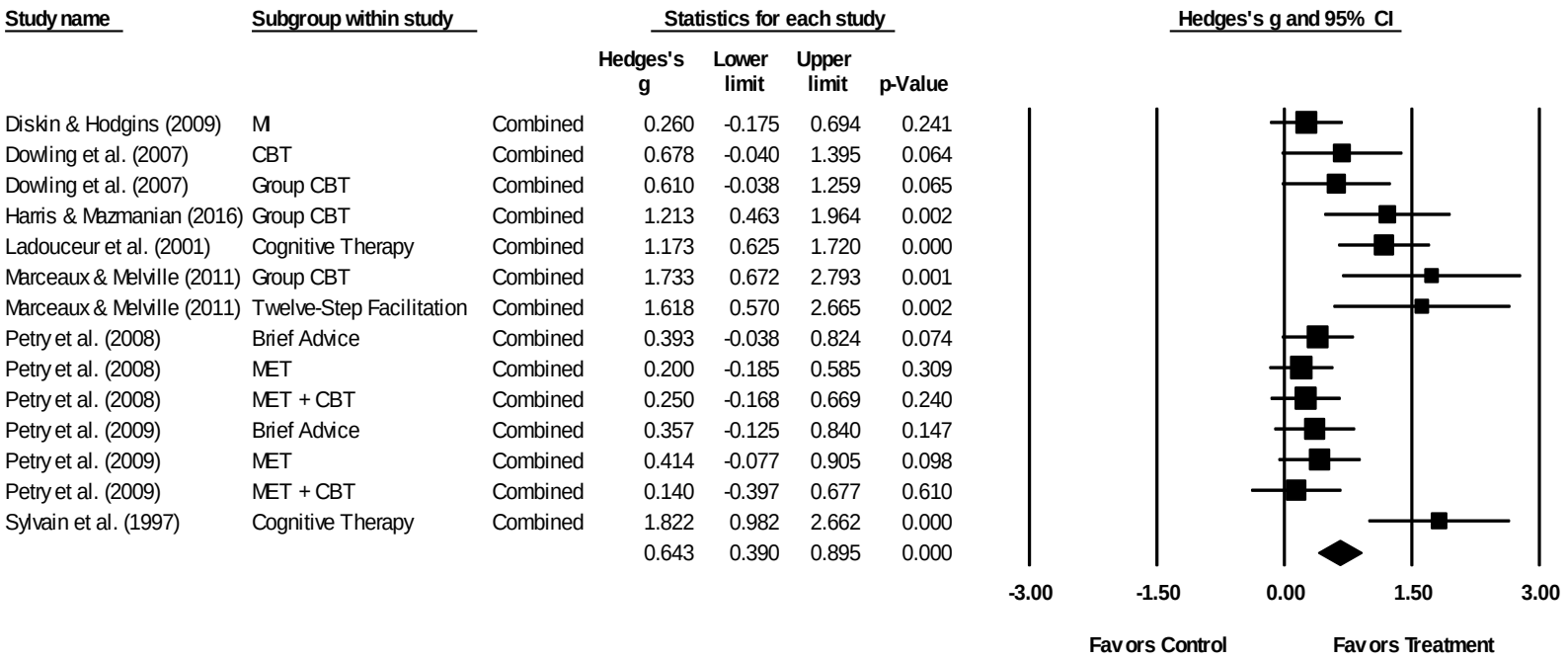

Figure 2.

Forrest plot of effect sizes of face-to-face psychological treatments for gambling disorder versus control at posttreatment with all outcomes combined

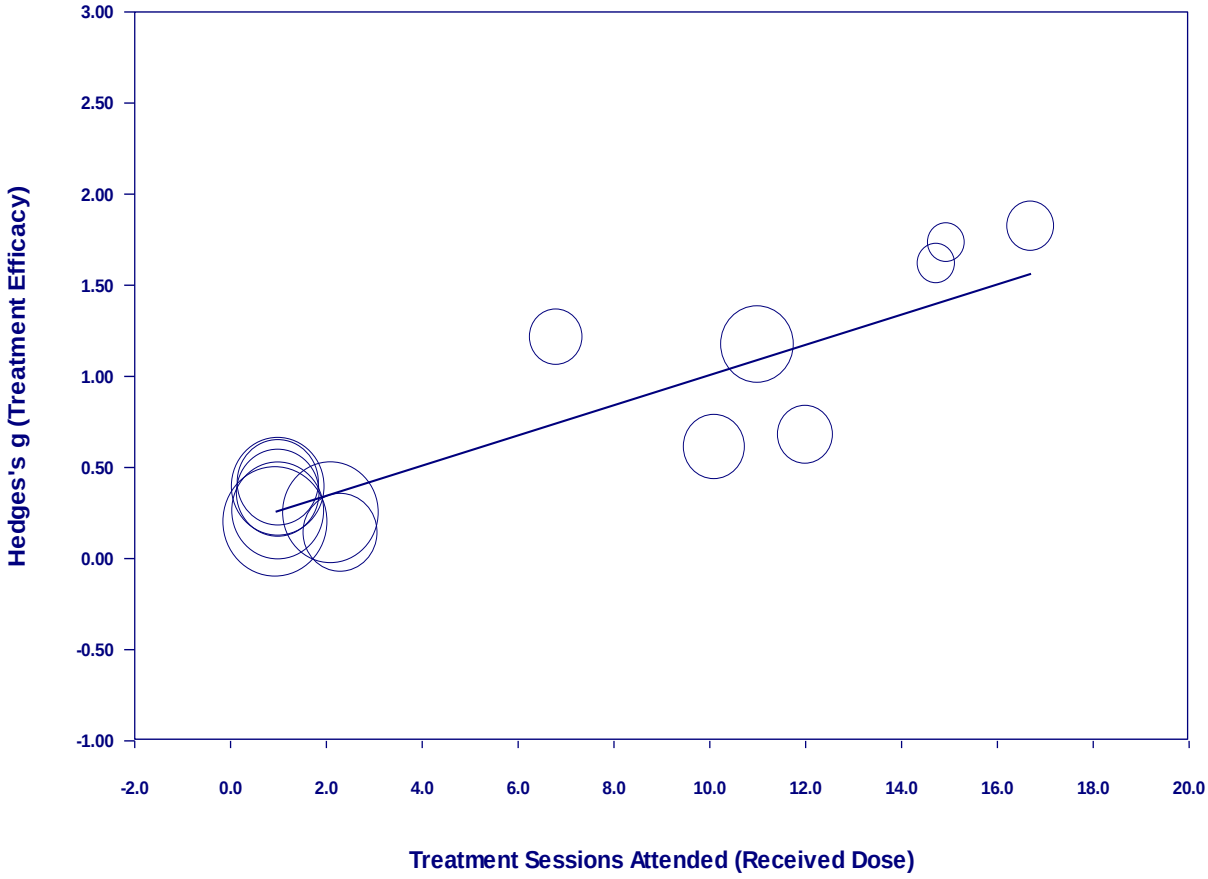

Figure 3.

Simple scatterplot of dose and efficacy in face-to-face psychological treatments for gambling disorder

Appendix A

Table of studies that were excluded from the review with the primary reason for their exclusion

	Primary reason for exclusion							
Study authors (year)	Involved pharmacotherapy (*k* = 28)	Not face-to-face (*k* = 19)	Insufficient statistical information (*k* = 14)	No random assignment (*k* = 11)	Inappropriate control group (*k* = 10)	Not a treatment study (*k* = 5)	No problem, pathological, disordered gamblers (*k* = 3)	No outcomes related to gambling (*k* = 1)
Abbott et al. (2018)		X						
Berlin et al. (2013)	X							
Black et al. (2007)	X							
Blanco et al. (2002)	X							
Blaszczynski et al. (2005)				X				
Blaszczynski et al. (1991)				X				
Bouchard et al. (2017)				X				
Boudreault et al. (2018)		X						
Bucker et al. (2018)		X						
Campos et al. (2016)		X						
Canale et al. (2016)		X						

Carlbring et al. (2010)			X					
Carlbring & Smit (2008)		X						
Casey et al. (2017)		X						
Celio & Lisman (2014)		X						
Champine & Petry (2010)						X		
Cunningham et al. (2012)		X						
Cunningham et al. (2009)		X						
Dannon et al. (2011)	X							
Dannon et al. (2005a)	X							
Dannon et al. (2005b)	X							
de Brito et al. (2017)	X							
Dickerson et al. (1990)							X	
Doiron & Nicki (2007)			X					
Echeburua et al. (1996)			X					
Echeburua et al. (2000)			X					
Echeburua et al. (2011)			X					

Grant et al. (2011)			X					
Grant et al. (2009)				X				
Grant et al. (2008)	X							
Grant et al. (2007)	X							
Grant et al. (2003)	X							
Grant et al. (2014)	X							
Grant et al. (2010)	X							
Grant et al. (2006a)	X							
Grant et al. (2006b)	X							
Grant et al. (2017)	X							
Hodgins et al. (2001)		X						
Hodgins et al. (2004)		X						
Hodgins et al. (2007)		X						
Hodgins et al. (2009)		X						
Hollander et al. (1998)	X							
Hollander et al. (2000)	X							

Hollander et al. (2005)	X							
Jimenez-Murcia et al. (2007)				X				
Jimenez-Murcia et al. (2012a)				X				
Jimenez-Murcia et al. (2012b)	X							
Jiménez-Murcia et al. (2017)					X			
Josephson et al. (2016)						X		
Kim et al. (2001)	X							
Kim et al. (2002)	X							
Korman et al. (2008)					X			
Kovanen et al. (2016)	X							
LaBrie et al. (2012)		X						
Ladoceur et al. (2003)			X					
Larimer et al. (2012)			X					
Linardatou et al. (2014)								X

Lee & Awosago (2015)			X					
Luquiens et al. (2016)		X						
Martens et al. (2015)		X						
McConaghy et al. (1988)					X			
McConaghy et al. (1983)					X			
McConaghy et al. (1991)					X			
McElroy et al. (2008)	X							
Melville et al. (2004)			X					
Milton et al. (2002)					X			
Myrseth et al. (2009)			X					
Myrseth et al. (2011)	X							
Neighbors et al. (2015)	X							
Oakes et al. (2012)				X				
Oei et al. (2010)			X					
Oei et al. (2018)		X						
Pallanti et al. (2002)	X							

Petry et al. (2010)							X	
Petry et al. (2006a)			X					
Petry et al. (2006b)							X	
Petry et al. (2007)						X		
Petry et al. (2016)			X					
Saiz-Ruiz et al. (2005)	X							
Shaffer et al. (2005)				X				
Smith et al. (2015)					X			
Smith et al. (2018)						X		
Stea et al. (2015)				X				
Stewart et al. (2016)				X				
Thomas et al. (2010)	X							
Tolchard et al. (2006)				X				
Toneatto (2016)					X			
Toneatto et al. (2009)	X							
Tse et al. (2013)					X			

Wong et al. (2015)					X			

Appendix B

References for Excluded Studies (in alphabetical order)

Abbott, M., Hodgins, D. C., Bellringer, M., Vandal, A. C., Palmer Du Preez, K., Landon, J., Sullivan, S., Rodda, S., & Feigin, V. (2018). Brief telephone interventions for problem gambling: a randomized controlled trial. *Addiction, 113*, 883-895.

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