Exposure Therapy for Gambling Disorder: Systematic Review and Meta-analysis

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Abstract

Purpose of Review Cognitive behaviour therapy is the gold standard for the treatment of gambling disorder. Obstacles remain regarding its efficacy, namely relapses and difficulty in implementing cognitive restructuring for some clients. Given these observations, behavioural interventions for gambling disorder, such as exposure therapy, which aims to decrease gambling craving, may be effective as a complementary or alternative intervention to cognitive behaviour therapy. This systematic review and meta-analysis aims to explore how exposure therapy for gambling disorder has been studied and to evaluate its efficacy. To answer these questions, 3406 studies, retrieved using PsycNet, Medline and Google Scholar, were screened.
Recent Findings After two screenings, 13 papers were selected for the systematic review and five were statistically combined for the meta-analysis. Quantitative results support exposure therapy's efficacy to decrease gambling craving at post-intervention ($g = -0.955$) and at last follow-up (6 or 12 months; -1.010). Results also show a large decrease in gambling severity as documented by screening instruments (-1.087) as well as time spent gambling (-2.136) at post-intervention. Furthermore, a large decrease in gambling measured via screening instruments (-1.162) and erroneous beliefs (-1.308) was found at last follow-up.
Summary This is the first meta-analysis on behavioural exposure therapy for gambling disorder. Results support that exposure therapy reduces gambling cravings and severity, as well as time spent gambling and erroneous beliefs. These results are discussed in comparison to other therapeutic approaches and are interpreted according to the high risk of bias in included studies.

Keywords Gambling disorder therapy · Cognitive-behaviour therapy · Exposure therapy

Introduction

Gambling disorder (GD) is recognised as a persistent and recurrent problematic gambling behaviour leading to clinically significant impairment or distress [1]. To this day, cognitive behaviour therapy (CBT) is the most empirically validated treatment for GD [2•, 3]. CBT integrates behavioural interventions with aspects of cognitive therapy. It is used alone or in combination with motivational interventions. A recent systematic review of treatments for problem

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gambling found some benefits of CBT in the short term; only a few studies demonstrated long-term benefits [4].

Many problem gambling etiological models consider erroneous beliefs as a significant contributing factor in developing GD [5–8]. Given this contribution, it is natural that many CBT interventions include and may primarily rely on cognitive restructuring. Cognitive restructuring comprises both the identification of erroneous thoughts and the restructuring of those thoughts. The most used technique to identify erroneous beliefs is exposure to a gambling scenario [9•]. Cognitive therapy by itself could have no better benefits in the short or long term relative to an active control condition (exposure therapy) [4]

Recent addiction management literature [10, 11] also demonstrates that exposure to a gambling scenario may also be used as a stand-alone therapy. The rationale for exposure therapy is that by definition, addiction is a learned behaviour resulting from the coupling of substance use and pleasure, and can therefore be un-learned. In order to support the

unlearning process, cue-exposure therapy presents individuals with relevant drug cues to extinguish the conditioned response [12–14]. This conceptualisation is based on learning theory, according to which drugs represent an unconditioned stimulus, and the effects are the unconditioned responses. By associative learning, neutral stimuli such as visual, olfactory, tactile and auditory cues can elicit a conditioned craving response, as these cues are frequently paired with drug use [13, 15, 16].

Exposure in the Gambling Literature

Exposure has taken different forms in gambling treatment, such as imaginal desensitisation and exposure with response prevention [17–20]. These variations of exposure therapy share the same core conceptualisation as cue-exposure therapy for addiction and can take the form of imaginal, in vivo or virtual reality exposure [21, 22]. Battersby et al. [21] use exposure therapy to specifically target gambling craving. Gambling craving can manifest as physical sensations such as heart palpitations or muscle tension, emotional states like stress and increased arousal, or as thoughts pertaining to different aspects of gambling (i.e. dreams of winning or negative flashbacks; [23]). To extinguish craving induced by gambling cues, Battersby et al. [21] use graded exposure where initial cues elicit less craving, thus making them easier to cope with and progressively become more challenging. Authors suggest that this type of graded exposure makes it easier for patients to concentrate on cravings elicited by the cue and experience a reduction of craving over time. It is expected that cravings will diminish over the course of therapy through a process called habituation.

To date, only one study has sought to summarise exposure therapy's efficacy for the treatment of GD. In their 2008 narrative review, Dowling, Jackson and Thomas [18] concluded that exposure therapy appears to be a promising technique for the treatment of GD, yet requires further empirical evidence to confirm its efficacy. This review did not predetermine which outcome measures would be used to quantify exposure therapy's efficacy in treating GD. Given the key role of craving in exposure therapy's rationale [21], an investigation of exposure therapy should first establish its efficacy in lowering the craving to gamble. Dowling et al.'s [18] review included studies that contained data on perceived self-efficacy in controlling gambling behaviour [24] making it another important outcome to investigate. Perceived self-efficacy is defined as an individual's belief in their ability to resist an opportunity to gamble in a given situation [25, 26]. A systematic review by Chrétien et al. [9•] found that reported gambling behaviour (i.e. the amount of time and money spent gambling) and severity of problem gambling measured with screening instruments

were the most commonly documented efficacy variables in GD therapy studies. Lastly, erroneous beliefs are often documented in GD intervention studies [9•], as they are believed to be central to GD aetiology and maintenance [5–7]. Documenting exposure therapy's efficacy in lowering erroneous beliefs will provide a way to contrast its efficacy to other therapeutic approaches.

Objectives

The main objective of this systematic review and meta-analysis was to document the use of exposure therapy as a behavioural treatment of GD and to evaluate its efficacy. To do so, the current study sought to determine to what extent exposure therapy reduces: (1) gambling craving; (2) severity of problem gambling; (3) gambling behaviour; (4) erroneous beliefs; and (5) increases perceived self-efficacy.

Method

Protocol

This systematic review and meta-analysis was conducted according to the recommendations outlined in the Cochrane Handboock for Systematic Reviews of Interventions [27]. Findings were reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [28].

Search Strategy

In order to be included in the meta-analysis, potential studies must have (1) an exposure therapy condition; (2) one or more of the following measurements: severity of GD, gambling behaviours (money spent, time spent, etc.), craving intensity and perceived self-efficacy; (3) data for pathological or at-risk gamblers according to a screening instrument or clinical interview; (4) been written in French or English; and (5) been published since 1980, year of the introduction of pathological gambling in the DSM-III. Studies that documented the efficacy of CBT programs with exposure therapy as one of the treatment components were excluded.

A three-step systematic review of the literature was conducted to identify relevant studies. First, the electronic databases PsychNET (via APA), MEDLINE (via PubMed) and Google Scholar were screened up to July 1st, 2019. For PsychNET and Google Scholar, the following search equation was used: {*exposure* OR *virtual reality* OR *imaginal desensitization* OR *imaginal relaxation* OR "in

vivo"} AND {*gambl**} in any field and index terms. For Medline, the following search strategy was used: {*exposure therapy* OR *Virtual Reality Exposure Therapy* OR *Desensitization, Psychologic*} AND {gambl*} where the first part of the criteria was in *MESH* terms. These strategies were developed with the help of a specialised social sciences librarian. The reference lists of selected articles were also retrieved from the databases to identify other potential eligible studies. Lastly, authors of selected studies were contacted by e-mail to inquire about unpublished data. No paper was added to the screening by the use of the last two strategies.

Study Selection

First, study eligibility was determined by reading article titles and abstracts. For the first step of article screening, interrater agreement between the first author and a graduate research assistant was based on a random sample of 10% of the studies. The first author carried out the rest of the screening. Studies that passed the initial screening were then read in their entirety. For this second selection, interrater agreement was based on the full-sample and carried out by the first author and an undergraduate research assistant. Disagreements were settled by consensus.

Data Extraction

As suggested by the Cochrane Collaboration [27], a data extraction form was developed to gather all relevant study information. The data extraction form included information on authors, methodology (experimental design, condition assignment), participant characteristics, outcome measures and results. A double data entry was carried out by the first author and a trained undergraduate research assistant. Disagreements were settled by consensus.

Assessment of Risk of Bias in Included Studies

In accordance with the Cochrane Risk of Bias assessment tool [27], each of the following study's risk of bias was rated "High", "Low" or "Unclear": random sequence generation (selection bias); allocation concealment (selection bias); blinding of participants, personnel and outcome assessors (detection bias); incomplete outcome data (attrition bias); selective outcome reporting (reporting bias); and other potential threats to validity (see [28] for a complete description).

Outcome Measures

Gambling craving was the primary outcome variable in this study. Secondary outcome variables included the time and money spent gambling, the frequency of gambling, GD screening scores and erroneous beliefs and perceived self-efficacy measured with validated self-report questionnaires.

Unit of Analysis

Analyses compared data for a number of outcome variables from baseline to post-intervention and last follow-up using Hedges' g as the measure of effect [29, 30]. Hedges' g provides a standardized mean difference with a correction for small sample size and is interpreted as a z score, where the output represents the number of pooled standard differences between two timepoints [29, 31]. In the present study, a negative Hedges' g indicates a decrease in the given variable at post-intervention or last follow-up. Hedges' g is interpreted similarly to Cohen's d, where 0.2, 0.5 and 0.8 represent small, medium and large effects, respectively [29, 32]. Effect sizes were calculated using Biostat software Comprehensive Meta-analysis (Biostat Inc., Engelwood, NJ) using timepoint means, standard deviations and pre-post-correlation estimates for each variable. Pre-post-correlation estimates were calculated using data from other gambling clinical studies [33, 34]. Forest plots were also calculated according to these analyses, including Hedges's g, variance and global effect size for each variable according to a random measure effect with a 95% confidence interval.

Results

Descriptive Data Analysis

Sample

As shown in Fig. 1, 3406 publications were initially screened, and from those, 3393 were excluded. Most of these articles were excluded because they did not include exposure therapy. Interrater agreement reached 95.1% for the screening and 99% for the full sample. Thirteen articles were retained for the final sample.[1] Even though four were single-case studies and one had only two participants, these studies are included in the study descriptive as they provide input on how exposure therapy has been used on gambling treatment. The meta-analysis therefore includes six studies.

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[1] Of the 13 selected studies, Riley, Smith and Oakes (2011) [23] had two eligible groups for the current meta-analysis. Therefore, these groups are presented separately as [43] and [44●●] (see Table 1).

Fig. 1 PRISMA study selection flowchart
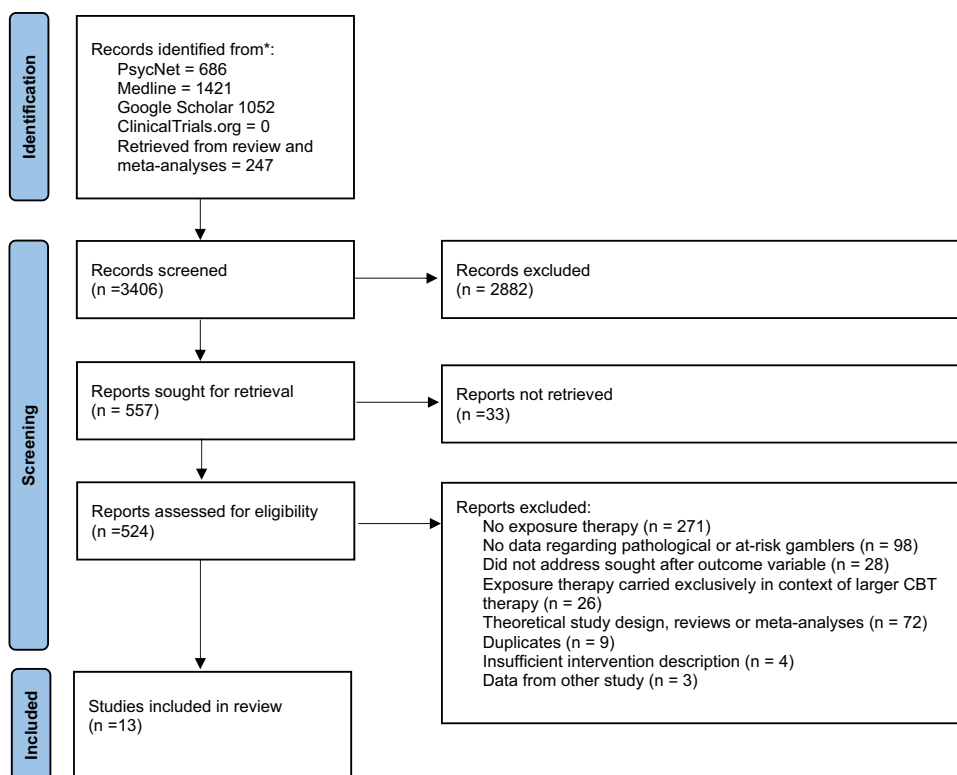
From 13 selected studies, 948 participants were allocated to an exposure condition. Excluding single-case studies [36, 39, 42, 47], the mean number of participants was 104.9 (SD = 104.1, median = 49). Participants from 12 studies [34–39, 41–43, 44••, 45, 46••] reported gambling mostly or exclusively on electronic gambling machines, while the majority of participants in the remaining study [40] bet on horse races.

Eight of the included studies provided baseline descriptive data on time spent gambling [34, 36–39, 43, 44••, 47] and four on money spent on gambling[34, 37–39]. Participants in these studies spent an average of 6.9 h per week (SD = 2.2, min = 3.8, max = 12.8) gambling and had spent an average of $441.40 USD per week on gambling (SD = 455.30, median = 150). Table 1 provides data on participant characteristics, study localisation as well as included studies referencing number for the current article.

Intervention

Nine studies were carried out in outpatient settings [34, 35, 37–39, 42, 43, 44••, 45, 46••], three in inpatient settings [36, 40, 41] and one study did not specify the context of treatment [47]. Three studies used in vivo exposure [37–39], three imaginal exposure [34, 35, 40] and seven used a mix of both techniques [36, 41–43, 44••, 45, 46••, 47]. Six of the seven studies using both imaginal and in vivo exposure included a gradual increase in difficulty by first using imaginal exposure and then in vivo exposure [36, 42, 43, 44••, 45, 46••, 47]. Participants met with a therapist 7.4 times on average (median = 9.5) and took part in an average of 23.1 exposure sessions (either with the therapist or as betweensession homework; SD = 19.9, median = 14). Table 2 provides characteristics of the exposure session for each study.

Theory and Learning Processes Behind Exposure Therapy

Five studies considered habituation to be the mechanism of action of the intervention [36, 42, 43, 44••, 45, 47]. One study aimed to lower gambling behaviour and craving, a definition considered similar to habituation for the current review [37]. Two studies involved altering the behaviour completion mechanism such that participants would no longer feel compelled to gamble in a gambling environment [40, 41]. One study [38] aimed to increase participants' perceived self-efficacy through craving resistance. The remaining studies did not describe their intervention's mechanism of action [34, 35, 39, 46••]

Table 1 Participants' sociodemographic characteristics

Study	Reference number	N (final)	Gender (Men %)	Age	Country	Problematic game	Hours spent gambling (per month)	Gambled money (USD per week)
Blaszczynski 2005	[25]	79 (47)	77	37.1 (10.9)	MI	60% EGM[c] 32% horse betting 8% combination of both	12.8 (9.2)	1352 (median = 150)
Blaszczynski 2003	[36]	9 (2)	55	32.5 (7.7)	55% Australia 15% Croatia 30% other	90% EGM 15% many games	MI	MI
Dham 2015	[37]	1 (1)	100	56	MI	MI	30	MI
Echeburúa 1996	[38]	16 (16)	44	35 (11)	MI	EGM	24.3 (25.6)	99.6
Echeburúa 2000	[39]	23 (23)	87	36 (13.7)	100% Spain	EGM	52.2	127
Echeburúa 2002	[40]	1 (1)	0	47	MI	EGM	26.1	187
McConaghy 1988	[41]	10 (10)	95	35	MI	70% horse racing 10% EGM 20% combination of both	MI	MI
McConaghy 1991	[42]	80 (43)	94.7	42	MI	MI	MI	MI
Oakes 2008	[43]	1 (1)	0	31	MI	EGM	MI	MI
Riley 2011 (metropolitan)	[44••]	496 (496)	51.4	43.7 (12.6)	MI	89.9% EGM	14.5 (9.6)	MI
Riley 2011 (rural)	[44••]	55 (55)	54.5	45.3 (11.7)	MI	90.1% EGM	19.7 (6.3)	MI
Smith 2010	[45]	127 (83–80[a])	54	43.1 (12.7)	MI	86.6% EGM	MI	MI
Smith 2015	[35]	49 (43)	50	45.5 (12)	MI	EGM	16 (25.6)	MI
Tolchard 2006	[46••]	1 (1)	0	50	MI	EGM	MI	MI

Data are mean (standard deviation) unless stated otherwise. Hours spent gambling are normalised to month format when necessary.

MI missing information, *EGM* electronic gambling machine.

[a]Follow-up number of participants differs according to each variable.

Outcome Variables

The most common outcome variables were time spent gambling at post-intervention [34, 36, 39, 43, 44••, 46••]; gambling craving using the Gambling Urge Scale [48; 45, 46••], visual analogue scale [34, 35] or categorical scale [40]; erroneous beliefs using the Gambling-Related Cognitions Scale [49; 36, 45, 46••] and the Gambling Beliefs Questionnaire [50; 35]; and subjective indicators [37–39, 47]. Studies also used three GD screening instruments: three used the Victorian Gambling Screen [VGS; 51; 36, 45, 46••], three used the South Oaks Gambling Screen [SOGS; 52; 42, 43, 44••, 47] and one used the Canadian Problem Gambling Index [53; 36]. Table 3 provides a detailed account of the gambling related outcomes for the selected studies.

Risk of Bias in Selected Studies

Risk of bias of the included studies is presented in Table 4. The studies included in this review had a high risk of bias

due to the lack of blinding of study personnel, random sequence generation and allocation concealment.

Meta-analyses

Four variables were analysed at post-treatment and at the longest available follow-up. Five studies [35, 37, 39, 47] had too few participants (≤ 2) and therefore could not be statistically combined for Hedges' *g*. One study [38] combined outcome variables in the Inadaptation Scale [54], making it impossible to include them in analyses. Two more studies [40, 41] also contained selected outcome variables measured categorically and were thereby unable to be pooled with the continuous data from the other studies. For studies included in the meta-analyses [34, 37, 43, 44••, 45], last follow-up is either 6 [46••] or 12 months [34, 37, 45]. No analysis could be carried out on perceived self-efficacy, as only one study had enough participants for this outcome.

Figure 2 shows the forest plot for each analysis according to a random effects model with 95% confidence interval. Included variables pertained to gambling craving, GD screening instruments, time spent gambling and erroneous beliefs.

Table 2 Treatment description

Study	Therapeutic mechanism	Intervention aim	Number of meetings	Number of exposure	Type of exposure	Intervention description
Blaszczynski 2005	MI	MI	1	15	Imagination	- Muscle relaxation - Imaginal exposure with emphasis on gambling craving until extinction (10–20 min) - Home imaginal exposure with audiocassette, three times a day, five days a week
Blaszczynski 2003	MI	Reduction in subjective arousal and heart rate responses	10	10	Imagination	- Imaginal exposure using an audiocassette specific to main problematic game (EGM or horse betting)
Dham 2015	Habituation	MI	MI	MI	Imagination and in vivo	Graded exposure - Imaginal exposure with response prevention - In vivo exposure with response prevention - Exposure homework
Echeburúa 1996	Make exposure cues lose their power to induce urge and gambling behaviour	Gambling abstinence	6 (6.5 h)	MI	In vivo	Graded exposure with: - Stimulus control: maintaining control of money and avoiding situations or routes of risk - Response prevention: forces to experience gambling craving and learn to resist this desire
Echeburúa 2000	Learn how to resist this desire in a gradual, more self-controlled way	Gambling abstinence	MI	MI	In vivo	Graded exposure with: - Stimulus control: maintaining control of money and avoiding situations or routes of risk - Response prevention: forces to experience gambling craving and learn to resist this desire
Echeburúa 2002	MI	Gambling abstinence	9 (+ 3 evaluation sessions)	54 (6 exposure per week for 9 weeks)	In vivo	Graded in vivo exposure involving a relative as co-therapist
McConaghy 1988	Behaviour completion mechanism	- Lower level of arousal - Reduction in gambling	14	14	Imagination	Imaginal desensitisation: - Muscle relaxation - Imaginal exposure with response prevention

Table 2 (continued)

Study	Therapeutic mechanism	Intervention aim	Number of meetings	Number of exposure	Type of exposure	Intervention description
McConaghy 1991	MI	MI	14	14	Imagination or In vivo	Two different treatment: - Imaginal desensitisation ○ Muscle relaxation ○ Imaginal exposure with response prevention - In vivo brief ○ In vivo exposure with response prevention lasting 20 min
McConaghy 1991 (suite)	MI	MI	5	5	In vivo	In vivo exposure with response prevention for one hour at a time
Oakes 2008	Habituation	MI	6	60 à 84	Imagination and in vivo	Graded exposure until habituation. From imaginal exposure to in vivo exposure
Riley 2011 (metropolitan)	Habituation	MI	11.29 (SD=12.60)	MI	Imagination and in vivo	Graded exposure until habituation. From imaginal exposure to in vivo exposure
Riley 2011 (rural)	Habituation	MI	11.29 (SD=12.60)	MI	Imagination and in vivo	Graded exposure until habituation. From imaginal exposure to in vivo exposure
Smith 2010	Habituation	- Master urge to gamble - Feel comfortable being alone in a gambling venue with money in the close proximity of gaming machines - Not requiring any modifying factors to help cope with their urge to gamble	MI	MI	Imagination and in vivo	- Graded exposure using audiocassettes - From imaginal exposure to in vivo exposure in gambling venues familiar to each participant - Exposure homework for 5 to 7 weeks
Smith 2015	MI	MI	12	MI	Imagination and in vivo	- Graded exposure with stimulus control - Stimulus control is faded out as weeks progress - From imaginal exposure to in vivo exposure

Table 2 (continued)

Study	Therapeutic mechanism	Intervention aim	Number of meetings	Number of exposure	Type of exposure	Intervention description
Tolchard 2006	Habituation	Eliminate the gambling urge using habituation	1	1	Imagination and in vivo	- Graded exposure within a single session - From imaginal exposure to in vivo exposure outside gambling venue and inside gambling venue - Progression to the next step when craving has dropped to 50% initial craving

MI missing information.

Table 3 Outcome variables related to gambling in each selected study

	Blaszczynski 2005	Blaszczynski 2003	Dham 2015	Echeburúa 1996	Echeburúa 2000	Echeburúa 2002	McConaghy 1988	McConaghy 1991	Oakes 2008	Riley 2011	Smith 2010	Smith 2015	Tolchard 2006	Total
Time spent gambling	X		X			X				X		X		5
Craving	X	X					X				X	X		5
Erroneous beliefs		X	X								X	X		4
Subjective indicator				X	X	X							X	4
Victorian Gambling Screen			X								X	X		3
Therapeutic success				X	X			X						3
South Oaks Gambling Screen									X	X			X	3
Frequency of gambling						X	X							2
Money spent	X					X								2
Self-control	X	X												2
Preoccupations towards gambling	X													1
Problem Gambling Severity Index			X											1

Table 4 Bias assessment using Cochrane risk assessment tool

Study	Random sequence generation	Allocation concealment	Blinding	Attrition bias	Selective outcome reporting	Other potential threats to validity
Blaszczynski 2005	-[a]	-	-	-	?[b]	?
Blaszczynski 2003	+[c]	+	-	-	-	?
Dham 2015	-	-	-	+	-	?
Echeburúa 1996	+	?	-	+	?	?
Echeburúa 2000	+	+	+	+	?	?
Echeburúa 2002	-	-	-	+	+	?
McConaghy 1988	+	?	-	+	?	-
McConaghy 1991	+	?	+	-	-	-
Oakes 2008	-	-	-	+	?	?
Riley 2011	-	-	-	+	?	?
Smith 2010	-	-	?	+	?	?
Smith 2015	+	+	+	+	+	?
Tolchard 2006	-	-	-	+	-	?

[a]High risk of bias

[b]Uncertain risk of bias

[c]Low risk of bias

Craving

Three studies were included in the analyses of exposure therapy's impact on craving post-treatment [34, 45, 46••]. Pooled results show a decrease in mean Gambling Urge Scale [32] and visual analogue scale scores from 12.31 ($sd_{pooled} = 6.49$) to 8.17 ($sd_{pooled} = 6.12$). This decrease is equivalent to a Hedge's g of -0.955 (CI = [$-1.78, -0.13$]), $p = 0.024$, corresponding to a large effect [29, 32].

Two studies were included in the analyses of exposure therapy's impact on craving at last measure [45, 46••]. Pooled mean scores on the Gambling Urge Scale [48] decreased from 13.71 ($sd_{pooled} = 7.32$) to 2.89 ($sd_{pooled} = 10.21$) at last measure. This decrease is equivalent to a Hedge's g of -1.010 (CI = [$-1.51, -0.51$]), $p < 0,001$, corresponding to a large effect [29, 31, 32].

GD Screening Instruments

Three studies totalling four groups [44••, 45, 46••] were included in the analysis of exposure therapy's impact on GD screening instruments at post-intervention. SOGS pooled average scores decreased from 9.57 ($sd_{pooled} = 4.33$) to 4.01 ($sd_{pooled} = 4.37$) in two groups [44••] and VGS pooled scores decreased from 38.14 ($sd_{pooled} = 10.87$) to 29.13 ($sd_{pooled} = 10.01$) at post-intervention for the two other groups [45, 46••]. Hedges' g was -1.09 (CI = $-1.54, -0.64$), $p < 0.001$, corresponding to a large effect [29, 32].

Given that the two groups [44••] documenting SOGS score did not have follow-up measures, VGS score in the two remaining studies [45, 46••] represents GD screening instrument scores for the last measure. Pooled VGS scores decreased from 38.14 ($sd_{pooled} = 10.87$) to 15.83 ($sd_{pooled} = 16.33$) at last measure, equivalent to a Hedge's g of -1.69 (CI = [$-2.750, -0.63$]), $p = 0.002$, which indicates a large effect [29, 32].
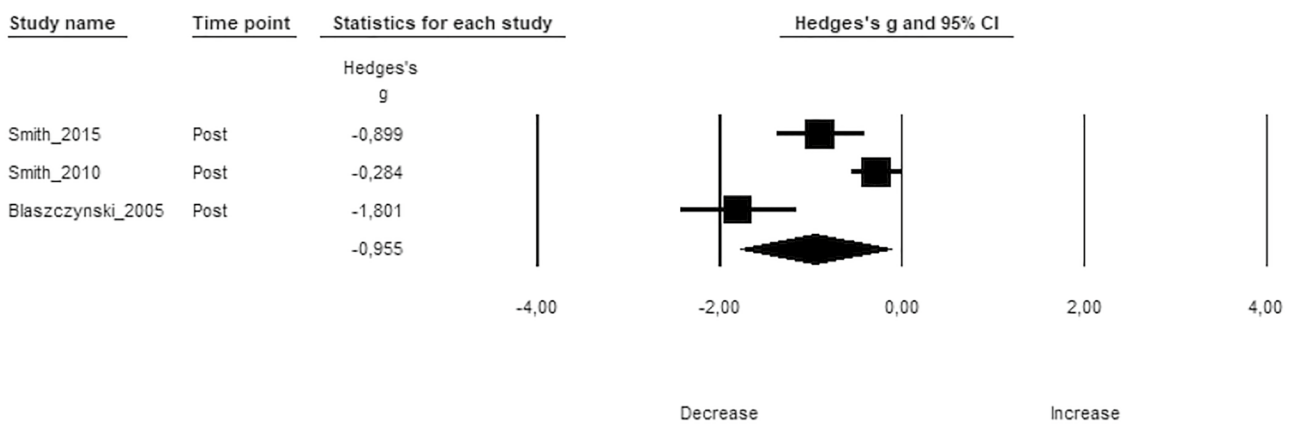
Time Spent Gambling

Four studies (totalling five groups; 1R, 4R, 10R, 11R, 13R) were included in the analysis of exposure therapy's impact on time spent gambling at post intervention. The average hours spent gambling per month decreased from 18.51 ($sd_{pooled} = 6.52$) to 3.21 ($sd_{pooled} = 4.33$) h post-treatment. A large effect was observed for this outcome with a Hedge's g of -2.16 (CI = [$-3.05, -1.27$]), $p < 0.001$ [29, 32].

Two studies were included in the analysis of exposure therapy's impact on time spent gambling at last measure [39, 46••]. Mean hours spent gambling per month fell from 18.02 ($sd_{pooled} = 8.05$) to 2.90 ($sd_{pooled} = 2.72$). Hedge's g was non-significant, -2.45 (CI = [$-5.34, 0.44$]), $p = 0.096$.
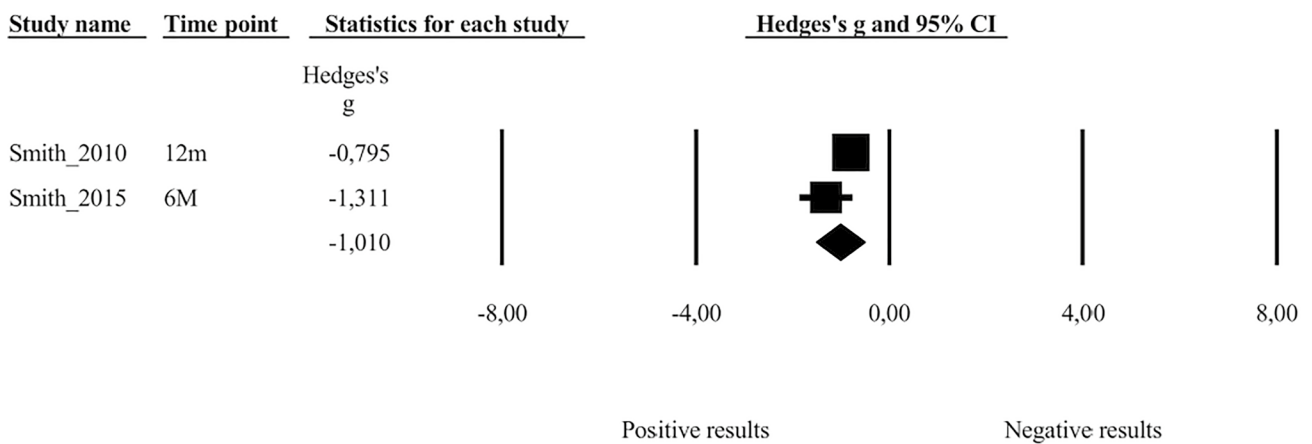
Erroneous Beliefs

Two studies were included in the analyses of exposure therapy's impact on erroneous beliefs at post intervention

Craving : post intervention

Study name	Time point	Statistics for each study
		Hedges's g
Smith_2015	Post	-0,899
Smith_2010	Post	-0,284
Blaszczynski_2005	Post	-1,801
		-0,955

Hedges's g and 95% CI

Decrease   Increase

Craving : last measure

Study name	Time point	Statistics for each study
		Hedges's g
Smith_2010	12m	-0,795
Smith_2015	6M	-1,311
		-1,010

Hedges's g and 95% CI

Positive results   Negative results

GD screening instruments: post intervention

Study name	Time point	Hedges's g
Riley_2011_Rural	Post	-1,350
Riley_2011_Metropolitan	Post	-1,267
Smith_2010	Post	-0,487
Smith_2015	Post	-1,354
		-1,087

Hedges's g and 95% CI

Favours Exposure therapy   Does not favour Exposure therapy
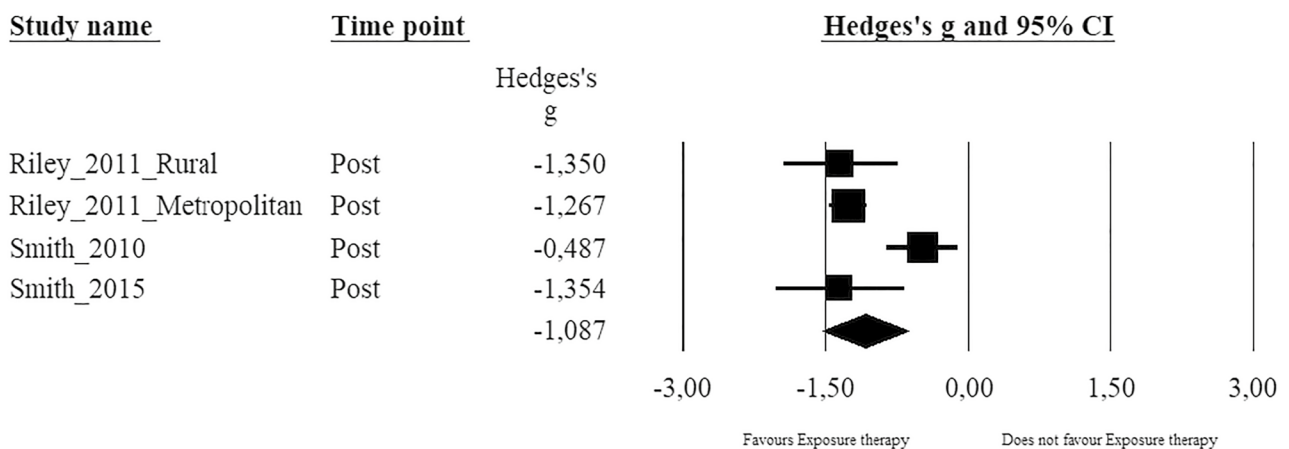
Fig. 2 Meta-analyses' Forest-plots

GD screening instruments: last measure

Study name	Time point	Hedges's g	Hedges's g and 95% CI
Smith_2010	12m	-1,184	
Smith_2015	6m	-2,268	
		-1,690	

Favours Exposure therapy   Does not favour Exposure therapy
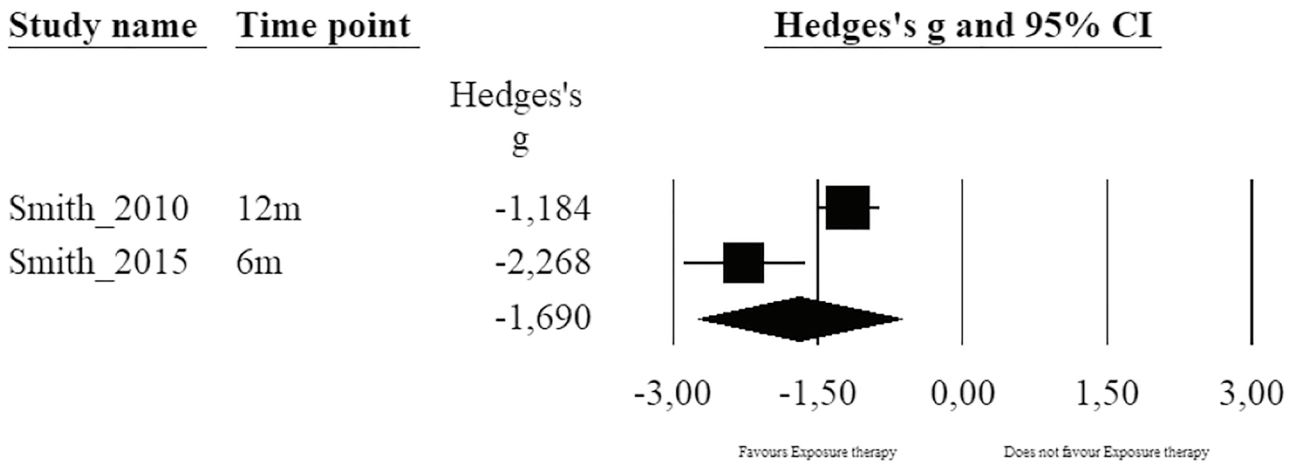
Time spent gambling: post intervention

Study name	Time point	Statistics for each study		Hedges's g and 95% CI
		Hedges's g		
Blaszczynski_2005	Post	-1,428		
Riley_2011_Rural	Post	-1,540		
Riley_2011_Metropolitan	Post	-2,974		
Smith_2015	Post	-2,600		
Echeburua_1996	Post	-1,002		
		-1,921		

Less time spent gambling   More time spent gambling
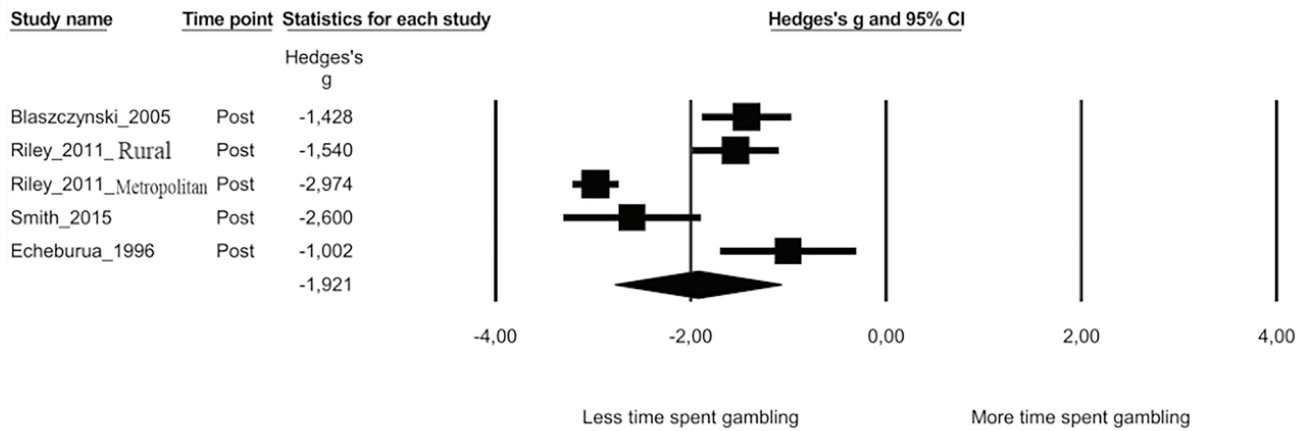
Time spent gambling: last measure

Study name	Time point	Statistics for each study		Hedges's g and 95% CI
		Hedges's g		
Smith_2015	6m	-3,948		
Echeburua_1996	12m	-1,000		
		-2,452		

Less time spent gambling   More time spent gambling
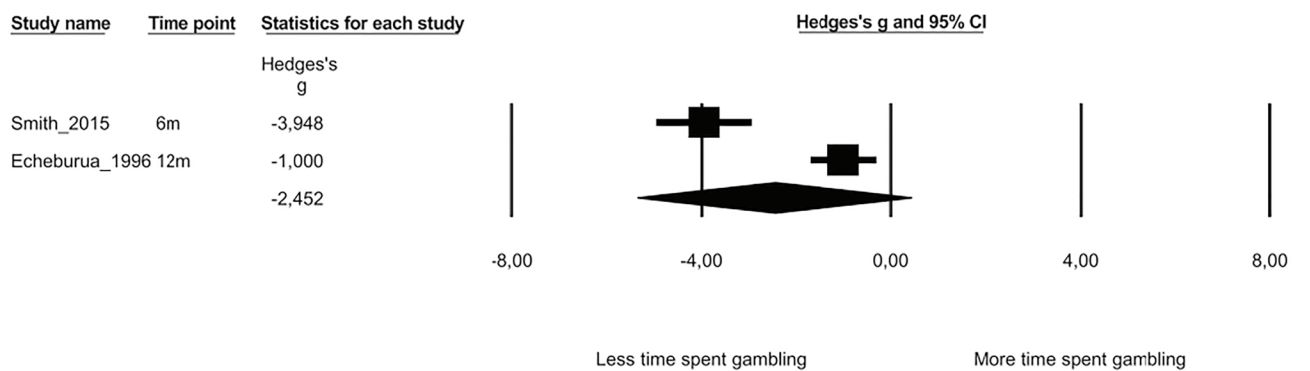
Fig. 2 (continued)

Erroneous beliefs: post intervention
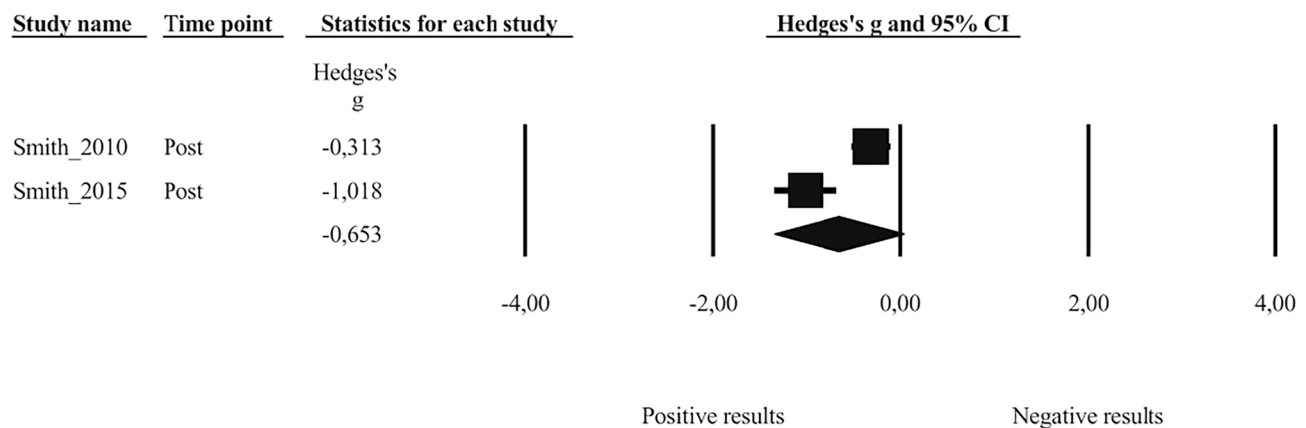
Erroneous beliefs: Last measure
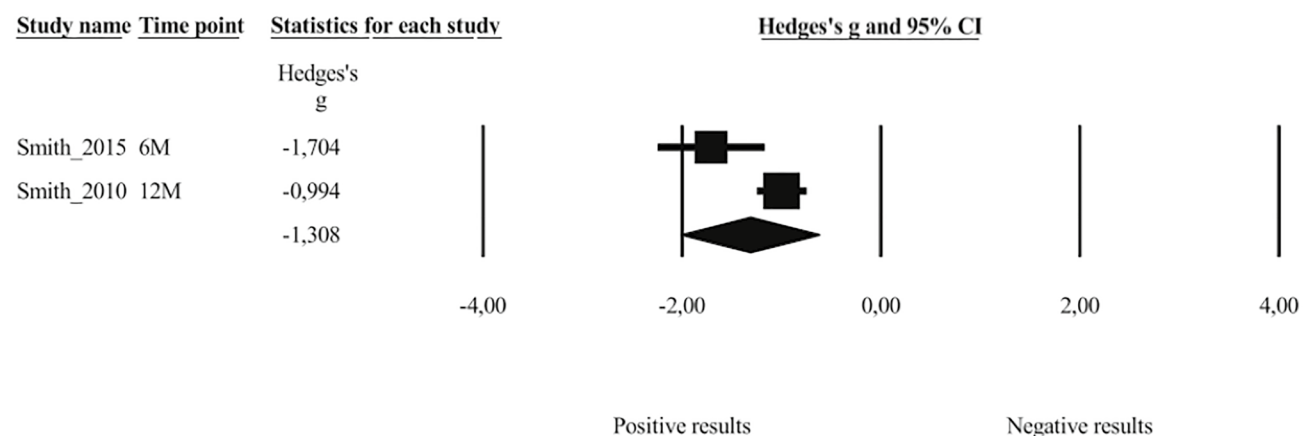
Fig. 2 (continued)

[45, 46••]. Pooled mean Gambling Related Cognitions Scale [49] scores decreased from 68 ($sd_{pooled} = 21.5$) to 55.4 ($sd_{pooled} = 19.5$) which was also non-significant, Hedge's $g = -0.65$ (CI = [− 1.34, 0.04]), $p = 0.064$.

Two studies were included in the analyses of exposure therapy's impact on erroneous beliefs at last measure [45, 46••]. Pooled Gambling Related Cognitions Scale [48] mean scores decreased from 68 ($sd_{pooled} = 21.5$) to 34.15 ($sd_{pooled} = 25.14$). A large effect was observed for this measure, Hedge's $g = -1.31$ (CI = [− 2.00, − 0.62]), $p < 0.001$ [29, 32].

Table 5 summarises data relating to quantitative analyses for each outcome.

Discussion

This systematic review and meta-analysis aimed to describe how exposure therapy is implemented in the treatment of GD, as well as its efficacy in reducing cravings, gambling behaviour and screening test scores, as well as decreasing erroneous beliefs and improving perceived self-efficacy.

Studies Description

To date, exposure therapy for GD has been most widely studied in predominantly male participants, with more recent

Table 5 Summary of quantitative findings

Variable	Pre intervention pooled mean (pooled sd)	Post intervention pooled mean (pooled sd)	Last follow-up pooled mean (pooled sd)	Hedges' g	CI (95%)	p
GD screening instruments (pre-post-intervention)[A]	9.57 (4.33)	4.01 (4.37)	N/A	−1.087	−1.536, −0.637	<0.001
	38.14 (10.87)	29.13 (10.01)				
Victorian gambling screen (pre-last follow-up)	38.14 (10.87)	N/A	15.83 (16.33)	−1.162	−1.976, −0.347	0.002
Time (pre-post intervention)	18.51 (6.52)	3.22 (4.32)	N/A	−2.136	−3.034, −1.238	>0.001
Time (pre-intervention – last follow-up	18.02 (8.05)	8.05	2.90 (2.72)	−2.452	−5.340, 0.437	0.096
Craving (pre-post intervention)	12.31 (6.49)	8.17 (6.12)	N/A	−0.955	−1.782, −0.129	0.024
Craving (pre-intervention—last follow-up)	13.71 (7.32)	N/A	2.88 (10.21)	−1.010	−1.508, −0.512	>0.001
Erroneous beliefs (pre-post intervention)	68 (21.5)	55.4 (19.5)	N/A	−0.653	−1.343, 0.038	0.064
Erroneous beliefs (pre-intervention – last follow-up)	68 (21.5)	N/A	34.15 (25.14)	−1.308	−1.999, −0.617	<0.001

[A]Pooled means and SD are presented in two lines to differentiate SOGS score (first result) and VGS score (second result). Hedges' g, CI, and p data combine results from SOGS and VGS on this line.

studies striving to include more women in their samples. Exposure therapy for GD was studied in two countries, Australia and Spain, and participants mainly preferred electronic gambling machines. Participants were mostly seen individually and in outpatient settings.

Most studies presented a mix of imaginal and in vivo exposure with exposure intensity gradually progressing as participants became increasingly capable of successfully confronting each cue. Most exposure therapy studies were theoretically based on habituation, such that exposure to different gambling cues induces craving, yet as the craving is not acted upon, it decreases and would ultimately be extinguished. This rationale is akin to systematic desensitisation as originally developed in the 1950s [55].

Only three studies had therapeutic mechanisms other than habituation. McConaghy et al.'s studies [40, 41] conceptualise exposure therapy as a means of altering the behaviour completion mechanism, leading patients to no longer feel compelled to gamble in a gambling environment. McConaghy et al. (1988) [40] conclude that it is not possible to determine if the behaviour completion mechanism better explains exposure therapy's efficacy. Echeburúa el al. [38] conceptualise that exposure therapy raises perceived self-efficacy to not gamble when faced with gambling situations. This conceptualisation resembles that of more recent inhibitory learning views of exposure therapy for anxiety [56]. According to this model, exposure does not produce the unlearning between a cue and a conditioned response but rather produces a new learning that inhibits the conditioned response. Combining this conceptualisation to Echeburúa et al.'s (2000) [38], craving would be the conditioned response and increased self-efficacy would

be the new learning brought about by exposure, which would in turn reduce the craving to gamble. Given that this conceptualisation has yet to be applied to GD, future studies in line with this understanding would further clarify how exposure therapy works, while potentially providing a treatment description that better reflects participants' subjective experience.

Last of all, the analysis of selected studies shows a high risk of bias as a result of insufficient blinding of study personnel, random sequence generation and allocation concealment. Moreover, only two to three studies conducted in Spain and Australia could be included in each meta-analysis. This highlights the necessity for more methodologically sound studies to evaluate exposure therapy for GD in order to better ascertain its efficacy.

Exposure Therapy's Efficacy

Exposure therapy had a large effect on craving reduction at post intervention and was even larger at 6- and 12-month follow-up. Confidence intervals were also closer to the corresponding g measure, indicating that results are more homogenous at follow-up. These results from the limited literature on exposure therapy support its efficacy in lowering gambling cravings. The effect of exposure therapy was larger at follow-up, which is similar to other studies of CBT [see 57]. Improved results at follow-up may be attributable to participants' continued application of techniques learned in therapy; however, this has yet to be empirically tested. It is important to mention that one study did not include follow-up data on gambling craving, which may explain the more homogenous results and higher effect size data. Overall, it is surprising that

only five of the 13 studies tested exposure therapy's effect on reducing craving, given this variable's crucial importance to treatment rationale.

From a statistical viewpoint, a large decrease of gambling screening instruments score was attained at post-treatment. Using SOGS's cut-off scores, pooled means decreased from "probable pathological gambler" to "potential pathological gambler". Using VGS cut-off scores, pooled mean results decreased at post-intervention while remaining in the "problem gambler" range. For final follow-up, pooled mean results indicate a score of "borderline gambling". These large decreases remain lower than what was obtained from CBT in comparison to control in Cowlishaw et al.'s (2012) meta-analysis [2•]. Looking at other therapies investigated in the same meta-analysis, exposure therapy's efficacy to lower participants gambling screening scores indicate that it is the next best intervention to reduce GD severity. This result is preliminary as it was derived from only a few studies with a high risk of bias. Nevertheless, these preliminary results are encouraging and support the efficacy of exposure therapy to reduce the severity of gambling behaviour.

Results show that exposure therapy produces a substantial decrease in time spent gambling at post-intervention, yet these results became non-significant at 6 to 12 months post-intervention. Given that confidence intervals were particularly large at last follow-up, the loss of significance may be attributable to the larger variance resulting from a small number of combined studies comprising few participants. Further studies with larger sample sizes are likely required to detect statistical significance. Still, Echeburúa et al. (2000) [38] have argued that adding relapse prevention after exposure therapy produces more therapeutic success than exposure therapy alone after 12 months. The effect of supplementing exposure therapy with relapse prevention should therefore also be studied in order to establish its added value.

Meta-analysis of two studies shows that exposure therapy resulted in a non-significant decrease in participants' erroneous beliefs at post-intervention, yet showed a large and significant effect at 6 and 12 months. These results appear in line with past studies suggesting that higher levels of erroneous beliefs are associated to with higher levels of problem gambling severity [34, 58, 59]. Further studies evaluating the impact of exposure therapy, a behaviour intervention, on erroneous beliefs will be necessary to better understand the exact mechanism driving the effect.

Limits and Strengths

This meta-analysis was limited by the studies included for analyses as these were few, at high risk of bias, and performed in only two countries (Australian and Spain). The literature search did not identify any randomised controlled trials (RCTs). In comparison, Cowlishaw et al. (2012) [2•],

who evaluated GD therapies including CBT, motivational interviewing therapy, integrative therapy and other psychotherapeutic interventions, found 14 RCTs. It is difficult to determine why exposure therapy has yet to be tested with a RCT design, but it is encouraging to see that 30% of the included studies used an empirical design with a lower risk of bias [44••, 45, 46••]. Another limitation of this study is that studies were included regardless of their risk of bias due to the small number of studies meeting the inclusion criteria. It was therefore necessary to combine this small number of studies while remaining critical of results in order to ascertain the pertinence of investigating exposure therapy's efficacy for GD in future studies. Furthermore, the current meta-analysis used pre-post analyses within-participants due to the lack of studies involving a control group; the pre-post design is known to overestimate effect sizes in comparison to those computed from controlled studies [30]. The rigorous study selection, with two independent interrater agreements and double selection of data from selected studies, is the main strength of the study. It is hoped that findings from the present study showing the benefits of exposure therapy for GD will promote further, more methodologically rigorous studies in order to reliably establish exposure therapy's efficacy for treating GD.

Conclusion

This study is the first meta-analysis on behavioural exposure therapy for GD. Pooled results from a small number of studies demonstrate a positive effect of exposure therapy for GD. The present study's results show that exposure therapy reduces gambling cravings and severity, as well as time spent gambling and erroneous beliefs. Future studies should investigate the efficacy of standardized exposure therapy using a treatment manual in RCTs to obtain more reliable outcome da ta. Evaluating by which process exposure therapy leads to clinical efficacy would also help in understanding the link between each efficacy variable. Overall, this study supports exposure therapy as a promising approach to the treatment of GD and may assist in broadening therapeutic options for individuals suffering from GD.

Declarations

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Papers of particular interest, published recently, have been highlighted as:
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