REVIEW ARTICLE

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Efficacy of face-to-face versus self-guided treatments for disordered gambling: A meta-analysis

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Background and aims: In the light of growing traditional and novel forms of gambling, the treatment of disordered gambling is gaining increasing importance and practical relevance. Most studies have examined face-to-face treatments. Although trials implementing self-guided treatments have recently been conducted, these options have not yet been systematically examined. The primary objective of this meta-analysis, therefore, was to analyze the efficacy of all types of psychological face-to-face and self-guided treatments. *Methods:* A multilevel literature search yielded 27 randomized controlled studies totaling 3,879 participants to provide a comprehensive comparative evaluation of the short- and long-term efficacies of face-to-face and self-guided treatments for disordered gambling. *Results:* As expected, the results revealed significantly higher effect sizes for face-to-face treatments (16 studies with Hedges's g ranging from 0.67 to 1.15) as compared with self-guided treatments (11 studies with Hedges's g ranging from 0.12 to 0.30) regarding the reduction of problematic gambling behavior. The intensity of treatment moderated the therapy effect, particularly for self-guided treatments. *Discussion and Conclusions:* The results of this meta-analysis favor face-to-face treatments over self-guided treatments for the reduction of disordered gambling. Although the findings broaden the scope of knowledge about psychological treatment modalities for disordered gambling, further research is needed to identify the reasons for these differences with the goal to optimize the treatment for this disabling condition.

Keywords: disordered gambling, face-to-face treatments, self-guided treatments, meta-analysis

BACKGROUND AND AIMS

With the publication of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013), pathological gambling, which is defined as "*a maladaptive pattern of wagering that persists despite negative consequences in major areas of functioning such as finances, relationships, and psychological health*" (Rash & Petry, 2014, p. 285), was categorized as "gambling disorder" under the new section "Substance-Related and Addictive Disorders." Consistent with this terminology, we will use the term "gambling disorder" for this condition.

To reduce the high illness burden, various psychological treatment approaches – traditionally delivered through direct face-to-face contacts between patients and therapists – have been investigated over the years. Psychological approaches range from more intensive treatment options that include the most commonly used cognitive-behavioral therapy (CBT) (for an overview, see Raylu, Loo, & Oei, 2013; Stea & Hodgins, 2011), the 12-step concept of Gamblers Anonymous (GA) groups, based on the principles of Alcoholics Anonymous (e.g., Petry, 2005), couples therapy (e.g., Lee & Awosoga, 2014), integrative interventions including a variety of treatment elements and settings (e.g., Blackman, Simone, & Thoms, 1989; Lesieur & Blume, 1991) to brief motivational strategies (e.g., Petry, Weinstock, Ledgerwood, & Morasco, 2008; Petry, Weinstock, Morasco, & Ledgerwood, 2009).

Because many gamblers do not seek professional help (Slutske, 2006; Suurvali, Hodgins, & Cunningham, 2010), self-guided treatments (SGTs) have been developed to expand accessibility and reduce barriers to treatment, such as stigmatization and cost (Rash & Petry, 2014; Raylu, Oei, & Loo, 2008; Stea & Hodgins, 2011). These treatment options offer patients the opportunity to utilize psychological interventions in an autonomous manner and are commonly delivered through written materials or self-help (SH) workbooks (WBs), by telephone, the Internet, or other media sources (e.g., Raylu et al., 2008). Since the 1990s, a number of trials have been published (for an overview, see Gainsbury & Blaszczynski, 2011; Raylu et al., 2008) using

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either a single session of motivational interviewing (MI) delivered over the telephone in combination with a mailed CBT-based WB (e.g., Hodgins, Currie, Currie, & Fick, 2009; Hodgins, Currie, & el-Guebaly, 2001), CBT-based WBs or a toolkit only (e.g., Hodgins et al., 2001, 2009; LaBrie et al., 2012), or personalized feedback (PFB) techniques (e.g., Cunningham, Hodgins, Toneatto, & Murphy, 2012; Cunningham, Hodgins, Toneatto, Rai, & Cordingley, 2009) yielding mixed results. Only recently, more intensive and structured Internet-based treatment programs have been producing promising findings. One of these programs (Carlbring & Smit, 2008) examined a successful 8-week Internet-based treatment with MI and CBT elements including homework assignments, regular therapist contacts through e-mail and telephone, and participation in an online discussion group. The impact of the therapist contact on treatment efficacy in SGTs is discussed in the literature with varying results (e.g., Apodaca & Miller, 2003; Barak, Hen, Boniel-Nissim, & Shapira, 2008; Haug, Nordgreen, Öst, & Havik, 2012; Riper et al., 2014; Spek et al., 2007). However, this issue has not yet been examined in the domain of disordered gambling.

Although earlier meta-analyses targeting psychological treatments for disordered gambling (Cowlishaw et al., 2012; Gooding & Tarrier, 2009; Leibetseder, Laireiter, Vierhauser, & Hittenberger, 2011; Pallesen, Mitsem, Kvale, Johnsen, & Molde, 2005) vary in the types of the included psychological interventions, study designs, outcome variables, and moderator variables, they provide support for the efficacy of psychological interventions for gambling when delivered through a face-to-face treatment (FTFT) format. Three of these meta-analyses (Gooding & Tarrier, 2009; Leibetseder et al., 2011; Pallesen et al., 2005) included SGTs, but the number of trials was small, and further research has since been conducted. The latest meta-analysis in gambling disorder (Cowlishaw et al., 2012), however, was exclusively limited to psychological interventions delivered through systematic and face-to-face contact. Therapies provided through telephone or the Internet, SH formats, and minimal FTFTs were not included. Moreover, moderator and sensitivity analyses were not conducted due to the small number of studies. Consequently, a comprehensive investigation of psychological FTFTs is still pending, and SGTs of disordered gambling have not yet been systematically investigated.

The primary objective of this meta-analysis, therefore, was to investigate the efficacy of all types of psychological FTFTs and SGTs based on randomized controlled trials (RCTs) for reducing (a) the global severity of disordered gambling, (b) frequency of gambling, and (c) financial loss from gambling at 0–3 months after treatment (short-term effects) and at the latest follow-up (long-term effects). We expected FTFTs to be more effective than SGTs due to the additional benefits discussed in former treatments, such as therapeutic alliance, empathy, and creating confidence (e.g., Feinstein, Heiman, & Yager, 2015; Wampold, 2015). In addition, our goal was to identify variables moderating the effect sizes of FTFTs and SGTs. We followed the recommendations of the PRISMA Statement (Moher, Liberati, Tetzlaff, & Altman, 2009).

METHODS

Eligibility criteria

Studies were considered for inclusion if they (a) employed any kind of psychological treatment (without restrictions around mode of delivery, setting, or duration of treatment); (b) used a randomized or quasi-randomized controlled study design, such as wait-list (WL) controls, participants not receiving treatment, assessment only, or a placebo intervention (e.g., attention control feedback excluding any kind of intervention-specific ingredients); (c) measured at least one of the three outcome variables; (d) reported sufficient statistical data for effect size calculations; and (e) treated adult participants (18 years or older) with the diagnosis of gambling disorder. Studies were excluded if (a) the study was a case study; (b) the study sample completely overlapped with the sample of another study included in the meta-analysis; and (c) no abstract or full text of the study was available.

Information sources and literature search

We conducted a multilevel literature search using databases, such as PsycINFO (1860), Medline (1902), PubMed (1966), Psyndex (1875), the Cochrane Central Register of Clinical Trials (1988), ProQuest Digital Dissertations (1964), and the web search engine Google Scholar (1969). The search covered all relevant publications from the first available year until March 31, 2017. The search term included the disorder-related key words pathological gambling OR gambl* OR ludomania combined with the intervention-related key words treatment OR intervention OR therapy OR psychotherapy, adding the RCT filter recommended by the Cochrane collaboration (Lefebvre, Manheimer, & Glanville, 2011). Subsequently, we conducted a thorough examination of the reference lists of review articles and original studies retrieved from the databases. In addition, the authors of relevant articles were contacted to ask for unpublished papers suitable for inclusion in the meta-analysis.

Outcome measures

Following the recommendations of the Banff, Alberta Consensus (Walker et al., 2006), we specified three outcome variables to measure the reduction of disordered gambling: (a) the global severity of gambling pathology, quantified by the use of valid and reliable instruments, or the number of DSM criteria; (b) frequency of gambling (e.g., number of days or hours gambled in the last week or month), and (c) financial loss due to gambling (e.g., net expenditure last week or last month), both (b) and (c) quantified using a timeline follow-up interview (Sobell & Sobell, 1992), diary cards, or other self-reporting forms.

Study selection

Study selection was performed by two independent reviewers (the first and the second authors, MG and ML, respectively), and supervised by the last author of this paper

(A-RL). Disagreements between the authors were resolved through discussion.

Data collection process and data items

We generated a structured data extraction form that we refined and modified after pilot testing a sample of 10 studies. To calculate controlled effect sizes, data from the treatment group and the respective control group of each study were collected. In addition, we extracted numerical and categorical data from each study to perform moderator analyses. The data extraction was performed by the first author (MG) and validated by the second author (ML). Disagreements were resolved through discussion.

Risk of bias in individual studies

We assessed the internal validity of each study using the Quality Assessment Tool for Quantitative Studies, developed by the Effective Public Health Practice Project (EPHPP) (Thomas, Ciliska, Dobbins, & Micucci, 2004). This tool has demonstrated content and construct validity (Thomas et al., 2004), and is recommended for use in systematic reviews and meta-analyses (Deeks et al., 2003).

Each study was rated in a standardized manner on six domains: selection bias, study design, identification and control of confounders, blinding, reliability and validity of data collection tools, and reporting and percentage of withdrawals and dropouts. Each domain was evaluated as strong, moderate, or weak. The global rating was composed after the evaluation of the six domains. The first two authors (MG and ML) independently assessed each study and determined the global score of each trial. Interrater reliability was quantified using the kappa statistic. Disagreements between the authors were resolved through discussion.

Moreover, to obtain numerical values for the quality score, which is not directly provided by the EPHPP procedure, we assigned each of the six domains differentiated scores. The domains rated as weak were assigned a value of 0, those rated as moderate were assigned a value of 1, and those rated as strong were assigned a value of 2. Thus, each study could receive a maximum score of 12 points when the values of the six domains were summed. This enabled us to calculate meta-regression analyses based on continuous data, the transformed EPHPP scores.

Summary measures and synthesis of results

Statistical analysis was performed using the software program Comprehensive Meta-Analysis (CMA) version 2.2.064 (Borenstein, Hedges, Higgins, & Rothstein, 2005). We calculated the effect sizes for the reduction of global severity of gambling, frequency, and financial loss separately for FTFTs and SGTs. The effect size calculations were based on continuous data indicating the difference between the treatment and control groups at posttreatment and the last follow-up assessment. If means and standard deviations (*SD*s) were not available, the effect sizes were calculated based on equivalent estimation procedures (e.g., t values or exact probability levels). Due to small sample sizes, the effect sizes were corrected for bias using Hedges's g with the corresponding 95% confidence interval (CI) (Hedges & Olkin, 1984). For studies comparing more than one treatment group with a single control group, separate comparisons were entered into the meta-analysis with the number of participants in the control group equally divided between the comparisons. This procedure ensures that participants in the control group are not counted more than once, and offers the possibility to investigate differences between distinct treatments through moderator analyses (Higgins, Deeks, & Altman, 2011). If an outcome variable was measured by more than one instrument, data for these instruments were entered separately and pooled together for the particular outcome variable (Lipsey & Wilson, 2000). For studies reporting data based on both completers and intention-to-treat (ITT) analyses, the ITT data were considered. The direction of the effect was adjusted according to the "success": the effect size was positive if the treated group performed superior to the control group. According to Cohen's recommendations (1977), effect sizes of 0.20–0.30 can be classified as small, those near 0.50 as medium, and those above 0.80 as large.

Assuming heterogeneity among the studies, we decided to use the random effects model for the integration of effect sizes. Heterogeneity of the effect sizes was investigated using the Q statistic with the corresponding p value, and the I^2 statistic, indicating to what extent real differences in effect sizes was reflected by the proportion of the variance (Borenstein, Hedges, Higgins, & Rothstein, 2009; Higgins, Thompson, Deeks, & Altman, 2003). I^2 values of 25%, 50%, and 75% were classified as low, moderate, and high, respectively (Higgins et al., 2003). Detailed information concerning the calculation and the integration of effect sizes can be found in Borenstein et al. (2005, 2009) and Lipsey and Wilson (2000). The studies most frequently reported untransformed data, which we used for the effect size calculations. We therefore followed the recommendation to avoid the mixture of transformed and untransformed data in a single meta-analysis (Deeks, Higgins, & Altman, 2011).

Risk of bias across studies

To control for publication bias, we conducted a thorough literature search and computed Rosenthal's fail-safe N (FS N; Rosenthal, 1979). According to Rosenthal (1991), effect sizes are considered robust, if the number of studies required to obtain a non-significant overall effect is greater than $5k + 10$, where k represents the number of studies. In addition, we used the trim-and-fill method (Duval & Tweedie, 2000) to estimate missing studies and their impact on the ascertained effect sizes. This method is based on the logic of the funnel plot and assumes a symmetrical distribution of the effect sizes for outcome variables in the absence of publication bias. In the case of asymmetrical distribution, the trim-and-fill method adjusts and corrects the effect sizes (Borenstein et al., 2009); we only applied this method, if 10 studies were available for the analysis (Sterne, Egger, & Moher, 2011). Funnel plot asymmetry was assessed using Begg's rank correlation test (Begg & Mazumdar, 1994). As singular extreme effect size values produce misleading interpretations of treatment effects (Lipsey & Wilson, 2000), we used the "one-study-removed"

method offered by CMA to examine the impact of each study's effect size on the overall effect (Borenstein et al., 2005). If the recalculated results did not substantially impact the effect size and remained within the 95% CI, the studies were retained in the analyses.

Moderator analyses

To explain the heterogeneity among the effect sizes, we determined the following categorical moderators for both FTFTs and SGTs: gambling type (electronic vs. other types of gambling), data analysis (ITT vs. completers), and type of psychological intervention. The type of psychological intervention was analyzed by dividing psychological strategies into the following subcategories: (a) CBT, covering cognitive and/or behavioral treatments. Studies predominantly applying CBT strategies (i.e., in at least about 70% of the treatment sessions) were assigned to this category. Since a limited number of studies using an equal number of CBT sessions and sessions including other psychological strategies (e.g., MI) were expected to be found in literature search, we decided to subsume this combination under the CBT category; (b) MI, which emphasizes the motivation to change gambling behavior. Studies predominantly implementing MI strategies (e.g., delivery of a single session of MI alone or in combination with a concomitant, self-administered CBT WB) were included in this category, as well as strategies associated with MI (e.g., PFB); and (c) psychological therapies that pertain to other treatment categories [e.g., congruence couple therapy (CCT) and 12-step facilitated (TSF) group therapy]. Considering the relevant publications (e.g., Gooding & Tarrier, 2009; Toneatto & Millar, 2004), we investigated whether CBT and combined CBT yielded higher treatment effects compared with other psychological treatments. With regard to FTFTs, we further investigated the mode of therapy (individual vs. group setting). Regarding SGTs, we considered the moderator variable of intensity of treatment, divided into the following categories: (a) high-intensity treatments (structured therapy program with ≥6 sessions/modules delivered over the Internet and over a period of several weeks, including homework assignments, participation in an online discussion group, or interactive exercises); (b) low-intensity treatments (<6 sessions/modules, e.g., a single session of MI delivered over the telephone); and (c) SH formats (e.g., a mailed CBT-based WB, a toolkit, or PFB). These formats are based on the individual, self-reliant acquisition of knowledge about problematic gambling behavior. Although PFB materials were typically processed within brief, single sessions, these treatment options cannot be classified according to structured modules/sessions. Moreover, the impact of therapist contact was examined by stratifying studies into two groups, such as those with therapist contact during treatment and those without therapist contact. Moderator analyses for categorical variables were conducted using the mixed effects model with pooled estimates of T^2 and the Q-test based on the analysis of variance with the corresponding p value for the interpretation of the differences between subgroups (Borenstein et al., 2009).

In case of at least 10 available studies (Deeks et al., 2011), we further conducted meta-regression analyses using the following continuous variables: year of publication, duration of treatment (assessed by the total number of hours spent in FTFTs), and study quality (assessed by the transformed scores of the EPHPP tool). Meta-regression analyses on the mean age and the percentage of male/female participants, however, were not performed, because age and sex across studies differ from those within studies (Thompson & Higgins, 2002). To test the stability of the effect sizes at follow-up, we performed meta-regression analyses using the length of the period between posttreatment and follow-up (measured in weeks) as moderator.

RESULTS

Study selection

A total of 27 studies were identified for inclusion in this meta-analysis. Among these, 16 implemented FTFTs containing 27 comparisons, and 11 studies used SGTs containing 22 comparisons. One publication contained two studies with independent samples (Melville, Davis, Matzenbacher, & Clayborne, 2004). However, only the first of these provided sufficient data for effect size calculation and was included in the analysis. Dowling et al. published three treatment outcome manuscripts based on one eligible sample randomly assigned to treatment and WL control conditions (Dowling, Smith, & Thomas, 2006, 2007, 2009). To avoid overlap, only the trial comparing individual and group CBT (Dowling et al., 2007) was included in our analysis. We further excluded three studies assessed in a previous meta-analysis (Cowlishaw et al., 2012), because participants in the control groups received either a CBT-based SH WB (Diskin & Hodgins, 2009) or participated in GA groups (Grant et al., 2009; Petry et al., 2006), and thus the types of control group did not satisfy the defined selection criteria. One unpublished study was not considered for our analysis, because participants in the control group received advice for dealing with problematic gambling behavior (Abbott et al., 2012). Two further studies cited by a recent review (Marchica & Derevensky, 2016) were excluded, because participants did not receive a formal diagnosis (Celio & Lisman, 2014), or there were insufficient data for effect size calculation (Takushi et al., 2004). The flow diagram of the study selection is presented in Figure 1.

Study characteristics

The present sample of studies varied in type of control condition: The majority implemented WL control groups ($k = 18$), several studies used only assessment or only attention ($k = 8$), and one study used no treatment. The results were reported based on completers ($k = 14$) and ITT analyses ($k = 12$). One study failed to indicate the type of data analysis (Melville et al., 2004). Five studies provided only follow-up data, collected within a period of 3 months after treatment (Cunningham et al., 2009, 2012; LaBrie et al., 2012; Martens, Arterberry, Takamatsu,

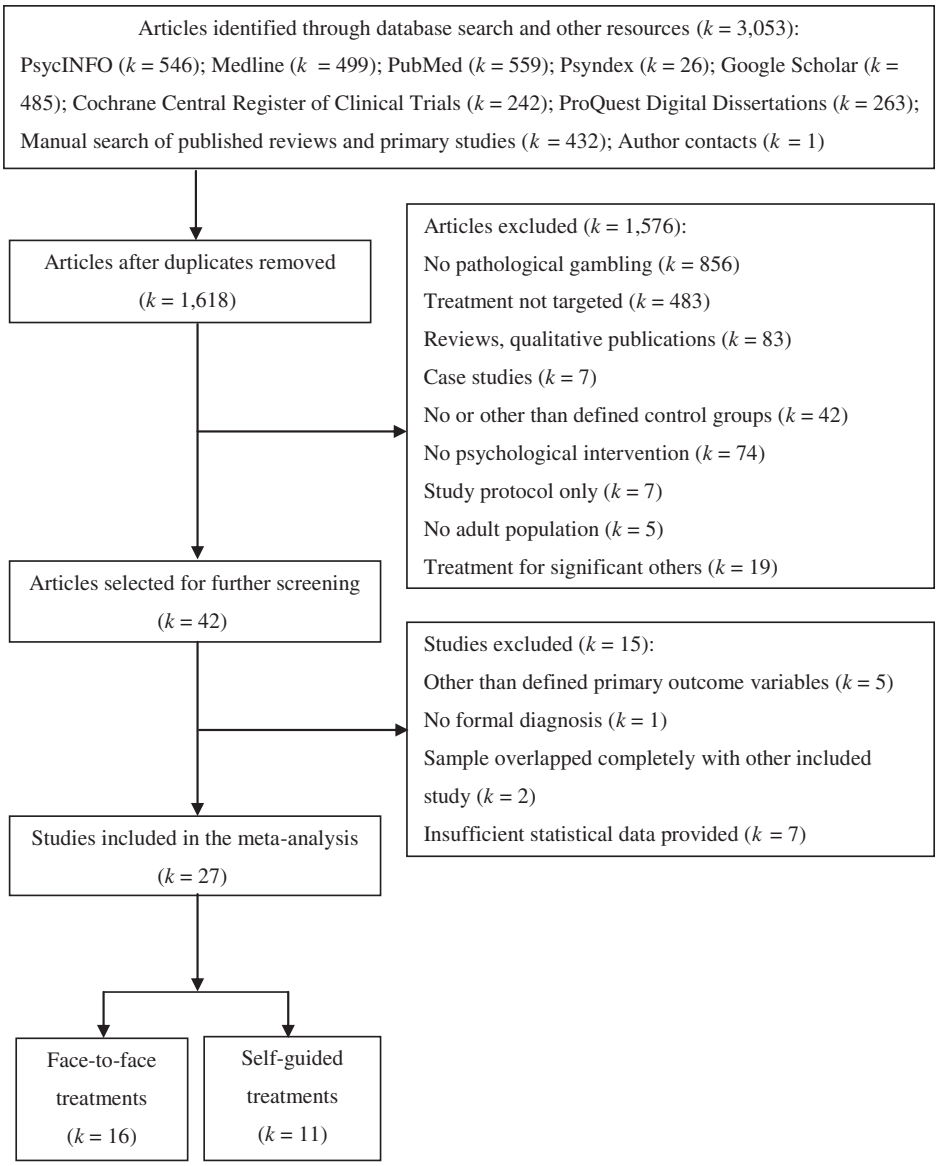


Figure 1. Flow diagram of the study selection process

Masters, & Dude, 2015; Neighbors et al., 2015). Since mean intervals between pre- and posttreatment of the remaining studies were comparable ($k = 19$; $M = 8.13$ weeks, $SD = 2.55$), these studies were included in the analyses of posttreatment data. Follow-up data for treatment and control groups were provided by 11 studies with periods ranging from 1.5 to 9 months ($M = 4.86$, $SD = 3.03$).

Among FTFTs, most studies implemented CBT and combined CBT strategies delivered through individual and group settings in equal shares. The total number of hours spent in FTFTs ranged from 10 min to 24 hr ($M = 12.23$ hr, $SD = 9.01$). SGTs typically implemented SH formats (CBT-based WBs and PFB) delivered over the Internet, and without therapist support.

A total of 3,879 participants across all studies were analyzed ($n = 912$ in FTFTs and $n = 2,967$ in SGTs). Of those, 2,655 patients were assigned to treatment conditions ($n = 587$ in FTFTs and $n = 2,068$ in SGTs), and 1,224 individuals to control groups ($n = 325$ in FTFTs and $n = 899$ in SGTs). All participants received a formal diagnosis. Most studies examined electronic gambling as the predominant type of gambling. The total sample was predominantly male (60.87%) with an average age of 39 years. Detailed information regarding the characteristics of studies is presented in Table 1.

Risk of bias within studies

The transformed global EPHPP scores ranged from 5 to 10 points [maximum score: 12 points; $M = 7.58$, $SD = 1.25$ ($M = 7.81$, $SD = 1.22$ for FTFTs; $M = 7.18$, $SD = 1.17$ for SGTs)]. Validity assessment yielded an interrater reliability of $\kappa = .75$. The transformed EPHPP scores for the global ratings are shown in Table 1.

Synthesis of results and risk of bias across studies

The pooled effect sizes for both types of treatment on all outcomes at 0–3 months posttreatment and follow-up, the 95% CI, and the significance tests are outlined in Table 2.

Table 1. Characteristics of studies

Reference	*N*[a]	Treatment (*N*)	Control (*N*)	Duration (hours)[b]	Modality/setting/ intensity/ therapist contact	FU (months)[c]	Outcomes (assessment)	Gambling type	ITT/CO	EPHPP[d]
Carlbring and Smit (2008)	66	CBT + MI (34) 4 modules MI + 4 modules CBT delivered over the Internet	WL (32)	NA	SGT/HI Contact	NA	GS (NODS)	E	ITT	7
Casey et al. (2017)	174	1. CBT (60) 2. MFS (59) Each intervention included 6 modules delivered over the Internet	AOC (55)	1. 6 2. 1	1. SGT/HI No contact 2. SGT/HI No contact	12[e]	GS (G-SAS; SOGS) FR (gambling activities/ week) FL (money gambled/ week)	E	ITT	6
Cunningham et al. (2009)	49	MI/PFB (24) Delivered over the Internet	WL (25)	NA	SGT/SH No contact	NA	GS (CPGI) FL (money spent past 3 months)	NA	CO	8
Cunningham et al. (2012)	209	1. MI/PNFB (70) 2. MI/PFB (70) Both interventions delivered over the Internet	WL (69)	1. NA 2. NA	1. SGT/SH No contact 2. SGT/SH No contact	9	FR (days gambled/ month) FL (dollars lost/month)	NA	ITT	8
Doiron and Nicki (2007)	40	CBT (20)	WL (20)	NA	FTFT/G	NA	GS (CPGI) FR (time spent/month) FL (money spent/month)	E	CO	7
Dowling et al. (2007)	56	1. CBT (14) 2. CBT (17)	WL (25)	1. 18 2. 24	1. FTFT/I 2. FTFT/G	NA	FR (days gambled/week) FL (money spent/week)	E	ITT	9
Echeburúa, Báez, and Fernández-Montalvo (1996)[f]	51	1. CBT (14) 2. CBT (13) 3. CBT (12)	WL (12)	1. 6.5 2. 12.5 3. 6	1. FTFT/I 2. FTFT/G 3. FTFT/I + G	6	FR (gambling activities/ week; hours/week) FL (money spent/week)	E	CO	8
Hodgins et al. (2001)	98	1. MI (single session) delivered over telephone + CBT WB (31) 2. CBT WB (33)	WL (34)	1. NA 2. NA	1. SGT/LI Contact 2. SGT/SH No contact	NA	FR (days gambled last 2 months) FL (money spent last 2 months)	E	CO	8

(Continued)

Table 1. (Continued)

Reference	N^a	Treatment (*N*)	Control (*N*)	Duration (hours)[b]	Modality/setting/ intensity/ therapist contact	FU (months)[c]	Outcomes (assessment)	Gambling type	ITT/CO	EPHPP[d]
Hodgins et al. (2009)	314	1. MI (single session) delivered over telephone + CBT WB (83) 2. MI + 6 booster sessions delivered over telephone + CBT WB (84) 3. CBT WB (82)	WL (65)	1. NA 2. NA 3. NA	1. SGT/LI Contact 2. SGT/LI Contact 3. SGT/SH No contact	NA	FR (days gambled/ month) FL (dollars lost/month)	E	ITT	8
Hopper (2008)	60	MI/PNFB (30) Delivered over the Internet	AOC (30)	NA	SGT/SH No contact	NA	FR (gambling activities past 6 months) FL (money spent/month)	NA	CO	6
LaBrie et al. (2012)	315	1. Toolkit, NV (59) 2. Toolkit, MA (49) 3. Guided toolkit (+ minimal therapist contact), NV (55) 4. Guided toolkit (+ minimal therapist contact), MA (50) All interventions delivered over the Internet	WL (102)	NA	1. SGT/SH No contact 2. SGT/SH No contact 3. SGT/SH Contact 4. SGT/SH Contact	2	FR (days gambled/ month)	NA	ITT	9
Ladouceur et al. (2001)	64	CBT (35)	WL (29)	11	FTFT/I	NA	GS (DSM-IV) FR (gambling sessions; hours gambled/week) FL (money spent/week)	E	CO	6
Ladouceur et al. (2003)	59	CBT (34)	WL (25)	20	FTFT/G	NA	GS (DSM-IV) FR (gambling sessions; hours gambled/week) FL (money spent/week)	NA	CO	6
Larimer et al. (2012)[f]	111	1. PFI (40) 2. CBT (30)	AOC (41)	1. 1.5 2. 6	1. FTFT/I 2. FTFT/G	6	GS (DSM-IV criteria) FR (gambling activities/ month) FL (money spent gambling/month)	NA	CO	8
Lee and Awosoga (2014)	16	CCT (8)	NT (8)	12	FTFT/G	2	GS (G-SAS)	L	CO	9

Luquiens and Tanguy (2016)	1,122	1. MI/PNFB (293) 2. CBT WB (264) 3. Guided CBT WB (six weekly modules) (301)[h] All interventions delivered over the Internet	WL (264)	NA	1. SGT/SH No contact 2. SGT/SH No contact 3. SGT/SH Contact	1.5	GS (PGSI)[g] FR (gambling sessions/ month) FL (total loss/month)	IP	CO/ITT	5
Marceaux and Melville (2011)	33	1. CBT (15) 2. TSF (11)	WL (7)	1. 24 2. 24	1. FTFT/G 2. FTFT/G	NA	GS (DSM-IV) FR (gambling episodes)[i] FL (money spent)[i]	NA	CO	10
Martens et al. (2015)	333	1. MI/PFB (111) 2. EDU (113) Delivered over paper printout	AOC (109)	NA	1. SGT/SH No contact 2. SGT/SH No contact	NA	GS (CPGI) FR (days gambled last 60 days) FL (money spent last 60 days)	NA	ITT	7
Melville et al. (2004), study 1[j]	13	1. CBT mapping (4) 2. CBT non-mapping (4)	WL (5)	1. 24 2. 24	1. FTFT/G 2. FTFT/G	NA	GS (DSM-IV)	E	NA	8
Myrseth, Litlere, Stoylen, and Pallesen (2009)	14	CBT + MI elements (7)	WL (7)	12	FTFT/G	3	GS (DSM-IV) FL (money spent/week)	E	ITT	8
Neighbors et al. (2015)	227	MI/PNFB (113) Delivered over computer	ACO (114)	NA	SGT/SH No contact	3	GS (GPI) FR (days gambled past year) FL (money spent/month)	C	CO	7
Oei et al. (2010)	102	1. CBT + MI elements (37) 2. CBT + MI elements (37)	WL (28)	1. 12 2. 15	1. FTFT/I 2. FTFT/G	NA	FR (gambling episodes past 2 weeks) FL (money gambled/ day)	E	ITT	8
Petry et al. (2008)	172	1. MI/BA (35) 2. MI/MET (single session) (52) 3. MI/MET (single session) + CBT (3 sessions) (38)	AOC (47)	1. 0.2 2. 1 3. 4	1. FTFT/I 2. FTFT/I 3. FTFT/I	9	GS (ASI-G) FL (money gambled/ week)[k]	SB/L	ITT	9
Petry et al. (2009)	114	1. MI/BA (32) 2. MI/MET (single session) (30) 3. MI/MET (single session) + CBT (3 sessions) (18)	AOC (34)	1. 0.2 2. 1 3. 4	1. FTFT/I 2. FTFT/I 3. FTFT/I	9	GS (ASI-G) FR (days gambled/ month) FL (gambling episodes/ month)[l]	C/P	ITT	9

(Continued)

Table 1. (Continued)

Reference	*N*[a]	Treatment (*N*)	Control (*N*)	Duration (hours)[b]	Modality/setting/ intensity/ therapist contact	FU (months)[c]	Outcomes (assessment)	Gambling type	ITT/CO	EPHPP[d]
Sylvain, Ladouceur, and Boisvert (1997)	29	CBT (14)	WL (15)	17	FTFT/I	NA	GS (DSM-III-R; SOGS) FR (gambling sessions; hours spent/week) FL (money spent/week)	E	CO	7
Toneatto, Pillai, and Courtice (2014)	18	CBT + mindfulness intervention (9)	WL (9)	7.5	FTFT/G	NA	GS (DSM-IV)	SB/L	CO	7
Watson (2012)	20	MI + PFB (7)	AOC (13)	2	FTFT/I	3	FR (gambling activities/ month) FL (money spent/month)	BG	CO	6

Note. ACO: attention control only; AOC: assessment only control; ASI-G: addiction severity index-gambling; BA: brief advice; BG: betting on games; C: cards; CBT: cognitive-behavioral therapy; CCT: congruence couple therapy; CO: completers; CPGI: Canadian Problem Gambling Index; E: electronic gambling; EDU: education program; EPHPP: Effective Public Health Practice Project; FL: financial loss; FR: frequency; FTFT: face-to-face treatment; FU: effect sizes from posttreatment to latest follow-up; G: group setting; GPI: Gambling Problems Index; GS: global severity; G-SAS: Gambling Symptom Assessment Scale; HI: high intensity; I: individual counseling; IP: Internet poker; ITT: intention-to-treat; L: lottery; LI: low intensity; MA: Massachusetts; MET: motivational enhancement therapy; MFS: monitoring, feedback, and support; MI: motivational interviewing; NA: not available; NODS: National Opinion Research Center DSM Screen for Gambling Problems; NT: no treatment; NV: Nevada; PFB: personalized feedback; PFI: personalized feedback intervention; PNFB: personalized normative feedback; PGSI: Problem Gambling Severity Index; P: poker; SB: sports betting; SGT: self-guided treatment; SH: self-help; SOGS: South Oaks Gambling Screen; STAI: State-Trait Anxiety Inventory; TSF: 12-step facilitated group therapy; WB: workbook; WL: wait-list.

[a]Number of subjects included in the analysis.

[b]Total number of hours spent in treatment.

[c]Only studies reporting data at follow-up for both treatment and control groups are included.

[d]The transformed EPHPP scores are presented.

[e]Effect sizes at follow-up were not calculated due to insufficient data.

[f]The study reported data for treatment and control groups at follow-up only.

[g]The PGSI scores were based only on a subset of randomized participants. Consequently, the data for this outcome variable were classified as "completers."

[h]This treatment condition was categorized as pure "SH," because no information about the intensity of treatment (e.g., homework assignments and communication between client and therapist) was available.

[i]Data for calculating the effect sizes at follow-up for frequency and FL were not available.

[j]This study reported only means for the treatment and control groups at posttreatment, but no *SD*s. The only available information for effect size calculation was the result from an independent groups *t*-test for the mapping group versus WL control group regarding the reduction of global severity. This statistic was used to calculate the *SD* for the combined CBT treatment groups versus WL control group (see also Cowlishaw et al., 2012). The formulae for the combination of subgroups and the calculation of *SD*s from *t* values are available in Higgins and Deeks (2011).

[k]Effect sizes for FL were not included, because data were log transformed.

[l]Effect sizes for FL were not included, because data were reported as medians and interquartile ranges.

Table 2. Effect sizes for both modalities of treatment and outcomes during posttreatment and follow-up

		FTFTs							SGTs						
Outcome	Effect	*k*	*g*	95% CI	*z*	*p*	I^2	FS *N*	*k*	*g*	95% CI	*z*	*p*	I^2	FS *N*
Global severity	Post	16	1.15	[0.63, 1.67]	4.35	<.001	85.97	418	10	0.30	[−0.02, 0.63]	1.83	.068	82.94	–[a]
	FU	10	0.42	[0.21, 0.63]	3.90	<.001	0.00	32	4	0.15	[−0.06, 0.36]	1.38	.168	0.00	–[a]
Frequency	Post	14	0.74	[0.48, 0.99]	5.63	<.001	44.37	207	20	0.12	[0.02, 0.22]	2.24	<.05	28.95	23
	FU	9	0.49	[0.25, 0.73]	3.98	<.001	0.00	34	9	0.08	[−0.04, 0.20]	1.37	.171	13.81	–[a]
FL	Post	12	0.67	[0.47, 0.87]	6.49	<.001	0.00	122	17	0.13	[0.05, 0.22]	3.01	<.01	0.00	36
	FU	7	0.25	[−0.03, 0.54]	1.75	.081	0.00	–[a]	5	0.07	[−0.05, 0.18]	1.09	.275	0.00	–[a]

Note. CI: confidence interval; FS *N*: fail-safe *N* (number of studies required to obtain a non-significant treatment effect); FU: effect sizes from posttreatment to latest follow-up; *g*: Hedges's *g*; I^2: percentage of total variation across studies; *k*: number of treatment conditions.
[a]FS *N* was not calculated, because *p* was not significant.

Further results concerning the effect sizes for FTFTs and SGTs and their corresponding forest plots are presented in Figure 2.

Effect sizes of FTFTs at posttreatment and follow-up

At posttreatment, all results were significant with a large effect size for the reduction of global severity and medium effect sizes for the remaining outcomes. At follow-up, the analyses revealed significant results with a small-to-medium effect size for the reduction of global severity and a medium effect size for the reduction of frequency. A small and non-significant effect size was registered for the reduction of financial loss. As depicted in Table 2, high and moderate heterogeneity across the studies was observed regarding the reduction of global severity and frequency. The effect size distribution for the reduction of financial loss was homogeneous.

The trim-and-fill method identified five studies causing funnel plot asymmetry for the reduction of global severity (Begg's test, $p = .005$) and two studies for the reduction of frequency (Begg's test, $p = .035$). If the asymmetry was due to publication bias, our analyses with these filled studies suggested a markedly reduced effect size for the reduction of global severity ($g = 0.55$, 95% CI [−0.03, 1.13]) indicating substantial impact of publication bias, and a slightly reduced effect size for the reduction of frequency ($g = 0.66$, 95% CI [0.39, 0.93]) indicating trivial impact of publication bias. No indication for publication bias was found for the reduction of financial loss (Begg's test, $p = .065$). According to the FS *N*s, the effect sizes were considered robust for all outcome variables at posttreatment. However, the effect sizes at follow-up were not robust.

Effect sizes of SGTs at posttreatment and follow-up

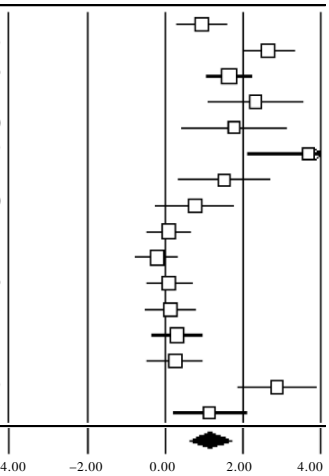
At posttreatment, the analyses revealed a non-significant and small effect size for the reduction of global severity, and significant and small effect sizes for the reduction of frequency and financial loss. At follow-up, all the results were non-significant with a small effect size for the reduction of global severity, and effect sizes approaching zero for the reduction of frequency and financial loss. As shown in Table 2, considerable heterogeneity across studies was observed for the reduction of global severity. For the remaining outcomes, the effect size distributions showed low heterogeneity or homogeneity.

The trim-and-fill method identified five studies causing funnel plot asymmetry regarding the reduction of frequency (Begg's test, $p = .043$), and four studies regarding the reduction of financial loss (Begg's test, $p = .016$). When considering these studies, the effect sizes changed only slightly for the reduction of frequency ($g = 0.04$, 95% CI [−0.08, 0.15]) and financial loss ($g = 0.10$, 95% CI [0.001, 0.19]). Furthermore, no indication for publication bias was found for the reduction of global severity (Begg's test, $p = .464$). The FS *N*s suggested that none of the effect sizes for the outcome variables were robust. Outlier identification through the one-study-removed procedure showed no impact of any single study on the overall effects.

1. Face-to-face treatments

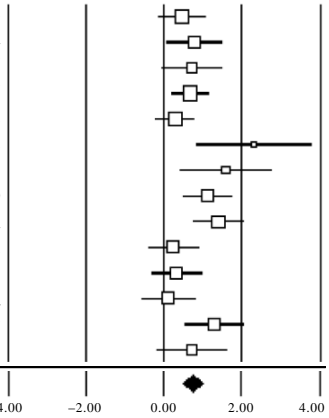
(a) Global severity

Study name	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Doiron and Nicki (2007)	CBT	0.94	[0.30, 1.58]	2.87	.00	6.85
Ladouceur et al. (2001)	CBT	2.65	[1.98, 3.32]	7.77	.00	6.79
Ladouceur et al. (2003)	CBT	1.64	[1.05, 2.23]	5.45	.00	6.96
Lee and Awosoga (2014)	CCT	2.34	[1.11, 3.57]	3.72	.00	5.35
Marceaux and Melville (2011)	TSF	1.78	[0.41, 3.14]	2.55	.01	5.00
Marceaux and Melville (2011)	CBT	3.67	[2.10, 5.25]	4.58	.00	4.49
Melville et al. (2004), study 1	CBT (map. + non-map.)	1.52	[0.33,2.71]	2.50	.01	5.45
Myrseth et al. (2009)	CBT + MI elements	0.77	[–0.25, 1.79]	1.48	.14	5.90
Petry et al. (2008)	MI/BA	0.11	[–0.48, 0.69]	0.36	.72	6.98
Petry et al. (2008)	MI	–0.21	[–0.76, 0.35]	–0.73	.46	7.03
Petry et al. (2008)	MI + CBT	0.10	[–0.49, 0.69]	0.35	.73	6.96
Petry et al. (2009)	MI/BA	0.14	[–0.53, 0.82]	0.42	.68	6.78
Petry et al. (2009)	MI	0.32	[–0.34, 0.98]	0.95	.34	6.81
Petry et al. (2009)	MI + CBT	0.26	[–0.45, 0.97]	0.71	.48	6.68
Sylvain et al. (1997)	CBT	2.87	[1.84, 3.89]	5.49	.00	5.89
Toneatto et al. (2014)	CBT + mindfulness	1.14	[0.19, 2.10]	2.34	.02	6.07
Overall effect size		1.15	[0.63, 1.67]	4.35	.00	



(b) Frequency

Study name	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Doiron and Nicki (2007)	CBT	0.47	[–0.05; 1.09]	1.49	.14	8.48
Dowling et al. (2007)	CBT/G	0.79	[0.05; 1.52]	2.11	.04	7.12
Dowling et al. (2007)	CBT/I	0.72	[–0.05; 1.49]	1.83	.07	6.67
Ladouceur et al. (2001)	CBT	0.67	[0.17; 1.17]	2.61	.01	10.27
Ladouceur et al. (2003)	CBT	0.28	[–0.24; 0.79]	1.04	.30	9.98
Marceaux and Melville (2011)	TSF	2.31	[0.84; 3.78]	3.08	.00	2.58
Marceaux and Melville (2011)	CBT	1.58	[0.41; 2.75]	2.66	.01	3.75
Oei et al. (2010)	CBT + MI elements/G	1.10	[0.46; 1.75]	3.37	.00	8.19
Oei et al. (2010)	CBT + MI elements/I	1.39	[0.73; 2.06]	4.12	.00	7.92
Petry et al. (2009)	MI/BA	0.25	[–0.43; 0.92]	0.72	.47	7.78
Petry et al. (2009)	MI	0.33	[–0.33; 0.99]	0.98	.33	7.95
Petry et al. (2009)	MI + CBT	0.11	[–0.60; 0.83]	0.32	.75	7.34
Sylvain et al. (1997)	CBT	1.28	[0.50; 2.07]	3.22	.00	6.57
Watson (2012)	MI + PNFB	0.72	[–0.19; 1.63]	1.56	.12	5.41
Overall effect size		0.74	[0.48; 0.99]	5.63	.00	



(c) Financial loss

Study name	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Doiron and Nicki (2007)	CBT	0.82	[0.19; 1.45]	2.53	0.01	10.22
Dowling et al. (2007)	CBT/G	0.54	[–0.18; 1.26]	1.48	0.14	8.00
Dowling et al. (2007)	CBT/I	0.85	[0.07; 1.63]	2.13	0.03	6.69
Ladouceur et al. (2001)	CBT	0.71	[0.20; 1.21]	2.76	0.01	16.31
Ladouceur et al. (2003)	CBT	0.55	[0.03; 1.08]	2.06	0.04	14.82
Marceaux and Melville (2011)	TSF	1.94	[0.54; 3.33]	2.72	0.01	2.11
Marceaux and Melville (2011)	CBT	0.50	[–0.56; 1.57]	0.93	0.35	3.61
Myrseth et al. (2009)	CBT + MI elements	0.55	[–0.45; 1.55]	1.08	0.28	4.09
Oei et al. (2010)	CBT + MI elements/G	0.51	[–0.10; 1.13]	1.64	0.10	10.89
Oei et al. (2010)	CBT + MI elements/I	0.49	[–0.13; 1.10]	1.57	0.12	10.91
Sylvain et al. (1997)	CBT	0.99	[0.24; 1.74]	2.58	0.01	7.24
Watson (2012)	MI + PNFB	0.53	[–0.37; 1.43]	1.16	0.25	5.11
Overall effect size		0.67	[0.47; 0.87]	6.49	.00	

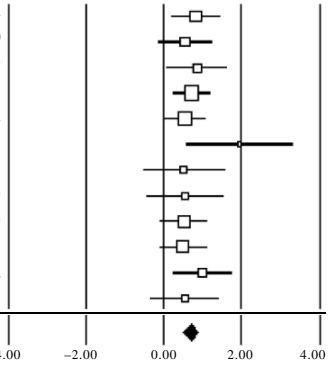


Figure 2. Overall effect sizes for each treatment modality and outcome at posttreatment. BA: brief advice; BS: booster sessions; CBT: cognitive-behavioral therapy; CCT: congruence couple therapy; CI: confidence interval; EDU: education program; G: group setting; I: individual counseling; map.: mapping group; Mass.: Massachusetts site; MFS: motivation, feedback, support; MI: motivational interviewing; Nev.: Nevada site; non-map.: non-mapping group; PFB: personalized feedback; PNFB: personalized normative feedback; RW: relative weight; TSF: 12-step facilitated therapy; WB: workbook

Moderator analyses

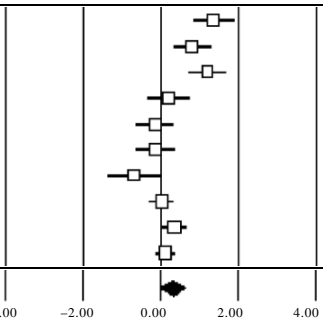
The results of the moderator analyses for categorical and continuous variables at 0–3 months posttreatment are presented in Tables 3 and 4, respectively.

The effect sizes were not moderated by the types of psychological interventions and the year of publication in both FTFTs and SGTs. Significantly larger effect sizes, however, were found for individuals preferring

2. Self-guided treatments

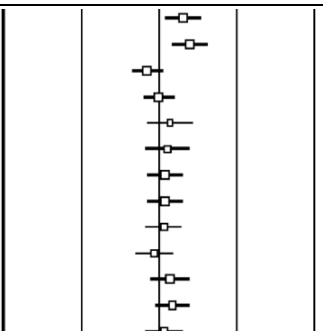
(a) Global severity

Study	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Carlbring and Smit (2008)	MI + CBT	1.34	[0.82; 1.87]	4.98	.00	13.55
Casey et al. (2017)	MFS	0.80	[0.82; 1.87]	3.35	.00	9.96
Casey et al. (2017)	CBT	1.19	[0.71; 1.67]	4.87	.00	9.88
Cunningham et al. (2009)	MI/PFB	0.18	[–0.44; 0.81]	0.57	.57	12.17
Luquiens and Tanguy (2016)	MI/PNFB	–0.16	[–0.64; 0.32]	–0.65	.52	14.29
Luquiens and Tanguy (2016)	CBT WB	–0.15	[–0.66; 0.35]	–0.60	.55	13.89
Luquiens and Tanguy (2016)	CBT WB/guidance	–0.70	[–1.38; -0.02]	–2.02	.04	11.39
Martens et al. (2015)	EDU	0.01	[–0.31; 0.34]	0.08	.93	14.46
Martens et al. (2015)	MI/PFB	0.32	[0.06; 0.59]	2.37	.02	17.32
Neighbors et al. (2015)	MI/PNFB	0.10	[–0.16; 0.36]	0.76	.44	17.39
Overall effect size		0.30	[–0.02; 0.63]	1.83	.07	



(b) Frequency

Study	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Casey et al. (2017)	MFS	0.61	[0.16; 1.08]	2.64	.00	3.83
Casey et al. (2017)	CBT	0.80	[0.34; 1.26]	3.41	.00	3.83
Cunningham et al. (2012)	MI/PNFB	–0.30	[–0.71; 0.11]	–1.45	.15	4.41
Cunningham et al. (2012)	MI/PFB	–0.01	[–0.42; 0.39]	–0.07	.95	4.54
Hodgins et al. (2001)	MI	0.29	[–0.29; 0.87]	0.97	.33	2.15
Hodgins et al. (2001)	CBT WB	0.21	[–0.36; 0.79]	0.72	.47	2.21
Hodgins et al. (2009)	MI + CBT WB + BS	0.15	[–0.32; 0.62]	0.63	.53	3.39
Hodgins et al. (2009)	MI + CBT WB	0.16	[–0-31; 0.64]	0.67	.50	3.25
Hodgins et al. (2009)	CBT WB	0.13	[–0.34; 0.59]	0.53	.60	3.37
Hopper (2008)	MI/PNFB	–0.12	[–0.62; 0.38]	–0.48	.63	2.95
LaBrie et al. (2012)	Guided toolkit/Mass.	0.28	[–0.21; 0.77]	1.12	.26	3.06
LaBrie et al. (2012)	Guided toolkit/Nev.	0.35	[–0.10; 0.81]	1.52	.13	3.57
LaBrie et al. (2012)	Toolkit/Mass.	0.13	[–0.36; 0.62]	0.51	.61	3.06
LaBrie et al. (2012)	Toolkit/Nev.	0.09	[–0.36; 0.53]	0.38	.71	3.70
Luquiens and Tanguy (2016)	MI/PNFB	0.60	[–0.18; 0.30]	0.49	.62	13.03
Luquiens and Tanguy (2016)	CBT WB	0.23	[–0.007; 0.48]	1.90	.06	12.65
Luquiens and Tanguy (2016)	CBT WB/guidance	0.07	[–0.17; 0.31]	0.57	.57	13.10
Martens et al. (2015)	EDU	–0.07	[–0.39; 0.26]	–0.40	.69	6.83
Martens et al. (2015)	MI/PFB	0.03	[–0.23; 0.30]	0.26	.80	10.62
Neighbors et al. (2015)	MI/PNFB	–0.14	[–0.40; 0.12]	–1.05	.29	10.93
Overall effect size		0.12	[0.02; 0.22]	2.24	.03	



(c) Financial loss

Study	Subgroup	Hedges's *g*	95% CI	*z*	*p*	RW
Casey et al. (2017)	MFS	0.26	[–0.19; 0.72]	1.14	.26	3.69
Casey et al. (2017)	CBT	0.51	[0.06; 0.96]	2.23	.03	3.73
Cunningham et al. (2009)	MI/PFB	0.36	[–0.23; 0.96]	1.19	.23	2.88
Cunningham et al. (2012)	MI/PNFB	–0.20	[–0.61; 0.21]	–0.96	.34	5.81
Cunningham et al. (2012)	MI/PFB	–0.16	[–0.57; 0.24]	–0.80	.42	5.92
Hodgins et al. (2001)	MI	0.57	[–0.02; 1.16]	1.88	.06	2.93
Hodgins et al. (2001)	CBT WB	–0.07	[–0.65; 0.50]	–0.25	.80	3.09
Hodgins et al. (2009)	MI + CBT WB + BS	0.35	[–0.20; 0.90]	1.25	.21	3.41
Hodgins et al. (2009)	MI + CBT WB	0.40	[–0.15; 0.94]	1.43	.15	3.42
Hodgins et al. (2009)	CBT WB	0.22	[–0.30; 0.75]	0.82	.41	3.61
Hopper (2008)	MI/PNFB	0.32	[–0.18; 0.83]	1.26	.21	3.98
Luquiens and Tanguy (2016)	MI/PNFB	–0.03	[–0.27; 0.21]	–0.25	.80	13.75
Luquiens and Tanguy (2016)	CBT WB	–0.01	[–0.26; 0.22]	–0.13	.90	13.51
Luquiens and Tanguy (2016)	CBT WB/guidance	–0.11	[–0.35; 0.13]	–0.91	.36	13.80
Martens et al. (2015)	EDU	0.15	[–0.17; 0.48]	0.93	.35	7.84
Martens et al. (2015)	MI/PFB	0.21	[–0.06; 0.47]	1.53	.13	11.80
Neighbors et al. (2015)	MI/PNFB	0.16	[–0.10; 0.42]	1.24	.21	12.10
Overall effect size		0.13	[0.05; 0.22]	3.01	.00	

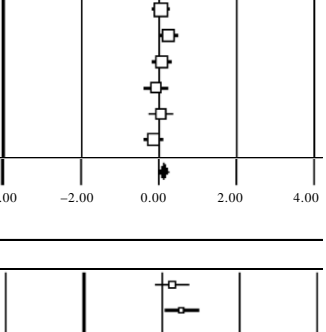


Figure 2. (Continued)

electronic gambling compared with those reporting other gambling activities with regard to the reduction of global severity and frequency in FTFTs, as well as all outcome variables in SGTs. In addition, the type of data analysis moderated the effect size for the reduction of global severity in both FTFTs and SGTs. In FTFTs, studies reporting data based on completers produced larger effect sizes compared with those using ITT analyses. In SGTs, larger effect sizes in

Table 3. Moderator analyses for categorical variables

Variable	*k*	*g*	*SE*	95% CI	*z*	*p*	$Q_{between}$	*p* (*Q*)
Face-to-face treatments								
Type of psychological intervention								
Global severity								
CBT	10	1.46	0.31	[0.86, 2.06]	4.78	<.001	2.98	.084
Other	6	0.61	0.39	[−0.16, 1.33]	1.55	.120		
Frequency								
CBT	10	0.78	0.15	[0.48, 1.08]	5.08	<.001	0.28	.598
Other	4	0.61	0.27	[−0.08, 1.15]	2.24	<.05		
Financial loss								
CBT	10	0.65	0.11	[0.44, 0.86]	6.05	<.001	0.54	.464
Other	2	0.94	0.38	[0.19, 1.69]	2.45	<.05		
Mode of therapy								
Global severity								
Individual	8	0.73	0.34	[0.07, 1.39]	2.17	<.05	3.23	.072
Group	8	1.63	0.37	[0.91, 2.35]	4.43	<.001		
Frequency								
Individual	8	0.68	0.18	[0.33, 1.02]	3.82	<.001	0.36	.549
Group	6	0.84	0.22	[0.42, 1.27]	3.90	<.001		
Financial loss								
Individual	5	0.70	0.15	[0.40, 1.00]	4.61	<.001	0.08	.784
Group	7	0.64	0.14	[0.37, 0.92]	4.57	<.001		
Type of gambling[a]								
Global severity								
Electronic	5	1.76	0.34	[1.09, 2.42]	5.20	<.001	10.31	<.01
Other	8	0.41	0.25	[−0.08, 0.90]	1.63	.104		
Frequency								
Electronic	7	0.88	0.13	[0.63, 1.13]	7.00	<.001	6.48	<.05
Other	4	0.31	0.18	[−0.05, 0.67]	1.70	.090		
Financial loss								
Electronic	8	0.68	0.12	[0.44, 0.91]	5.64	<.001	_[b]	_[b]
Other	1	0.53	0.46	[−0.73, 1.43]	1.16	.246		
ITT versus completer analyses								
Global severity[c]								
ITT	7	0.17	0.21	[−0.23, 0.58]	0.84	.399	34.41	<.001
Completers	8	1.97	0.23	[1.53, 2.41]	8.72	<.001		
Frequency								
ITT	7	0.68	0.19	[0.31, 1.05]	3.60	<.001	0.26	.609
Completers	7	0.82	0.20	[0.43, 1.21]	4.09	<.001		
Financial loss								
ITT	5	0.57	0.16	[0.25, 0.89]	3.52	<.001	0.63	.428
Completers	7	0.74	0.13	[0.48, 1.00]	5.51	<.001		
Self-guided treatments								
Type of psychological intervention								
Global severity								
CBT	4	0.47	0.27	[−0.07, 1.00]	1.72	.086	0.57	.450
Other	6	0.21	0.21	[−0.20, 0.62]	1.00	.317		
Frequency								
CBT	5	0.24	0.09	[0.06, 0.42]	2.56	<.05	2.50	.114
Other	15	0.06	0.06	[−0.05, 0.18]	1.08	.279		
Financial loss								
CBT	5	0.12	0.08	[−0.03, 0.26]	1.53	.126	0.10	.752
Other	12	0.14	0.06	[0.04, 0.25]	2.61	<.01		
Treatment intensity								
Global severity								
High intensity	3	1.10	0.17	[0.77, 1.43]	6.54	<.001	40.27	<.001
Low intensity	NA							
SH	7	0.03	0.10	[−0.16, 0.22]	0.27	.784		
EDU	1	0.01	0.18	[−0.34, 0.37]	0.08	.939		
PFB	4	0.14	0.10	[−0.06, 0.34]	1.41	.160		

Table 3. (Continued)

Variable	*k*	*g*	*SE*	95% CI	*z*	*p*	$Q_{between}$	*p* (*Q*)
WB	2	−0.35	0.22	[−0.77, 0.07]	−1.65	.100		
Frequency								
High intensity	2	0.71	0.17	[0.39, 1.04]	4.28	<.001	21.19	<.001
Low intensity	3	0.19	0.15	[−0.10, 0.48]	1.28	.201		
SH	15	0.05	0.05	[−0.04, 0.14]	1.14	.253		
EDU	1	−0.07	0.17	[−0.39, 0.26]	−0.40	.691		
PFB	6	−0.05	0.07	[−0.18, 0.08]	−0.78	.435		
WB	8	0.17	0.07	[0.04, 0.30]	2.59	<.05		
Financial loss								
High intensity	2	0.39	0.16	[0.07, 0.71]	2.38	<.05	6.90	.141
Low intensity	3	0.43	0.17	[0.11, 0.76]	2.62	<.01		
SH	12	0.09	0.05	[−0.008, 0.18]	1.80	.073		
EDU	1	0.15	0.17	[−0.17, 0.48]	0.93	.354		
PFB	7	0.09	0.07	[−0.04, 0.22]	1.36	.173		
WB	4	0.07	0.08	[−0.09, 0.22]	0.85	.393		
Therapist contact								
Global severity								
Contact	2	0.40	0.40	[−0.39, 1.19]	0.98	.325	0.07	.799
No contact	8	0.28	0.19	[−0.08, 0.65]	1.52	.128		
Frequency								
Contact	6	0.19	0.10	[−0.02, 0.39]	1.82	.069	0.62	.433
No contact	14	0.09	0.06	[−0.03, 0.21]	1.50	.135		
Financial loss								
Contact	4	0.22	0.10	[0.03, 0.41]	2.28	.<.05	1.05	.305
No contact	13	0.11	0.05	[0.01, 0.21]	2.22	.<.05		
Type of gambling								
Global severity[d]								
Electronic	3	1.10	0.18	[0.75, 1.44]	6.24	<.001	28.91	<.001
Other	4	−0.12	0.14	[−0.40, 0.16]	−0.84	.402		
Frequency[e]								
Electronic	7	0.35	0.10	[0.15, 0.55]	4.34	<.01	5.04	<.05
Other	4	0.06	0.08	[−0.09, 0.22]	0.77	.443		
Financial loss[f]								
Electronic	7	0.34	0.10	[0.13, 0.53]	3.27	<.01	4.52	<.05
Other	4	0.08	0.06	[−0.04, 0.20]	1.25	.213		
ITT versus completer analyses								
Global severity								
ITT	5	0.69	0.20	[0.29, 1.09]	3.40	<.01	7.55	<.01
Completers	5	−0.12	0.21	[−0.53, 0.30]	−0.54	.586		
Frequency								
ITT	16	0.14	0.06	[0.03, 0.25]	2.55	<.05	1.39	.238
Completers	4	−0.02	0.12	[−0.26, 0.22]	−0.15	.885		
Financial loss								
ITT	12	0.11	0.05	[−0.01, 0.21]	2.18	<.05	1.16	.283
Completers	5	0.23	0.10	[0.04, 0.42]	2.34	<.05		

Note. Due to the small number of studies, moderator analyses were not conducted on the reduction of depression and anxiety. *k*: number of treatment conditions; CBT: cognitive-behavioral therapy; CI: confidence interval; EDU: education program; *g*: Hedges's *g*; ITT: intention-to-treat; NA: not available; PFB: personalized feedback; $Q_{between}$: homogeneity statistic for differences between subgroups; SE: standard error; SH: self-help; WB: workbook.

[a]Studies excluded: Ladouceur et al. (2003) and Marceaux and Melville (2011), because no information regarding the type of gambling was available.

[b]Moderator analyses were not performed, because only a single study remained in one subgroup.

[c]Studies excluded: Melville et al. (2004), because no information regarding the type of data analysis was available.

[d]Studies excluded: Cunningham et al. (2009) and Martens et al. (2015), because no information regarding the type of gambling was available.

[e]Studies excluded: Cunningham et al. (2012), Hopper (2008), LaBrie et al. (2012), and Martens et al. (2015), because no information regarding the type of gambling was available.

[f]Studies excluded: Cunningham et al. (2009, 2012), Hopper (2008), and Martens et al. (2015), because no information regarding the type of gambling was available.

Table 4. Moderator analyses for continuous variables

Variable	*B* value	*SE*	95% CI	*z* value	*p* value
Face-to-face treatments					
Publication year					
Global severity	−0.09	0.06	[−0.19, −0.02]	−1.55	.122
Frequency	0.01	0.03	[−0.06, 0.08]	0.31	.757
Financial loss	−0.01	0.02	[−0.06, 0.03]	−0.60	.546
Treatment duration[a]					
Global severity	0.01	0.02	[0.06, 0.15]	4.71	<.001
Frequency	0.03	0.02	[0.00, 0.06]	1.96	.050
Financial loss	0.08	0.02	[−0.03, 0.05]	0.43	.670
Quality					
Global severity	−0.33	0.15	[−0.62, −0.04]	−2.20	<.05
Frequency	−0.005	0.09	[−0.17, 0.18]	0.06	.951
Financial loss	0.03	0.08	[−0.13, 0.19]	0.33	.746
Stability					
Global severity	−0.01	0.01	[−0.04, 0.01]	−0.93	.352
Frequency	0.01	0.02	[−0.02, 0.04]	0.81	.420
Financial loss	0.004	0.02	[−0.04, 0.05]	0.16	.869
Self-guided treatments					
Publication year					
Global severity	−0.04	0.60	[−0.16, 0.07]	−0.72	.473
Frequency	0.005	0.01	[−0.02, 0.03]	0.33	.741
Financial loss	−0.008	0.01	[−0.03, 0.02]	−0.65	.519
Quality					
Global severity	0.20	0.18	[−0.14, 0.55]	1.16	.246
Frequency	−0.01	0.04	[−0.09, 0.06]	−0.35	.724
Financial loss	0.02	0.04	[−0.05, 0.10]	0.66	.509
Stability					
Global severity	−0.05	0.04	[−0.12, 0.03]	−1.19	.233
Frequency	−0.009	0.007	[−0.02, 0.006]	−1.21	.227
Financial loss	−0.002	0.008	[−0.01, 0.02]	0.22	.828

Note. CI: confidence interval; SE: standard error.
[a]Study excluded: Doiron and Nicki (2007), because no information regarding the hours spent in treatment was available.

studies using ITT analyses compared with those reporting data based on completers were found.

When examining FTFTs, study quality and treatment duration moderated the effect size for the reduction of global severity evidencing larger effect sizes in studies with lower validity scores, and applying a higher number of hours spent in treatment. The mode of therapy, however, had no impact on the effect sizes. In SGTs, high-intensity treatments (≥6 sessions/modules) produced significantly larger effect sizes compared with the other categories regarding the reduction of global severity and frequency. Moderator analyses of therapist contact revealed no significant results.

Due to the high variability of follow-up periods, we conducted meta-regression analyses despite the small number of available studies. The results showed that effect sizes at follow-up in both FTFTs and SGTs were not moderated by the length of the periods between posttreatment and follow-up.

FTFTs versus SGTs. The comparisons between the two treatment modalities at posttreatment showed significantly larger effect sizes for FTFTs regarding the reduction of global severity ($Q_{between} = 6.92$, $df = 1$, $p < .01$), frequency ($Q_{between} = 23.38$, $df = 1$, $p < .001$), and financial loss ($Q_{between} = 22.74$, $df = 1$, $p < .001$).

DISCUSSION

The objective of this paper was to investigate the efficacy of FTFTs and SGTs for disordered gambling and to identify possible predictors of treatment outcome. We found that FTFTs effectively reduced frequency and financial loss from gambling at 0–3 months after treatment. We also ascertained strong effect sizes for the reduction of global severity; however, the results from the trim-and-fill analysis indicated asymmetry in the underlying study sample. Although this could be caused by publication bias, it is more reasonable to assume that the between-study heterogeneity led to the funnel asymmetry (Egger, Smith, Schneider, & Minder, 1997; Sterne, Egger, & Smith, 2001). Furthermore, the robustness of the training effect of FTFTs to reduce global gambling severity is supported by the FS *N* analyses. No firm conclusions can be drawn with regard to the treatment success over a longer period of time, since effect sizes at follow-up were not robust. Previous meta-analyses in this area reported comparable short-term effects (Gooding & Tarrier, 2009; Leibetseder et al., 2011; Pallesen et al., 2005), but better long-term effects. The reasons for this may be that effect sizes were pooled across different study designs and across scales with different contents (e.g., abstinence rates and cognitive distortions) (Leibetseder

et al., 2011; Pallesen et al., 2005), or that they were limited to CBT (Gooding & Tarrier, 2009). Thus, our results regarding the durability of treatment effects correspond to those reported in the latest meta-analysis based on RCTs (Cowlishaw et al., 2012). Moreover, we extended these results by including minimal FTFTs, SGTs, examining publication bias, and performing moderator analyses.

In accordance with relevant publications emphasizing CBT as the most supported treatment (Rash & Petry, 2014; Toneatto & Millar, 2004), we found an advantage of CBT over other therapies for the reduction of global severity, which, however, did not reach the statistical significance. This reflects the favorable results of the TSF group therapy (Marceaux & Melville, 2011) and CCT (Lee & Awosoga, 2014) yielding effect sizes comparable with those of CBT. Although these therapies proved to be successful in non-controlled trials (Lee & Rovers, 2008; Toneatto & Dragonetti, 2008) as well, more research is required to substantiate their efficacy relative to controls. Treatment success was not affected by the method of delivery in individual or group format, but increased with the number of hours spent in therapy, supporting the results of earlier research in this area (Dowling et al., 2007; Gooding & Tarrier, 2009; Leibetseder et al., 2011; Oei, Raylu, & Casey, 2010; Pallesen et al., 2005). The latter finding suggests that the chronic manifestation of disordered gambling requires more intensive treatment to achieve meaningful improvement. Of note, significant results were found only for the reduction of global severity. Since this effect size was also moderated by the quality of studies and the type of data analysis, the treatment effect for the reduction of global severity may be overestimated, and thus the association between treatment duration and treatment success should be interpreted with caution. Together with the similarly positive relation between treatment benefit and treatment duration for the reduction of frequency, our findings correspond to those reported in meta-analyses investigating other mental health problems (Glombiewski et al., 2010; Khoury et al., 2013; Kleinstäuber, Witthöft, & Hiller, 2011).

With regard to the type of gambling, individuals who preferred electronic gambling seemed to benefit more from treatment than other types of gamblers. The significantly lower effect size of the category subsuming gamblers favoring other gambling activities in FTFTs may be explained by the results of two studies (Petry et al., 2008, 2009), which differed from the remaining studies in applying brief interventions and yielding small effect sizes. Similarly, the significantly larger effect sizes of the category including electronic gamblers in SGTs may be explained by the results of two studies (Carlbring & Smit, 2008; Casey et al., 2017), which differed from the others by using high-intensity treatments and yielding large effect sizes. Therefore, the duration and the intensity of interventions may account for the between-group differences observed. Consequently, our results correspond to those reported in an earlier meta-analysis suggesting that all gamblers may share common mechanisms of addiction, which were effectively reduced during treatment (Gooding & Tarrier, 2009).

Comparable with the moderator analyses on the type of gambling, the significant differences between the effect sizes based on completers and ITT analyses for the reduction of global severity in both FTFTs and SGTs may be explained by the duration and intensity of interventions rather than the type of data analysis. In FTFTs, the relatively small effect size for studies applying ITT analyses may be caused by the small effect sizes of the two studies applying brief interventions (Petry et al., 2008, 2009). In SGTs, the small effect size for studies reporting data based on completers may be explained by the poor results of a trial using pure SH materials (Luquiens & Tanguy, 2016).

According to our hypothesis, SGTs yielded significantly inferior results compared with FTFTs. A number of reasons might account for these findings. First, the majority of SGTs included pure SH resources (e.g., CBT-based WBs, and PFB materials typically processed within a brief, single session) indicating limited treatment benefit relative to controls. Within the alcohol addiction area, significant but comparably small effect sizes were found for the use of bibliotherapy materials (Apodaca & Miller, 2003) and for brief Internet-delivered interventions (including studies using PFB) to reduce alcohol consumption for college drinkers (Carey, Scott-Sheldon, Elliott, Garey, & Carey, 2012), adult problem drinking (Riper et al., 2009, 2011, 2014), and alcohol and tobacco use (Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010). Alternatively, the poor results of one trial (Luquiens & Tanguy, 2016) may have influenced the treatment effects, which may especially be true for the reduction of global severity. Non-treatment-seeking online gamblers, particularly those assigned to the e-mail-guided CBT program, failed to show treatment success compared with controls. According to the study authors, the disapproving attitude of non-treatment-seeking gamblers toward therapeutic guidance, the therapist contact solely occurring over the Internet, and the lack of intrinsic motivation to change gambling behavior may have contributed to high attrition rates and poor treatment success. More general aspects, such as baseline assessments raising the awareness of problematic behavior, regression to the mean (Swan & Hodgins, 2015), or the natural recovery from gambling (e.g., Slutske, 2006) may also account for small between-group differences, particularly affecting brief interventions, which show limited treatment benefit (see also Hansen et al., 2012; Kypri, 2007).

Although a closer examination of our data showed that pure SH materials may not be helpful for all gamblers and for all behavioral aspects of gambling, some affected individuals may benefit from these treatment formats. Particularly notable is the use of WBs, which proved to reduce gambling frequency to a small, however, significant extent. Similarly, PFB materials showed a trend to ameliorate global symptom severity highlighting the clinical relevance of these SH formats, particularly for at-risk and problem gamblers (e.g., Marchica & Derevensky, 2016). Despite the small effect sizes, brief SH materials – especially when delivered over the Internet – offer key advantages compared with traditional, extensive FTFTs as they reach a large number of individuals, ensure cost-effectiveness, and provide treatment flexibility and anonymity (Gainsbury & Blaszczynski, 2011). Moreover, considering variations in motivational levels and symptom severity of gamblers, these treatment options align with the notion of the different stages of behavior change (Prochaska, DiClemente, & Norcross, 1992) and the conceptualization of

the stepped-care approach recommended for affected individuals (Gainsbury & Blaszczynski, 2011; Swan & Hodgins, 2015; Weinstock & Rash, 2014).

Nonetheless, the moderator analyses revealed more effective SH options providing support for high-intensity, structured Internet-based programs with MI and CBT elements (Carlbring & Smit, 2008; Casey et al., 2017). The effect size is equivalent to that obtained from FTFTs. Since only two such trials were available, the results should be interpreted with caution, and require further research. This preliminary finding, however, corresponds to those of more intense, Internet-delivered treatments for the reduction of mood and anxiety disorders (e.g., Andersson & Cuijpers, 2009; Arnberg, Linton, Hultcrantz, Heintz, & Jonsson, 2014; Haug et al., 2012; Richards & Richardson, 2012) suggesting that structured self-guided Internet-based interventions may lead to treatment benefits, possibly comparable with those found in FTFTs, and superior to bibliotherapy materials (Haug et al., 2012). Moreover, considering the reduction of financial loss, we found a significant and medium effect size for low-intensity treatments (i.e., a single session of MI delivered over the telephone alone or in combination with a CBT SH WB), which is comparable with that of high-intensity treatments underscoring the efficacy of MI for disordered gambling that represents a promising option for concerned individuals to change problematic behavior (Yakovenko, Quigley, Hemmelgarn, Hodgins, & Ronksley, 2015). It should be noted that MI was delivered through personal communication with therapists. Similar to the research focusing on CBT SH for the treatment of depression and anxiety (e.g., Andersson & Cuijpers, 2009; Spek et al., 2007), SGTs for disordered gambling with therapist contact showed an advantage over those without therapist support, although between-group differences were not significant. This finding may be due to the small number of studies including therapist contact, or mirrors the lack of acceptance of therapist guidance by concerned gamblers (Apodaca & Miller, 2003; Luquiens & Tanguy, 2016). Given the preliminary nature of these results, further studies are required to systematically investigate the influence of therapist support in SGTs on treatment outcome including the amount and the type of therapist support (Haug et al., 2012).

The limitations of this meta-analytic review include the following: First and foremost, our meta-analysis covered a relatively small number of studies. However, the short-term effect sizes were robust. Second, as is true for most meta-analytic reviews, the included studies differed in their methodological quality. However, we did not observe a systematic bias in the effect sizes due to differences in the qualities of the studies. Third, study participants varied in terms of gambling severity (pathological, moderate, or problem/at-risk gamblers). This variable was not considered in this meta-analysis, because some studies examining SGTs obtained symptoms of gambling pathology over the Internet. Despite the benefits of online tests for gamblers (for a review, see Wood & Griffiths, 2007), the validity of online diagnoses seems to be uncertain, because systematic investigations evidencing the psychometrical properties of traditional offline instruments used on the Internet have not been carried out (Andersson & Titov, 2014; Buchanan, 2003). Furthermore, most studies examining SGTs included gamblers with varying degrees of symptom severity without reporting separate data for the different subgroups of gamblers. Because these studies could not be considered for inclusion in subgroup analyses, meaningful results around this moderator were precluded due to the lack of data. Therefore, future studies are encouraged to report separate data for "problem/at-risk" and "pathological" gamblers to examine the impact of the different degrees of symptom severity on treatment outcomes. Similarly, the influential aspect of comorbidity on treatment outcomes was not addressed in this meta-analysis, because only a limited number of studies indicated the types and rates of comorbid disorders. Therefore, it remains an important issue for further investigation (e.g., Hodgins & el-Guebaly, 2010; Hodgins, Peden, & Cassidy, 2005). In addition, some participants were recruited from the general population through advertisements or from universities. Consequently, the results cannot be generalized to all patients (see also Cowlishaw et al., 2012). Again, this is a rather typical study limitation.

Despite these limitations, this study favors FTFTs over SGTs for the reduction of problematic gambling behavior, especially, when conducted over an extended period of time. Given the rapid growth of gambling problems, future research requires to further improve the treatments for this disabling condition.

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