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Review

Association between gambling disorder and emotion (dys)regulation: A systematic review and meta-analysis

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ABSTRACT

The aim of this systematic review and meta-analysis was to provide a comprehensive evaluation of the role of emotion (dys)regulation in gambling disorder (GD). PsycINFO, PsycARTICLES, MEDLINE, Scopus, Web of Science, and PubMed were systematically searched for articles published until November 3, 2020. Forty-nine studies were considered for the systematic review; of these, 38 comprising 5242 participants met the inclusion criteria for the meta-analysis. Associations were found between GD and specific emotion regulation (ER) deficits, namely (1) nonacceptance of negative emotional states, (2) difficulties in maintaining goal-directed behaviors when faced with intense emotional contexts, (3) lack of clarity about emotional states (poor emotional awareness), (4) low impulse control in reaction to negative emotional states, and (5) difficulties in accessing adaptive ER strategies. We furthermore found that GD is associated with a tendency for emotional suppression, which is known as a maladaptive ER strategy and linked with reduced mindfulness abilities. Additional moderator analyses were conducted regarding age, gender, type of instrument used to measure GD, clinical status of the samples, and quality of the studies. Overall, the data demonstrated consistent and significant associations between GD and ER. This systematic review and meta-analysis mostly supports the conceptualization of GD as an addictive disorder characterized by ER deficits and stresses the need to develop interventions in ER deficits that are tailored to the specificities of GD.

1. Introduction

Gambling disorder (GD) consists of a functionally impairing pattern of excessive and unregulated gambling behavior that induces significant negative consequences at social and individual levels (American Psychiatric Association, 2013). The growing concern about this worldwide mental health issue is justified by the results of numerous epidemiological studies (Calado & Griffiths, 2016; Molinaro et al., 2018), as well as by the relevance of social burden and harm related to the disorder (Browne et al., 2016; Collins & Lapsley, 2003). Previous research helped to disentangle the various psychological, social, and neurobiological processes related to the development and maintenance of GD and contributed to improving its prevention and treatment (Clark & Limbrick-Oldfield, 2013; Rogier et al., 2021; Sharpe, 2002). The wide amount of empirical data resulting from such efforts has been regularly synthesized in rigorous systematic reviews and meta-analyses, delineating useful clinical evidence for treating harmful and pathological gambling behaviors.

Strikingly, emotional factors that are known to play a role in GD have to date not been subjected to a meta-analysis. Indeed, there is robust evidence that emotional factors, more specifically emotion regulation (ER), may play a pivotal role in the onset, maintenance, and relapse of GD (Blaszczynski & Nower, 2014; Rogier & Velotti, 2018a). ER can be referred to as a transdiagnostic construct that is relevant to a wide range of disorders. It is defined as the ability to modulate the valence, intensity, or time course of one's emotional experience and expression consistently with one's goals and desires (Gross, 1998; Thompson, 1990). However, we still lack a comprehensive understanding of the multilevel involvement of the different dimensions of ER in GD. Indeed, to date, a single systematic review on the topic has been published by Marchica, Mills, Keough, Montreuil, and Derevensky (2019). Of note, these authors relied on a delimited definition of ER (i.e. restricted to the

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definition of ER strategies for reappraisal and suppression constructs), which hindered the development of a comprehensive and global understanding of ER processes in GD. Thus, it appears that these contributions might be further integrated through a systematic review of the broadest construct of ER in GD, which disentangles the specific role of ER in this disorder. Moreover, no meta-analysis on the relationship between ER and GD has been conducted to date.

1.1. Theoretical models assuming the role of ER in GD

Early models posit that GD is characterized by deficits in regulating internal emotional states. For instance, the general model of addiction, developed by Jacobs (1986), proposes that some patients with GD rely on dissociation, an extreme form of ER (Linehan, 2014), to regulate the emotional arousal connected to intrusive traumatic memories. Along the same lines, difficulty in managing emotional arousal has been described in the behavioral models of GD (McConaghy, Armstrong, Blaszczynski, & Allcock, 1988; McCormick, 1988), asserting that GD is associated with a specific proneness to avoid distressing levels of arousal. Similarly, the pathways model of GD (Blaszczynski & Nower, 2002) identified a subtype of problem gamblers, who were termed emotionally vulnerable and characterized by a deficit in coping with negative emotional states. This last theoretical contribution seems to assert that GD might be fueled by an uncontrolled tendency to regulate negative affect and aversive states through gambling activities. The concept of gambling as a maladaptive coping strategy or escapism behavior (Weatherly & Cookman, 2014) has even been operationalized as a diagnostic criterion to define GD in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5).

However, the description of the role played by ER in GD has not been limited to this topic, but encompasses other theoretical frameworks. For instance, the somatic marker hypothesis (Olsen, Lugo, & Sütterlin, 2015; Verdejo-García & Bechara, 2009) posits that the impairment in decision making observed among problem gamblers may be explained by a specific difficulty in perceiving and interpreting emotional cues (lack of emotional awareness) that support adaptive choices in ambiguous contexts (Bechara, Damasio, Tranel, & Damasio, 2005).

Recently, some authors attempted to conceptualize the role played by ER in GD (Navas, Billieux, Verdejo-García, & Perales, 2019; Rogier & Velotti, 2018a, 2018b). Conducting narrative reviews of existing literature, they argued that specific ER failures characterizing problem gambling account for distinct maladaptive patterns of gambling, such as the use of gambling as an escape strategy, chasing behavior, or hazardous decision making.

Although the findings of existing studies established a clear relationship between GD and ER-related constructs, they led to a limited understanding of the psychological mechanisms involved, as such studies have too often been conducted without considering the multifaceted nature of ER. Moreover, a recent study underlined that ER, albeit a transdiagnostic construct, strongly varies in its dimensions across different clinical populations and problematic behaviors (Aldao, Nolen-Hoeksema, & Schweizer, 2010). These issues are further complicated by the lack of consensus toward the conceptualization of the construct of emotion (dys)regulation itself.

1.2. Challenges in the conceptualization and measurement of emotion (dys)regulation

As mentioned earlier, ER refers to the ability to amplify and reduce the intensity and duration of emotions when required (Cole, Michel, & Teti, 1994). ER has received increasing attention for its crucial role in the onset of disruptive behaviors (Gillespie, Garofalo, & Velotti, 2018; Velotti, Casselman, Garofalo, & McKenzie, 2017) and psychopathological disorders (Dimaggio et al., 2017). However, disentangling the precise role of emotion (dys)regulation in GD is not easy, in particular because it is a multidimensional umbrella construct whose conceptualization is not consensual and is still actively debated. Still, two dominant perspectives of ER can be identified in the gambling literature, pertaining to *ER deficits* versus *ER strategies*. These perspectives do not necessarily have to be considered as opposite and can even be successfully integrated. The term *ER deficits* refers to specific impairments of psychological functioning leading to a poor ability to regulate emotional states. In contrast, the term *ER strategies* refers to specific strategies that are used to regulate emotional states, which can be adaptive or not. Finally, the term *emotion (dys)regulation* is used to refer to ER failures related to these deficits or regulation strategies.

1.2.1. ER deficits

An influential model was developed by Gratz and Roemer (2004), who successfully unpacked the construct and identified six types of difficulties – or ER deficits – accounting for general levels of emotional dysregulation. These facets encompass (1) poor emotional awareness, (2) lack of clarity about emotional states, (3) difficulty in maintaining goal-directed behavior when experiencing intense and negative emotions, (4) low impulse control behavior under the influence of negative emotional states, (5) perceived lack of capacity to access adaptive ER strategies, and (6) proneness to negatively judge internal emotional states.

Notably, some of these deficits can be linked to partially overlapping constructs. Typically, difficulty in achieving a clear awareness of one's emotional states coincides with the description of the alexithymia construct, which has also been found to relate to problem gambling symptoms in previous studies (e.g. Bonnaire & Phan, 2017). Furthermore, the tendency to act rashly under the influence of intense negative emotional states is similar to the definition of negative urgency, an emotion-related impulsivity construct that has been linked with GD in previous studies (Billieux et al., 2012; Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011). Finally, difficulty in accepting one's emotional states in a nonjudgmental way is considered a fundamental feature of the mindfulness trait, and several studies have revealed an association between a low mindfulness trait and problem gambling (Maynard, Wilson, Labuzienski, & Whiting, 2018; Riley, 2014).

1.2.2. ER strategies

Another significant model was developed a few years later by Gross and John (2003) and considers ER processing along a temporal line. This approach focuses on the nature of ER strategies rather than on the psychological functions implied in their execution. It distinguishes two main categories of ER strategies as a function of the period in which they occur along the temporal line. From this perspective, it is possible to identify *antecedent-focused* strategies, which emerge before the occurrence of emotional arousal and target either the modification of the situation (*situation selection*) or the modification of the significance attributed to the trigger. The most representative antecedent-focused strategy is *cognitive reappraisal*, which consists in the capacity to rethink (or reappraise) an emotional trigger, resulting in a more efficient modification of its emotional impact (Gross, 1998). In contrast, ER strategies that emerge after the activation of emotional arousal are labeled *response focused*. Typically, the suppression of the expressive manifestation of emotional states (*expressive suppression*) is a widely investigated ER strategy in psychopathology (Aldao et al., 2010).

This classification overlaps with the classic distinction made between adaptive and maladaptive ER strategies, which considers antecedent-focused strategies as adaptive and response-focused strategies as maladaptive. However, this dichotomy has been challenged. Rather, the potential adaptive nature of each type of ER strategy should be considered in relation to the specific context in which they are displayed. In this sense, it has been suggested that the main criteria for displaying adaptive ER is the capacity to flexibly use a wide range of ER strategies (Bonanno & Burton, 2013; Rogier, Garofalo, & Velotti, 2019).

Although cognitive reappraisal and expressive suppression have long been a main focus of empirical research on psychopathological

disorders, other authors have underlined the role of additional ER strategies. For instance, *experiential avoidance* is now considered one of the most maladaptive emotional regulation strategies (Hayes et al., 2004). *Emotional avoidance* consists in the avoidance of psychological experiences (including thoughts, emotions, sensations, memories, and urges) and results in a paradoxical increase of negative thoughts (Wenzlaff & Wegner, 2000).

In addition, *ruminative thinking* is a core feature of dysfunctional ER processes. Rumination generally involves a repeated pattern of negative thinking not oriented toward a problem-solving process (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Notably, studies have recently emphasized that rumination is not a unitary construct and that some of its dimensions appear to be consistently related to negative outcomes, whereas others seem to be more adaptive (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). For instance, brooding rumination shows a stronger association with depressive and anxious symptoms than does ruminative reflection (Armey et al., 2009; Burwell & Shirk, 2007; Schoofs, Hermans, & Raes, 2010; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). These processes were first identified among patients with anxiety disorders and depression (i.e. Nolen-Hoeksema, 2000) and have successively been considered transdiagnostic variables (Johnson & McLeish, 2016) that account for a wider range of mental disorders. Other studies have linked maladaptive styles of ruminative thinking to a wide range of disorders, including different forms of addictive disorders (e.g. Caselli, Bortolai, Leoni, Rovetto, & Spada, 2008; Kircaburun, Griffiths, & Billieux, 2019).

1.3. Hypothesized relationship between ER and GD

Clarifying the relationship between the different facets of ER and GD is likely to have important conceptual and clinical implications. In previous work, Rogier and Velotti (2018a) critically reviewed the current theoretical contributions in the field, shedding light on potential relationships between GD and emotion (dys)regulation. These authors proposed a review of the research, suggesting that difficulty in identifying and discriminating experienced emotional states constitutes a risk factor for GD, as it would impede the normal processing of functional – albeit distressing – emotional states (e.g. sadness). Indeed, such emotional information is crucial for stopping or interrupting involvement in dysfunctional behavior (e.g., persistent gambling following important financial loss). Moreover, the mere difficulty of being aware of one's own experienced negative emotional states per se deprives the individual from early signals that foster the entire ER process. Lack of integration of such a negative emotional state would lead to the use of immediate and poorly mentalized ways of regulating emotion (i.e. regulating it through an immediately rewarding activity such as gambling), which hinders one from more demanding reflection and reappraisal of the context that triggered the aversive emotional state. From this perspective, these two dimensions of ER deficits, nonawareness and lack of clarity, are expected to be significantly associated with GD.

Other ER-related deficits, such as emotionally laden impulsive behaviors, are well-known to be involved in GD. Impulsiveness may account for the preference for dysfunctional ER strategies, the individual overlooking the long-term consequences and focusing on immediate relief. This would both determine and maintain GD, leading the individual to use the highly accessible gambling activity to regulate negative emotional states. Proneness to act rashly when experiencing a negative emotional state (a particular aspect of impulsivity referred as to "negative urgency"; see Whiteside & Lynam, 2001) is especially heightened in GD and was widely documented in the meta-analysis by Maclaren, Fugelsang, Harrigan, and Dixon (2011).

The nonacceptance facet of ER deficits is also expected to be significantly associated with both impulsivity and GD. Mindfulness-related research in fact suggests that the capacity to observe, in a noncritical way, our own internal state, and not to react to it, is important in refraining from impulsive actions (Korponay et al., 2019). Indeed, Rogier and Velotti (2018a) suggested that difficulty in accepting and experiencing emotional states in a nonjudgmental way (somewhat the opposite of a mindfulness attitude) contributes to the maintenance of GD in diverse ways. First, through a secondary process of reappraisal, emotional information that would normally contribute to refrain from maintaining the gambling behavior (e.g., a series of losses) are ignored. Moreover, the difficulty to accept the negative emotional state may interfere with the development of a negative mnesic representation of this class of events (i.e. losses), promoting the development of a distorted and positive reappraisal of the event. Finally, the difficulty in accepting negative emotional states also constitutes an obstacle to the help-seeking process (Hing, Russell, Tolchard, & Nower, 2016).

Previous research showed that suppressing emotional states leads to heightened levels of emotional arousal and to the perpetuation of negative emotions (Barlow, Chorpita, & Turovsky, 1996). This dysfunctional process promotes the implementation of immediate and externally located regulation strategies such as gambling. Therefore, we expect GD is associated to a tendency to suppress aversive emotional states. In addition, difficulty in maintaining goal-directed behavior when facing emotional states is expected to be associated with the severity of GD, in particular because of the potential role of this ER deficit in the case of gambling-related withdrawal and craving.

Regarding other ER strategies, the formulation of hypotheses should be made with caution. Indeed, recent developments in the field argued for the need to consider the capacity to use ER strategies in a flexible way, considering the context of implementation, rather than considering one strategy to be adaptive or maladaptive per se (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Rogier, Garofalo, & Velotti, 2019). We expect ruminative thinking to be associated with GD principally because of the high rates of comorbidity between GD and mood disorders (Lorains, Cowlishaw, & Thomas, 2011) that have been shown to be the typical psychopathological areas in which these processes assume a dysfunctional value (Kovács et al., 2020). For other specific ER strategies, we explained earlier why suppression might potentially be considered to be involved in the disorder. Regarding cognitive reappraisal, however, the issue might be more complex. Indeed, recent results by Ruiz de Lara, Navas, and Perales (2019) showed that specific coping strategies, traditionally considered adaptive, such as positive refocusing and wishful thinking, appear to be overrepresented among the population of problematic gamblers. These authors provided an innovative interpretation of their results, arguing that proneness to positively reappraise negative triggers in order to reduce their emotional impact may be dysfunctional in gambling because it reduces the capacity to keep in touch with negative but functional emotional states that signal the need to change the behavioral strategy (i.e. to stop gambling after a loss). In addition, the authors gave evidence supporting the possibility that this aspect may be linked to cognitive bias in problem gamblers (Jara-Rizzo, Navas, Catena, & Perales, 2019). In contrast, Williams, Grisham, Erskine, and Cassedy (2012) found lower levels of cognitive reappraisal among a sample of problem gamblers. For them, problem gamblers may fail to implement sophisticated (i.e. cognitive) ER strategies to regulate their own negative emotional states, resulting in the use of a simpler external form of immediate – but costly in the long term – ER strategy such as gambling. The inconsistency of these theoretical views on the role of these strategies do not allow formulation of an a priori hypothesis for the role of cognitive reappraisal in GD.

1.4. Present study

As a whole, the evidence reviewed suggests that emotion (dys) regulation is likely a central feature of GD. Although this relationship has been largely circumvented in initial GD research, it has received increasing attention in recent years. Still, most GD treatment protocols are not specifically focused on the management of ER problems. There is therefore an urgent need to conduct a sufficiently broad systematic and meta-analytical examination of the available evidence (as existing

systematic reviews approach only a relatively narrow construct of ER) in order to learn whether current GD treatment would benefit from a more direct focus on ER.

Considering the controversies and lack of consensus surrounding the definition of ER, we decided to limit our examination of the topic by focusing on specific components of emotion (dys)regulation. In particular, we consider all components related to the definitions of ER that refer to the main two perspectives illustrated earlier: ER deficits and ER strategies. Notably, some important ER-related constructs as such as alexithymia, metacognition, craving, dissociation, and impulsivity are not targeted by our contribution because of existing research that already offers a systematic review of the evidence on this topic. Finally, correlates of emotion (dys)regulation integrated in gambling-related constructs are not included in our operational definition of emotion (dys)regulation. This decision was made to maintain our primary focus on the relationship between emotion (dys)regulation and GD.

Our aims are thus to conduct a systematic review and meta-analysis of the empirical data derived from exploring the relationship between GD and emotion (dys)regulation, following the approach that was previously undertaken in the ER field (e.g. Aldao et al., 2010). The more specific objectives are (1) to identify the overall effect of the relationship between GD and the earlier-mentioned emotion (dys)regulation-related constructs and (2) to analyze the reported effects in relation to (a) the characteristics of the participants (e.g. gender, age, clinical status), (b)

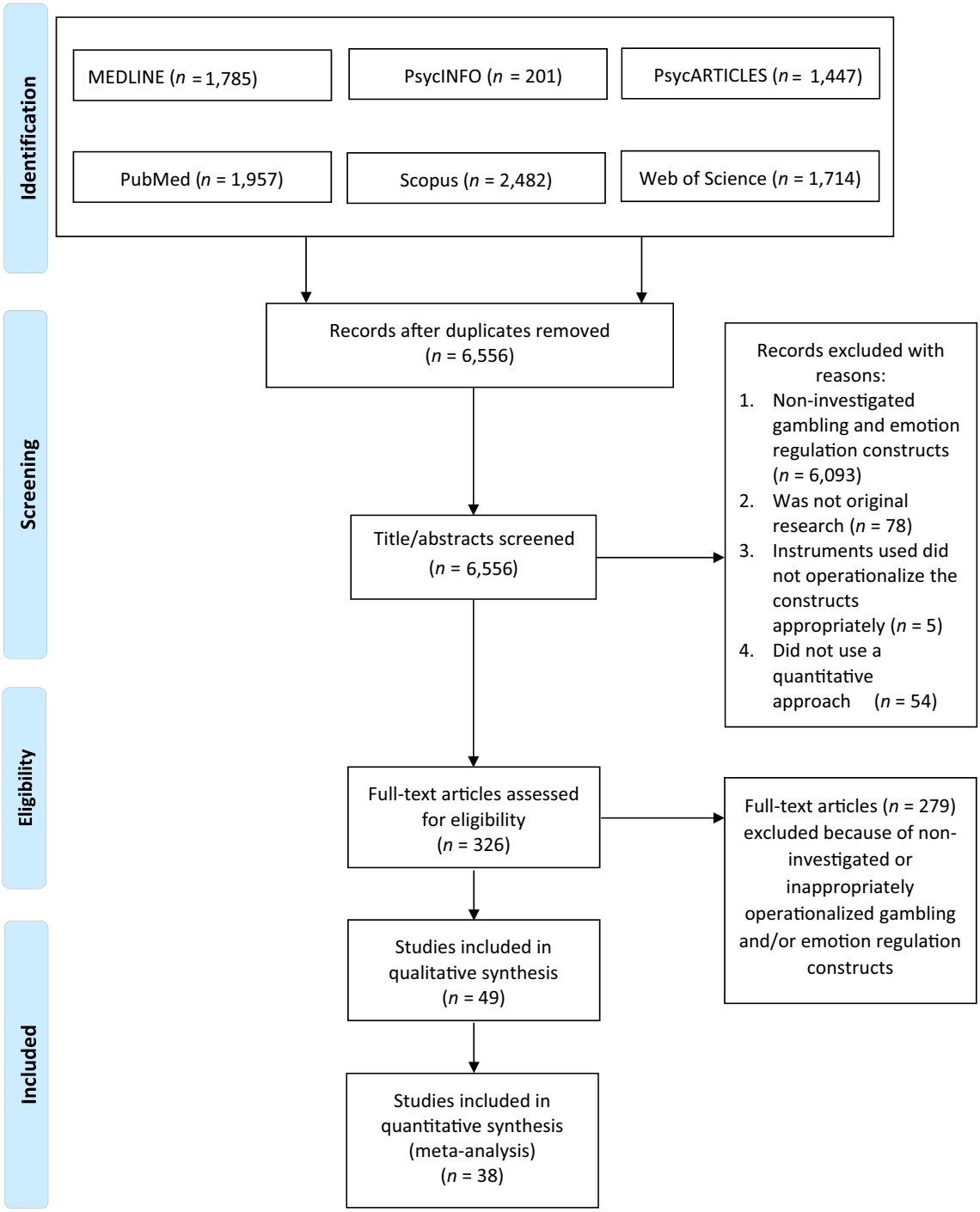

Fig. 1. Flow diagram of identification and selection of included studies.

the instruments used to assess both GD and emotion (dys)regulation, (c) and the overall quality of the studies reviewed.

2. Method

A systematic search was conducted according to the PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2010). The flowchart depicted in Fig. 1 illustrates the entire process of study identification and selection (based on the inclusion criteria used; see Eligibility Criteria below).

2.1. Eligibility criteria

An overview of the inclusion and exclusion criteria used is available in Table 1. The main inclusion criteria were related to (1) the characteristics of the participants (e.g., age > 14 years), (2) the study design (e.g. quantitative, cross-sectional, longitudinal, experimental), (3) the investigation of both emotion (dys)regulation and GD through reliable and validated measures, (4) the type of outcome provided (e.g. correlation between both constructs or comparison between a control group and a clinical group of individuals with GD), and (5) the characteristics of the contribution (e.g. original research). These selection criteria are described in more detail below.

2.1.1. Types of participants

Since previous research on GD revealed a significant incidence of the disorder after middle adolescence (e.g. Calado, Alexandre, & Griffiths, 2017), for the purpose of the current review and meta-analysis, we included samples of adolescents or adults (i.e. 14 years or more). GD was considered from the perspective of a continuum of severity ranging from subclinical to clinical levels. Therefore, both clinical and nonclinical samples of gamblers were considered.

2.1.2. Types of comparison and outcome measures

Studies were included in the systematic review if they (1) reported the effect size (ES) by estimating the association between emotion (dys)regulation and GD severity, or (2) reported the ES by estimating the difference, in terms of ER deficits or strategies, between a group of problem gamblers and a comparison group. The primary focus was emotion (dys)regulation. To achieve this objective, we included any study that assessed ER deficits or strategies with one of the validated measures presented earlier (an overview of the main measures considered in the present study is available in Table 2). When studies performed comparisons between clinical and nonclinical participants, the criteria for defining the GD status of the clinical group included having received a clinician diagnosis of current GD or reaching the cutoff for probable GD on the basis of a valid and reliable screening instrument. The comparison group consisted of community participants and/or clinical participants characterized by other conditions. For studies that estimated the association between emotion (dys)regulation and GD, we included only those that had relied on a valid and reliable measure of GD severity, such as DSM-based instruments, the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987), or the Problem Gambling Severity Index (Ferris & Wynne, 2001).

When an article indicated that the authors measured both emotion (dys)regulation and GD, but the data (related to the outcomes or values of moderator variables) were not reported, the corresponding author of the study was contacted to recover such information. Of 19 contacted authors, only 1 author responded and provided additional data or information. The lack of available data regarding the outcome determined the exclusion of the study.

2.1.3. Types of studies

To be included, studies had to rely on quantitative methodology without any limitation regarding research design. We included all studies, with no limitation on language. In order to be able to include potentially unpublished data, we did not consider publication in a peer-reviewed journal to be an inclusion criterion. Articles that did not provide original research data were excluded.

2.2. Search strategy

A literature search was conducted by using the following databases: PsycINFO, PsycARTICLES, MEDLINE, Scopus, Web of Science, and PubMed (all years until November 3, 2020). Search terms were compiled into two concepts for all databases, namely, emotion (dys)regulation and GD. For PsycINFO, PsycARTICLES, MEDLINE, and Scopus, the

Table 1
Overview of the inclusion and exclusion criteria used in the screening process.

	Inclusion criteria	Exclusion criteria
Participants	Age > 14 years	Age < 14 years Animals
Study design	Quantitative Cross-sectional Longitudinal Experimental	Qualitative Case study Commentary Review
Comparisons and outcomes	Measure of GD severity Measure of GD status Measure of ER Association between GD and ER Comparison between ER levels in GD and non-GD groups	Unreliable measure of GD Unreliable measure of ER No estimation of the association between ER and GD and/or the difference in ER levels in GD and non-GD groups
Type of contribution	Published Unpublished	Duplicate of original research

Note. GD: gambling disorder; ER: emotion regulation.

Table 2
Main measures of emotion (dys)regulation considered in the study.

Construct	Measure
ER features	
General emotion dysregulation	DERS total score TMMS
Poor emotional awareness	Awareness DERS subscale LEAS
Lack of emotional clarity	Clarity subscale of the DERS
Difficulty accepting emotions in a nonjudgmental way	Acceptance subscale of the DERS
Difficulty maintaining goal-directed behavior while aroused	Goals subscale of the DERS
Proneness to act impulsively while aroused	Impulse subscale of the DERS
Perceived difficulty accessing a wide range of effective ER strategies	Strategies subscale of the DERS
ER strategies	
Cognitive reappraisal	Cognitive reappraisal subscale of the ERQ Positive reappraisal subscale of the CERQ
Suppression	Expression suppression subscale of the ERQ WBSI
Rumination	RRQ Rumination subscale of the CERQ RSQ
Mindfulness	MAAS FFMQ CAMM

Note. DERS: Difficulties in Emotion Regulation Scale; TMMS, Trait Meta-Mood Scale; LEAS: Levels of Emotional Awareness Scale; WBSI: White Bear Suppression Inventory; ERQ: Emotion Regulation Questionnaire; CERQ: Cognitive Emotion Regulation Questionnaire; RSQ: Response Style Questionnaire; RRQ, Rumination-Reflection Questionnaire; MAAS, Mindfulness Attention Awareness Scale; FFMQ, Five Facet Mindfulness Questionnaire; CAMM, Child and Adolescent Mindfulness Measure.

search terms were entered into the title, abstract, and keyword fields; for Web of Science, the terms were entered into the topic field; and for PubMed, the terms (including Mesh terms), were entered into the title and abstract fields (Appendix A).

Lastly, we searched the gray literature by (1) writing emails to the main authors of the field, asking for unpublished data on the topic; and (2) searching for eligible papers (using the same terms and keywords) in Google Scholar (the first four pages) and in the database of Dissertation Abstracts International. Finally, we cross-checked the references of the papers included in the quality assessment step to identify other studies eligible for the meta-analysis.

2.3. Study selection

Two authors (SBZ and GR) independently conducted the systematic literature searches by using the aforementioned databases. Through their independent work on these databases, they identified 9586 articles with the initial search terms, which were then examined for eligibility. After the duplicates were removed, 6556 records were screened based on their title and abstract, resulting in the identification of 326 full-text articles to be further scrutinized. After closer examination of these articles, a consensus among authors resulted in retaining 49 of them based on the inclusion criteria (see Table 1).

2.4. Data extraction process and management

A protocol was developed to extract and code the following types of information: (1) characteristics of the publication (i.e., year, publication status, qualitative assessment), (2) characteristics of the sample (i.e., total size, gender, age, composition), (3) information about the methodological characteristics (i.e., country, cross-sectional versus longitudinal design, instruments used to measure GD and emotion (dys) regulation), and (4) main results (reported along with the statistical index used in the study).

We also examined the influence of moderator variables that could potentially account for the relation between observed variables. Specifically, the candidate moderator variables considered included gender, sample composition, mean age of participants, clinical status of participants, type of instrument used to measure emotion (dys)regulation and GD, study design, and publication status. These additional analyses were computed only for moderator variables that presented enough variability (i.e. when not excessively homogeneous) and when the number of studies that measured these variables were sufficient. Furthermore, statistical tests for assessing publication bias were computed when possible. However, these statistics were not performed when the number of studies considered for the analysis was fewer than 10, as the power of the analysis was too low in this condition (Higgins et al., 2019).

Considering all of the above-mentioned criteria, we were able to examine the following moderators in the meta-analysis:

a. Gender, coded as the percentage of males composing the sample
b. Age, coded in years
c. Type of instrument used to measure GD, coded in two categories: 1 = SOGS and 2 = others
d. Clinical status of the population, coded in two categories: 1 = clinical or mixed and 2 = nonclinical (community participants) or, alternatively, 1 = clinical and 2 = nonclinical and mixed
e. Methodological quality of the studies

The meta-analytic analyses were computed on the 38 identified studies corresponding to the criteria described earlier, which overall comprised 5242 individuals. Details on the variable coding and a complete overview of the main extracted information are provided in Appendix B.

2.5. Assessment of methodological quality

A modified version of the Newcastle-Ottawa Scale (Wells et al., 2000; O'Driscoll, Laing, & Mason, 2014; Modesti et al., 2016) adapted for cross-sectional studies was used to assess the quality of the studies. In particular, aspects such as selection (e.g. representativeness and size of the sample), comparability (i.e. existence of matching variables between clinical and control groups), and outcome (i.e. reliability of measures used and appropriateness of statistical analyses) were rated as good, fair, or poor. Two authors (GR and SBZ) made independent quality ratings; disagreements were resolved through discussion and consultation with a third author (PV). Fig. 2 summarizes the quality of the studies included in the meta-analysis.

2.6. Statistical analyses

To perform the meta-analysis, we used the statistical software Comprehensive Meta-Analysis (version 3.0, Biostat Inc.) to calculate the individual studies and the pooled ESs. The ESs were computed as Fischer's *z* transformed correlation coefficients to stabilize the variance of correlation coefficients (Fisher, 1925). ESs were coded so that positive associations represented a higher level of association between GD and ER. As recommended by Cooper, Hedges, and Valentine (2009), ESs were transformed back to *r* following completion of analyses. When a study reported multiple ESs, they were aggregated into a composite ES to eliminate dependencies in the data. In accordance with recent recommendations by Gignac and Szodorai (2016), the magnitude of zero-order Pearson's correlation coefficients (*r*) were read as small (0.15), medium (0.25), or large (0.35).

2.6.1. Computation of ESs

Overall ESs were calculated by using a random effects model. In random effects models, unlike the fixed effects model, the possibility that each study has a separate ES relative to its own population is considered (Rosenthal, 1995). In addition, when a series of ESs is significantly heterogeneous, random-effects models appear to be more appropriate (Cooper, Hedges, & Valentine, 1994) and allow unconditional inferences to be made about the population.

Planned analyses were then computed to examine the effects of potential moderators. Two continuous moderators (age, gender and quality assessment) were tested with a meta-regression technique. A categorical moderator (instrument used to measure GD) was tested by using grouped analysis. We computed *Q* statistics to test the heterogeneity of ESs and the significance of categorical moderators (Borenstein, 2009; Rosenthal, 1995).

2.6.2. Publication bias

Publication bias tests were computed with Duval and Tweedie's (2000) trim-and-fill method. This method provides an estimation for the number of studies missing – due to publication bias – by including missing studies and giving an estimate of the adjusted ES. The aim of this

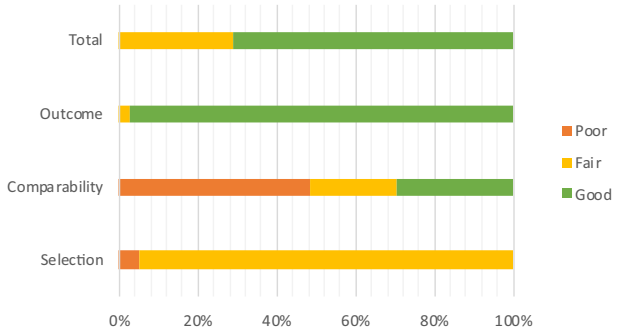

Fig. 2. Qualitative assessment of the studies included.

adjusted ES with confidence intervals is to show the average ES in the situation in which no publication bias is present (Duval & Tweedie, 2000). Moreover, publication bias was also assessed by using Egger, Smith, Schneider, and Minder's (1997) linear regression method in order to determine whether studies conducted on a small number of participants were disproportionately associated with larger ESs.

3. Results

Overall, 49 studies that explored emotion (dys)regulation in GD were retained (see Appendix B). These studies were published in less than 15 years, between 2006 and 2020. Only six studies conjointly investigated ER deficits and strategies, whereas 21 specifically focused on ER deficits in GD and 22 focused on ER strategies in GD. Most of the studies (42.85%) were conducted among the community population, 12 compared a sample of individuals with GD and a community sample, and 16 involved clinical samples of individuals with GD.

For the relationship between GD and specific ER deficits or ER strategies, meta-analytic analyses were conducted only when a sufficient number of studies were available (>10). In the following sections, the meta-analytic results are presented first, followed by the systematic review results (see Appendix B).

3.1. Meta-analytic results

The detailed number of independent samples and corresponding number of individuals identified for each meta-analysis is displayed in Table 3.

3.1.1. ER deficits

3.1.1.1. ER deficit total. Regarding general ER deficits, the average ES was significant [$r = 0.23$, $p < .0001$ (see Table 3 and Fig. 4a)]. Although the funnel plot did not suggest the presence of some publication bias [Egger's test = 1.54, $p > .05$ (Fig. 3a)], Duval and Tweedie's trim-and-fill method indicated that four studies should be trimmed and filled. However, the resulting adjusted ES ($r = 0.20$; 95% CI [0.15; 0.24]) was still significant.

The set of studies available for GD and emotion dysregulation exhibited significant heterogeneity [$Q(20) = 76.35$, $p < .0001$]. Moderation analyses showed that all the moderators selected, namely, age ($p = .167$), gender ($p = .253$), quality evaluation ($p = .905$), the instrument used to evaluate GD severity ($p = .451$), and clinical status ($p = .886$; $p = .660$), were nonsignificant.

3.1.1.2. Awareness. Regarding the awareness dimension, we observed a small but significant average ES [$r = 0.07$, $p < .01$ (see Table 3 and Fig. 4b)]. The funnel plot [Egger's test = −0.14, $p > .05$ (Fig. 3b)] and Duval and Tweedie's trim-and-fill method indicated that publication bias did not impact ES. Despite studies showing significant heterogeneity [$Q(14) = 47.80$, $p < .0001$], none of the moderators tested, namely, age ($p = .065$), gender ($p = .606$), quality evaluation ($p = .807$), the instrument used to evaluate GD severity ($p = .823$), and clinical status ($p = .204$; $p = .914$), were significant.

Table 3
Overall results for the association between GD and ER deficit and strategies.

ER deficits and ER strategies						
	k	*N*	*r*	95% CI	*z*	*p*
DERS total	21	9358	0.23	[0.19; 0.27]	10.46	< 0.0001
Awareness	15	5694	0.07	[0.02; 0.12]	2.60	<0.01
Clarity	16	6121	0.14	[0.10; 0.17]	7.36	< 0.0001
Goals	16	6121	0.14	[0.08; 0.20]	4.27	< 0.0001
Impulse	12	3629	0.24	[0.18; 0.29]	8.08	<0.0001
Nonacceptance	16	6121	0.19	[0.15; 0.24]	8.16	<0.0001
Accessibility	12	3629	0.21	[0.16; 0.25]	8.15	<0.0001
Reappraisal	9	1931	−0.02	[−0.10; 0.14]	0.37	0.712
Suppression	10	2063	−0.01	[0.01; 0.18]	2.30	<0.05
Mindfulness	10	2033	−0.12	[−0.30; 0.06]	−1.35	0.176

Note. GD: gambling disorder; ER: emotion regulation; DERS: Difficulties in Emotion Regulation Scale; CI: confidence interval.

3.1.1.3. Clarity. The average ES related to the clarity dimension was small and significant [$r = 0.14$, $p < .0001$ (see Table 3 and Fig. 4c)]. The funnel plot pointed to the presence of some publication bias [Egger's test = 1.35, $p < .05$ (Fig. 3c)], converging with the conclusion of Duval and Tweedie's trim-and-fill method that recommended that three studies should be trimmed and filled. The adjusted ES ($r = 0.12$, 95% CI [0.08; 0.16]) was lower but still significant.

The set of studies exhibited significant heterogeneity [$Q(15) = 26.64$, $p < .05$]. Indeed, results showed that age and qualitative assessment were significant moderators [$Q(1) = 12.09$, $p < .0001$; $Q(1) = 3.89$, $p < .05$, respectively)]. Gender ($p = .692$), the instrument used to assess GD severity ($p = .906$], and clinical status ($p = .433$, $p = .563$, $p = .284$) were not significant moderators.

3.1.1.4. Goals. Concerning the goals dimension, the ES turned out to be small and significant [$r = 0.14$, $p < .0001$ (see Table 3 and Fig. 4d)]. However, the funnel plot showed the presence of some publication bias [Egger's test = 3.44, $p < .005$ (Fig. 3d)] and Duval and Tweedie's trim-and-fill method concluded that seven studies should be trimmed and filled. The adjusted ES ($r = 0.04$, 95% CI [−0.04; 0.11]) turned out to be nonsignificant.

Because of the significant heterogeneity exhibited by the pool of studies [$Q(15) = 80.95$; $p < .001$], we proceeded with the analysis of possible moderators. It turned out that age significantly moderated the relationship between GD severity and the goals dimension [$Q(1) = 12.59$, $p < .001$], while gender ($p = .130$), qualitative assessment ($p = .711$), the instrument used to evaluate GD severity ($p = .579$), and clinical status ($p = .090$, $p = .396$) did not have a significant effect.

3.1.1.5. Impulse. The average ES that estimated the relationship between impulse and GD was significant [$r = 0.24$, $p < .0001$ (see Table 3 and Fig. 4e)]. Although the funnel plot did not suggest the presence of publication bias [Egger's test = 0.95, $p > .05$ (Fig. 3e)], Duval and Tweedie's trim-and-fill method was performed anyway, indicating that only one study had to be trimmed and filled. Nevertheless, the resulting adjusted ES ($r = 0.23$, 95% CI [0.17; 0.29]) was a little lower but still significant.

Because the set of studies was characterized by significant heterogeneity [$Q(11) = 27.80$, $p < .05$], moderation analyses were performed. None of the moderators, namely, age ($p = .894$), gender ($p = .212$), quality evaluation ($p = .645$), the instrument used to evaluate GD severity ($p = .654$), and clinical status ($p = .667$, $p = .823$), were significant.

3.1.1.6. Nonacceptance. The average ES concerning this dimension was moderate and significant [$r = 0.19$, $p < .0001$ (see Table 3 and Fig. 4f)]. Consistent with the indications of the funnel plot [Egger's test = 2.30, $p < .001$ (Fig. 3f)], Duval and Tweedie's trim-and-fill method indicated that five studies should be trimmed and filled. The resulting adjusted ES was small but still significant ($r = 0.15$, 95% CI [0.10; 0.20]).

The observed significant heterogeneity [$Q(15) = 41.06$, $p < .0001$] was further investigated by moderation analyses. Age turned out to be a positive and significant moderator [$Q(1) = 17.91$, $p < .0001$], as did gender [$Q(1) = 3.96$, $p < .05$]. All the other moderators tested, namely, quality evaluation ($p = .645$), the instrument used to evaluate GD severity ($p = .132$), and clinical status ($p = .060$, $p = .899$), were not significant.

3.1.1.7. Accessibility. Regarding the accessibility dimension, the

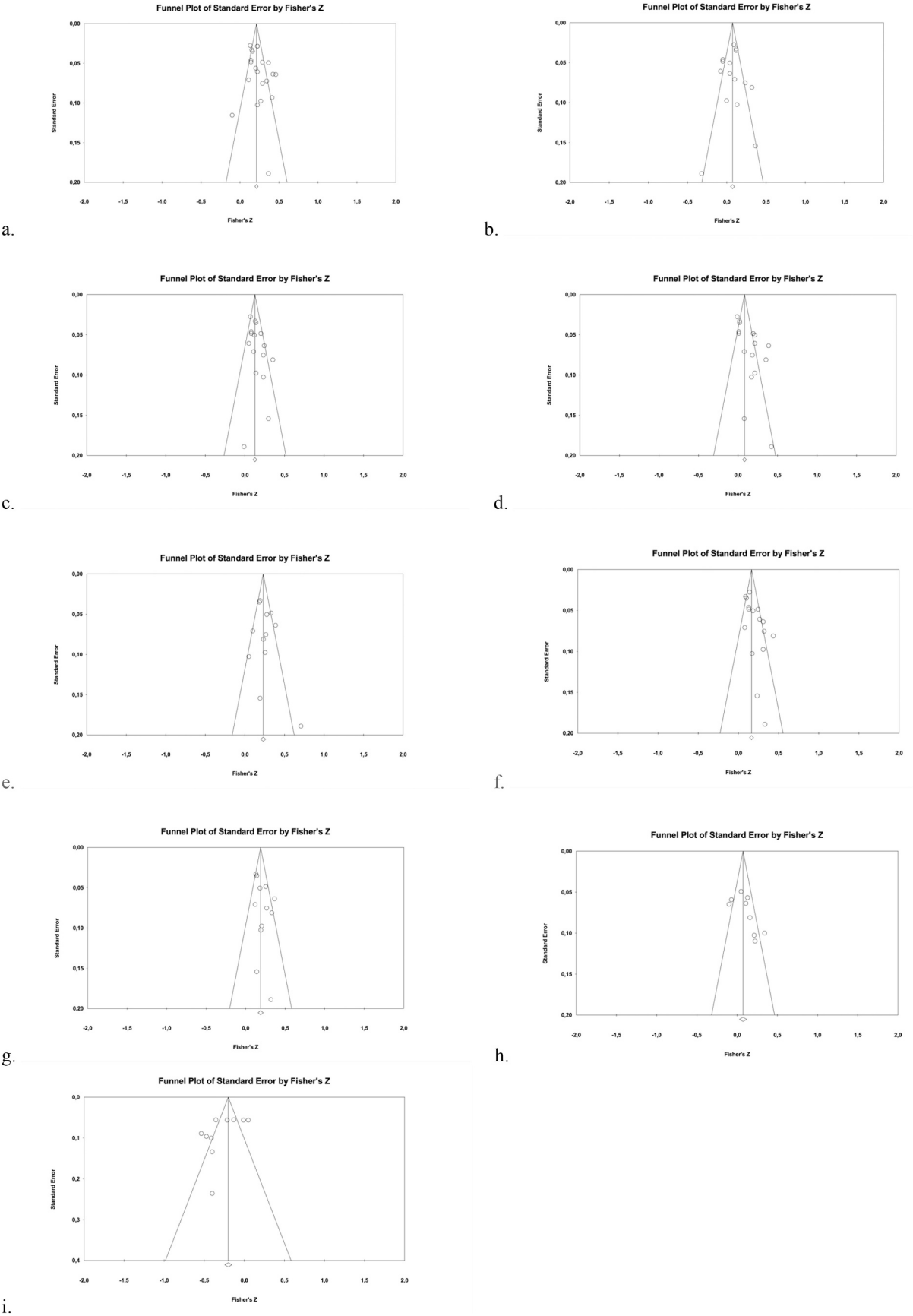

Fig. 3. Funnel plots of all meta-analyses.

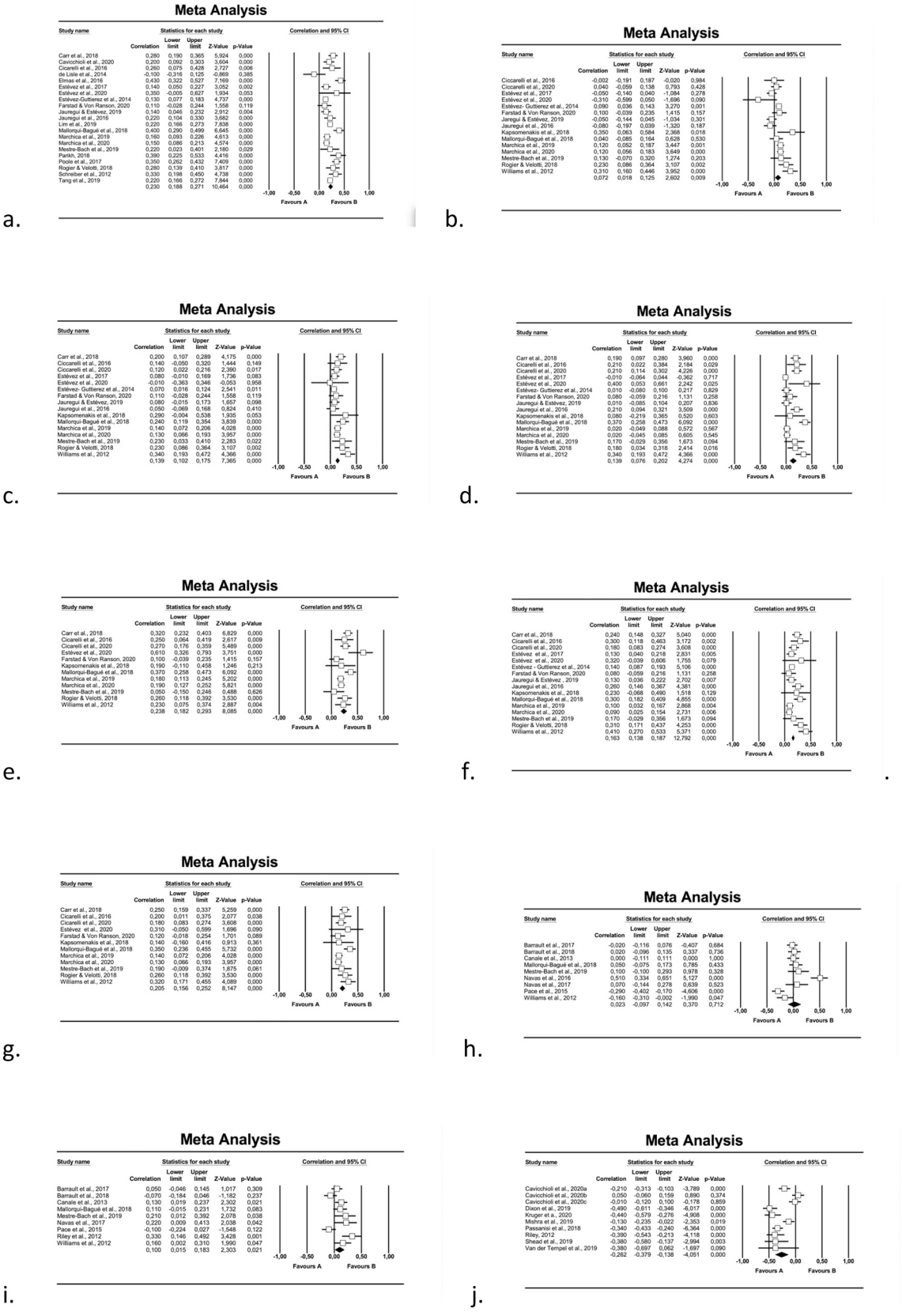

Fig. 4. Funnel plots of all meta-analyses.

average ES was moderate and significant [$r = 0.21$, $p < .0001$ (see Table 3 and Fig. 4g)]. In contrast with the indication of the funnel plot [Egger's test = 1.36, $p > .05$ (Fig. 3g)], Duval and Tweedie's trim-and-fill method suggested that three studies should be trimmed and filled. Nonetheless, the adjusted ES was still moderate and significant ($r = 0.17$, 95% CI [0.12; 0.23]).

Additional analyses showed that the significant heterogeneity between studies [$Q(11) = 20.22$, $p < .05$] was explained by the moderating role of age [$Q(1) = 9.31$, $p < .005$] but not gender ($p = .182$), quality evaluation ($p = .344$), the instrument used to evaluate GD severity ($p = .535$), or clinical status ($p = .254$; $p = .911$).

3.1.2. ER strategies

3.1.2.1. Reappraisal. For reappraisal, the average ES was not significant ($r = -0.02$, $p = .712$) (See Table 3 and Fig. 4h). Because of the number of studies, we could not perform publication bias analyses and moderation analyses (Higgins et al., 2019).

3.1.2.2. Suppression. Concerning suppression, analyses showed that the average ES obtained was small but significant ($r = 0.10$, $p < .05$) (See Table 3 and Fig. 4i). The funnel plot confirmed the presence of publication bias [Egger's test = 4.12, $p > .05$ (Fig. 3h)]. Duval and Tweedie's trim-and-fill method was performed, recommending that two studies should be trimmed and filled with an adjusted ES no longer being significant ($r = 0.09$, 95% CI [−0.03; 0.15]).

Considering the significant heterogeneity [$Q(9) = 26.78$, $p < .001$], potential moderators were tested. After performing a meta-regression, we found that none of the tested moderators, namely, age ($p = .650$), gender ($p = .311$), clinical status ($p = .701$), and quality evaluation ($p = .194$), were statistically significant.

3.1.2.3. Mindfulness. In relation to mindfulness, the average ES obtained was small and nonsignificant ($r = -0.26$, $p > .05$) (See Table 3 and Fig. 4j). The funnel plot confirmed the presence of publication bias [Egger's test = −4.10, $p > .05$ (Fig. 3i)]. However, Duval and Tweedie's method indicated that no studies should be trimmed and filled.

Because these studies were significantly heterogeneous [$Q(9) = 70.12$, $p < .001$], we performed moderation analyses. We found that none of the tested moderators namely age ($p = .778$), gender ($p = .394$), and quality evaluation ($p = .864$) was significant.

3.2. Systematic review of studies not included in meta-analytic analyses

3.2.1. ER strategies not included in the meta-analyses

3.2.1.1. Rumination. In Appendix B, it can be seen that only six studies investigated the relationship between rumination and GD. In one study conducted on an Australian sample of problem gamblers (de Lisle, Dowling, & Allen, 2014), a significant correlation was observed between levels of rumination and severity of GD that partially converged with the results of the study by Ruiz de Lara et al. (2019) and showed an association between rumination and gambling cognitions. In a study conducted by Washington (2005), clinical gamblers recruited from Gamblers Anonymous groups presented higher rumination than did a convenience sample, whereas Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016) did not replicate these results. The research conducted in Germany by Krause et al. (2018) showed instead that ruminative brooding, but not ruminative reflection, significantly predicted GD severity in a sample of problem gamblers. In another study conducted in Australia, McIntosh, Crino, and O'Neill (2016) observed that in clinical gamblers, a mindfulness-based intervention helped to reduce dysfunctional rumination.

3.2.1.2. Other ER strategies. Several authors explored the role of specific ER strategies in GD. Related findings suggested an association between GD severity and emotion-focused strategies (Gomes & Pascual-Leone, 2009), as well as higher levels of dysfunctional ER strategies (e.g., self-blame, other-blame, catastrophizing), among problem gamblers compared with healthy controls (Navas, Verdejo-García, López-Gómez, Maldonado, & Perales, 2016; Rogier, Garofalo, & Velotti, 2019; Ruiz de Lara et al., 2019). Moreover, significant relationships have also been found between GD severity and distancing and escape-avoidance (Bilevicius et al., 2019; Sanscartier, Shen, & Edgerton, 2019). These studies are displayed in Appendix B.

4. Discussion

Although emotion (dys)regulation is supposed to play a pivotal role in the onset, maintenance, and relapse of GD (Jacobs, 1986; Navas et al., 2017; Rogier & Velotti, 2018a), no meta-analytic review had addressed this important issue to date. The present study thus fills an important gap in current knowledge by offering an estimation of the overall association between GD and emotion (dys)regulation. Potential moderator effects related to the characteristics of participants and to specific features of the studies were also considered, along with an analysis of publication bias.

4.1. GD and ER deficits

4.1.1. General levels of emotion dysregulation

Results showed that the relationship between GD and general difficulties in ER was positive and of low to medium size. This result was expected in light of the theoretical contributions that highlighted the role of emotion dysregulation in the origin and maintenance of GD (e.g. Navas et al., 2017; Rogier & Velotti, 2018a).

4.1.2. Clarity and awareness

The first two specific ER deficits examined in this meta-analysis relate to the dimensions of clarity and awareness. A similar pattern of results emerged for these two constructs, highlighting a positive and significant but weak effect. These findings are in line with the results of most of the studies that have examined the role of alexithymia in GD (e.g. Bibby & Ross, 2017; Bonnaire & Phan, 2017; Mitrovic & Brown, 2009). The results are compatible with the somatic marker hypothesis and suggest the existence of a deficit in the ability to process the informative content of emotional states in GD. However, the different results reported by some researchers (e.g. Di Trani, Renzi, Vari, Zavattini, & Solano, 2017; Montel, Ducroz, & Davidson, 2014) and the weak ES observed in the present meta-analysis suggest that this relationship may be moderated by other variables. Unfortunately, regarding the awareness dimension, the variables considered in the current meta-analysis did not show any moderation effects, suggesting that other variables may account for the observed results. For instance, future studies may want to take into account other variables such as decision-making abilities or psychiatric comorbidities, given their established relation with alexithymia (Garofalo, Neumann, & Velotti, 2018; Velotti, Garofalo, Dimaggio, & Fonagy, 2019) and GD (Vaddiparti & Cottler, 2017). In contrast, regarding the clarity dimension, age and the methodological quality of the studies turned out to be significant moderators. Specifically, we found that in studies with older participants, investigators observed a higher association between clarity and GD. This is somewhat surprising, as existing literature suggests that ER difficulties are more prevalent among adolescents and young adults (John & Gross, 2004). Yet, these results may be interpreted by considering a potential confounding variable: the duration of GD among participants. Given that GD often emerged in early adulthood (American Psychiatric Association, 2013), it seems reasonable to think that older participants are likely to have had GD for a longer period. In turn, the duration of the disorder is likely to be associated with higher levels of chronic stress and negative affect, which may lead to impairments in ER capacities. Finally,

methodological quality has been observed to positively moderate the ES, stressing the need to conduct studies that conform with high methodological standards to avoid the risk of underestimating the role played by the difficulty in identifying one's own emotional states in GD.

4.1.3. Nonacceptance of emotional states

An association of small amplitude was observed between the nonacceptance facet of ER and GD. This supports the view that individuals with GD struggle to accept aversive feelings and negative emotions in a nonjudgmental way. Contextualizing this result within the extended process model of emotional regulation (Sheppes, Suri, & Gross, 2015), this specific impairment may affect the perceived need to regulate (or not) the emotional state via down-regulating strategies. Overestimating the need to regulate an emotional state, which may be fostered by difficulty in accepting it in a nonjudgmental way, is likely to support overregulation through the use of emotional suppression, a cognitive ER strategy that is known to maintain aversive emotional states (e.g. Gross & John, 2003). Furthermore, excessive regulation of emotional states can hinder healthy emotional processing that allows the use of important information related to the emotions required in adaptive social interactions. Such interpretation echoes the somatic marker theory (Olsen et al., 2015; Verdejo-García & Bechara, 2009). Furthermore, the nonacceptance of the emotional state is likely to generate maladaptive secondary appraisal of emotions, which elicits negative emotions aroused by the negative judgment toward one's internal states. This may further increase the experienced negative emotional arousal, thus depleting available cognitive resources. In relation to this point, further exploration should be undertaken regarding which specific secondary emotions are triggered in these processes, how they are processed, and through which mechanisms they can potentially lead to the development or maintenance of GD.

In addition, further analyses showed that age positively moderates the relationship between nonacceptance and GD levels. As discussed earlier, this might appear to be counterintuitive, but it is in line with the idea that high levels of emotion dysregulation in older individuals are more likely to signal psychological impairments than in youths and with the potential confounding effect of the duration of problematic gambling. We found that gender moderates the observed relationship, being stronger among males than among females. This might be surprising because previous studies found comorbid mental disorders among female gamblers and suggested that female problematic gamblers are more prone to use gambling as an escape than male problematic gamblers (Hing et al., 2016; Tavares, Zilberman, Beites, & Gentil, 2001). However, these data should also be examined in light of a recent investigation showing that the proneness to not accept one's own negative emotional state may moderate the relationship between suppression tendencies and depression among men but not among women (Flynn, Hollenstein, & Mackey, 2010). These results suggest that implicit internalized expectations toward gender roles lead to greater difficulty in accepting negative emotional states among men. In turn, the pathological mechanisms linking nonacceptance to GD are likely to be exacerbated.

4.1.4. Goals

Although we observed a small but significant positive association regarding the relationship between GD and difficulty in maintaining goal-directed behavior when experiencing an intense negative emotional state, additional analyses suggested that these associations might have been subjected to publication bias, and thus any derived conclusion must be considered with caution. In addition, moderation analyses highlight that this component of ER might be predominantly involved in older participants. Although further studies are needed to ascertain the relations observed, this result is in accordance with previous studies having shown that negative emotions are likely to promote gambling craving and compulsions (Cornil et al., 2018; de Castro, Fong, Rosenthal, & Tavares, 2007) or gambling persistence despite losses (Devos, Clark, Maurage, & Billieux, 2018).

4.1.5. Impulse

We found a moderate and significant relation between emotionally laden impulsivity and GD which might, however, have been affected by publication bias. Yet, this result is in line with the results of a previous meta-analysis (Maclaren et al., 2011) that observed a strong association between GD and the negative urgency dimension of the multidimensional impulsivity model developed by Whiteside and Lynam (2001). Notably, negative urgency conceptually overlaps with the impulse dimension of the Difficulties of Emotion Regulation Scale.

4.1.6. Accessibility

Regarding the accessibility dimension, we observed a moderate association that might be underestimated because of potential publication bias. Interestingly, this dimension is likely to measure an undervalued construct in the field: ER self-efficacy (Tamir & Mauss, 2011). Recent studies showed that the extent to which individuals are confident about their capacity to adaptively regulate their own emotional states predicts their ER abilities (Benfer, Bardeen, & Clauss, 2018). In turn, this effect may be mediated by metacognitive beliefs about the malleable nature of emotional states. Indeed, emotional malleability-related beliefs (i.e. beliefs that emotional states are malleable and dynamic and not fixed entities that exist outside personal control) have been thought to predict ER efficiency (Kneeland, Dovidio, Joormann, & Clark, 2016; Tamir, John, Srivastava, & Gross, 2007). Finally, as was the case for other ER features, we found that age positively moderated the observed link, suggesting that poor ER self-efficacy predicts GD more strongly among older participants.

4.2. GD and ER strategies

4.2.1. Cognitive reappraisal

We failed to identify a significant effect regarding the relationship between GD and cognitive reappraisal. This is unexpected given that cognitive reappraisal is generally considered an adaptive ER strategy and that theoretical contributions have supported the presence of dysfunctional ER strategies in GD. However, it has recently been stressed that ER strategies should not be considered adaptive or maladaptive per se, but that their adaptive potential is better assessed in light of contextual needs (Bonanno et al., 2004; Rogier, Garofalo, & Velotti, 2019). These findings are also in line with studies that have shown a greater tendency to positively refocus on problem gamblers than on community participants (e.g. Parke, Griffiths, & Parke, 2007). Furthermore, this can be understood in light of studies that highlight the role of excessive optimism in GD (Gibson & Sanbonmatsu, 2004). In line with this reasoning, we suggest that a number of moderator variables (that we were unfortunately not able to test) may intervene in the observed relationship between cognitive reappraisal and GD. This requires future studies to explore the conflicting nature of the results brought to light by these empirical studies.

4.2.2. Suppression

A significant and positive but small association has been identified between suppression and GD. This result was expected because suppression was described as a maladaptive ER strategy that perpetuates negative affect. A tendency toward relying on suppression can therefore promote difficulties in keeping in touch with negative emotional states related to loss, which likely leads to low sensitivity toward negative reinforcements in the context of gambling and difficulty in interrupting gambling behavior. Furthermore, suppression of emotional arousal related to a state of craving can hinder the use of adapted coping strategies and promote loss of control and/or relapse.

4.2.3. Mindfulness

We found a strong association between poor mindfulness capacities

and GD. This result may be contextualized within the wider literature that has documented the effectiveness of mindfulness-based therapy in the context of GD (McIntosh et al., 2016). Given that one of the therapeutic targets of mindfulness-based therapy focuses on increasing the ability to observe internal states in a nonjudgmental way, it can be hypothesized that the improvement of this ER capacity could mediate the relationship between these clinical interventions and therapeutic success. This would be in line with our findings related to the role of nonacceptance in GD. However, the mindfulness construct is multidimensional and, because of the lack of exhaustive information provided by the included studies, we were not able to test the differentiation of associations between GD and the mindfulness dimensions. To better disentangle the issues surrounding the relationships between mindfulness and GD, we would encourage investigators to adopt a multidimensional approach toward the construct in future studies.

5. General comment, future directions, and conclusions

ER deficits have been extensively studied in the context of substance use disorders (Kober, 2014), while empirical research on the relationship between ER and GD specifically appears to be a recent but thriving field. Crucially, our systematic review and meta-analysis allowed to identify important overlap between ER deficits in GD and ER deficits previously identified in substance use disorders, in particular with regard to experiential avoidance (Cooper, Wood, Orcutt, & Albino, 2003), ruminative thinking (Borders, Barnwell, & Earleywine, 2007; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007), emotional suppression (i.e. Ghorbani, Khosravani, Sharifi Bastan, & Jamaati Ardakani, 2017), lack of emotional clarity (Hardy, Fani, Jovanovic, & Michopoulos, 2018), or the inability to cognitively reappraise negative events (Britton, 2004). Taken together, these data suggest that gambling is susceptible, in a similar way that drugs or alcohol, to promote external regulation of emotional states and ultimately results in a dysfunctional behavior or coping strategy.

Some limitations of our work have to be acknowledged. First, relatively few studies were available, which hindered the ability to compute meta-analytic analyses for all constructs under study. In particular, most studies overlooked the role played by ER strategies, focusing on ER deficits instead. Furthermore, within the pool of studies that examined the role of ER strategies, our systematic review highlighted the lack of available research that has examined the role of other ER strategies among people with GD. For example, rumination has been poorly studied despite the encouraging results of two preliminary studies.

Second, it is interesting to note that almost no studies have examined the role of dysregulation of positive emotions. This is quite surprising, given that the relevance of the topic has been highlighted by several authors (Rogier & Velotti, 2018a) and that the importance of the topic has been highlighted in the field of alcohol and substance abuse (Weiss, Risi, Bold, Sullivan, & Dixon-Gordon, 2019). Further research is thus necessary to better understood the role of positive emotion dysregulation in GD.

Third, there is a partial overlap between the ER constructs examined and others investigated in the literature. Constructs such as alexithymia and negative urgency were therefore excluded from the present work, potentially reducing the completeness of the conclusions drawn. Furthermore, some of the selected studies used the Spanish version of the Difficulties of Emotion Regulation Scale, counting only five subscales (Hervás & Jódar, 2008). This different factorial structure may have compromised a comparison between studies. For example, data for the fifth subscale (Control) were not examined in the present study.

Fourth, we noticed that most of the selected studies were cross-sectional. This is an important limitation as it does not allow the identification of any causal link between ER and GD. In this sense, more experimental and longitudinal studies are needed.

Finally, the studies examined investigated the relationship between the severity of ER and either clinical status (having a diagnosis of GD or not) or the severity of GD symptoms (as measured by scales such as the SOGS). However, this approach somewhat limits the ability to consider clinical implications. Indeed, the role of the specific component of emotional (dys)regulation should be identified in relation to specific features or aspects of GD such as craving, chasing, or impaired decision making. A more clinically oriented and symptom-centered approach (e.g. through network analytic approaches; see Borsboom, 2017), taking into account the multidimensional nature of both GD and ER constructs, would benefit from the development of tailored clinical indications.

Despite these limitations, the current systematic review and meta-analysis calls for future development of these lines of research and has potential clinical implications. First, the study of the role played by ER in GD may suffer somewhat from the lack of a unifying theoretical framework that integrates the main dominant perspectives on the topic. Indeed, most of our results argue for the role played by a multiplicity of ER-related variables in GD but few studies have investigated their interplay. Researchers operating in this field may want to conduct studies that investigate the relationships and the respective roles of ER components in GD in a comprehensive way. Regarding this point, the theoretical proposal of Rogier and Velotti (2018a) may be useful in paving the way for future empirical studies, as these authors provided a comprehensive model explaining how specific deficits in psychological processes accounting for the main steps of ER (i.e. identification of emotional states, selection of appropriate ER strategies, implementation of selected strategies) are involved in the onset and maintenance of GD. In that sense, clarifying the interplay between ER components would, for instance, help clinicians to better select the objectives of clinical interventions, showing the role of mediating and moderating factors that should be targeted first.

Furthermore, the present findings suggest that the investigation of the role played by other variables, such as ER self-efficacy and emotional malleability beliefs, should be addressed. In addition, studies on the effectiveness of mindfulness-based interventions for GD may benefit from an examination of the potential moderator role of ER acceptance capacity. Finally, other clinical interventions that aim to increase the ability to accept one's emotional state in a nonjudgmental way should be developed and integrated in psychological interventions targeting GD.

Overall, the promising data found in the literature should prompt researchers to further explore the topic and replicate these findings to increase the pool of empirical evidence supporting the conceptualization of the role played by ER failures in GD. Such future efforts will contribute to the successful integration of the clinical objectives related to ER difficulties with tailored GD treatment.

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Contributors

Contributor PV designed the study. GR and SBZ conducted the literature search and study selection. GR and PV rated study quality. GR and SBZ computed the meta-analytic analyses. PV, GR, and JB interpreted the results. PV, GR, and JB wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Search terms compiled into two concepts for all database

Concept	Construct	Term (linked with "OR")
Gambling	A. Gambling	Gambl* MeSH term: gambling
Emotion regulation	B. Emotion	emotion* affect* mood feel*
	C. Regulation	regulat* dysregulat* tolera* manag*
	D. Emotion regulation strategies	avoid* suppress* ruminat* accept* mindful* reapprais* self compass*

Note: Final Search = (A) AND ((B AND C) OR D).

Appendix B. Studies ($N = 49$) investigating the relationship between GD and ER included in the systematic review and meta-analysis ($n = 41$)

Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
ER deficit total								
* Carr (2018)	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.28
*Cavicchioli et al. (2020)	Cross-sectional	319	46.26 (9.08)	58.2	SPQ	DERS	7	0.20
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.26
*** De Lisle et al. (2014)	Cross-sectional	78	44.6 (12.9)	100	PGSI	TMMS	5	−0.10
* Elmas et al. (2017)	Cross-sectional	246	33.31 (11.64)	100	SOGS	DERS	6	0.43
*Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	0.35
* Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	0.14
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	0.13
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.12
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	0.22
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	0.14
* Lim et al. (2020)	Cross-sectional	1.231	37.28 (9.16)	45.7	PGSI	DERS	8	0.22
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.40
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.15
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.16
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.22
* Parikh (2018)	Cross-sectional	118	29.66 (9.65)	49.2	SOGS	DERS	7	0.39
* Poole et al. (2017)	Cross-sectional	414	35.5 (11.1)	14.98	PGSI	DERS	7	0.35
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.28
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
* Schreiber et al. (2012)	Cross-sectional	194	21.13 (3.21)	70.62	SCI-PG	DERS	3	0.33
* Tang et al. (2019)	Cross-sectional	1.233	37.28 (9.16)	54.4	PGSI	DERS	7	0.22

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Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
Awareness								
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.04
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	−0.002
*Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	−0.31
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	0.09
*** Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	−0.05
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.10
** Gomes and Pascual-Leone (2009)	Cross-sectional	110	42.77 (9.27)	40	PGSI	LEAS-B	*na*	*na*
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	−0.08
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	−0.05
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.35
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.04
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.12
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.12
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.13
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.23
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.31
Clarity								
* Carr et al. (2018)	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.20
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.12
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.14
* Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	−0.01
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	0.07
*** Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	0.08
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.11
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	0.05
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	0.08
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.29
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.24
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.13
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.14
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.23
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.23
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*

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Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.34
Nonacceptance								
* Carr (2018)	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.24
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.18
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.30
* Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	0.32
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	0.14
*** Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	0.13
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.08
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	0.26
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	0.13
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.23
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.30
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.09
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.10
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.17
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.31
* Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.41
Goals								
* Carr (2018)	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.19
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.21
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.21
* Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	0.40
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	0.01
*** Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	0.02
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.08
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	0.43
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	−0.01
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.08
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.37
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.02
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.02
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.17
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.18
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*

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Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.34
Impulse								
* Carr (2018)	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.32
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.27
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.25
* Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	0.61
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.10
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.19
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.37
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.19
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.18
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.05
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.26
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.23
Accessibility								
* Carr, 2018	Cross-sectional	427	37.27 (11.86)	38.17	RAD	DERS-16	7	0.25
* Ciccarelli et al. (2021)	Cross-sectional	396	17.22 (1.03)	30.8	SOGS-RA	DERS	7	0.18
* Ciccarelli et al. (2016)	Cross-sectional	108	36.8 (11.52)	100	SOGS	DERS	8	0.20
* Estévez et al. (2020)	Cross-sectional	31	20.08 (2.4)	90.3	CAGI	DERS	8	0.31
* Farstad & Von Ranson (2021)	Longitudinal	202	36.03 (12.39)	0	PGSI	DERS	7	0.12
* Kapsomenakis et al. (2018)	Cross-sectional	45	45.12 (11.05)	100	SOGS	DERS	5	0.14
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	SCI-PG	DERS	8	0.35
* Marchica et al. (2020)	Cross-sectional	919	21.16 (2.86)	51.9	CPGI	DERS	9	0.13
* Marchica et al. (2019)	Cross-sectional	820	21.14 (2.9)	49.1	CPGI	DERS	9	0.14
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	DERS	8	0.19
* Rogier & Velotti (2018)	Cross-sectional	179	47.24 (11.64)	75.98	SOGS	DERS	8	0.26
** Sancho et al. (2019)	Cross-sectional	484	41.27 (13.21)	93	DSM-5	DERS	*na*	*na*
** Weatherly & Cookman (2014)	Cross-sectional	311	*na*	55.30	SOGS-PGSI	DERS	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	DERS	6	0.32
Control								
*** Estévez et al. (2017)	Cross-sectional	472	15.6 (1.33)	31.78	SOGS	DERS	6	0.20
***Estévez-Gutierrez et al. (2014)	Cross-sectional	1316	17.28 (2.7)	57.37	MULTICAGE	DERS	5	*na*
*** Jauregui et al. (2016)	Cross-sectional	274	39.29 (11.84)	100	SOGS	DERS	6	0.25
*** Jauregui & Estévez (2020)	Cross-sectional	430	15.6 (1.33)	48.4	SOGS	DERS	8	0.20

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Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
Reappraisal								
* Barrault et al. (2019)	Cross-sectional	287	34.1 (10.2)	100	SOGS	ERQ	7	0.02
* Barrault et al. (2017)	Cross-sectional	416	34.17 (9.7)	100	CPGI	ERQ	7	−0.02
* Canale et al. (2013)	Cross-sectional	313	22.4 (2.8)	46.64	SOGS	ERQ	7	0.00
* Jara-Rizzo et al. (2019)	Cross-sectional	197	33.18 (13.44)	67.5	SOGS	ERQ	*na*	*na*
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	DSM-5	ERQ	8	0.05
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	ERQ	8	0.10
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	6	0.51
* Navas et al. (2017)	Cross-sectional	86	34.17 (9.7)	100	SOGS	ERQ	7	0.07
* Pace et al. (2015)	Cross-sectional	241	33.02 (13.09)	58.92	SOGS	ERQ	6	−0.29
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	*na*	*na*
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	ERQ	6	−0.16
Suppression								
* Barrault et al. (2019)	Cross-sectional	416	34.17 (9.7)	100	CPGI	ERQ	7	0.05
* Barrault et al. (2018)	Cross-sectional	287	34.1 (10.2)	100	SOGS	ERQ	7	−0.07
* Canale et al. (2013)	Cross-sectional	313	22.4 (2.8)	46.64	SOGS	ERQ	7	0.13
* Jara-Rizzo et al. (2019)	Cross-sectional	197	33.18 (13.44)	67.5	SOGS	ERQ	*na*	*na*
* Mallorqui-Bague et al. (2018)	Cross-sectional	249	40.25 (12.82)	91.7	DSM-5	ERQ	8	0.11
** McIntosh et al. (2016)	Cross-sectional	115	38.48 (1.68)	60.86	SOGS	WBSI	*na*	*na*
* Mestre-Bach et al. (2019)	Cross-sectional	98	42.7 (12.7)	90.8	SOGS	ERQ	8	0.21
* Navas et al. (2017)	Cross-sectional	86	34.17 (9.7)	100	SOGS	ERQ	7	0.22
* Pace et al. (2015)	Cross-sectional	241	33.02 (13.09)	58.92	SOGS	ERQ	6	−0.10
* Riley (2014)	Cross-sectional	103	42 (13.99)	49.51	PGSI	WBSI	6	0.33
* Williams et al. (2012)	Cross-sectional	155	37.3 (11.36)	34.19	SOGS	ERQ	6	0.16
Rumination								
*** De Lisle et al. (2014)	Cross-sectional	78	44.6 (12.9)	100	PGSI	RRQ	5	−0.20
** Krause et al. (2018)	Cross-sectional	506	41.18 (12.17)	80.43	CIDI	RSQ	*na*	*na*
** McIntosh et al. (2016)	Cross-sectional	115	38.48 (1.68)	60.86	SOGS	RRQ	*na*	*na*
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	6	0.27
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	*na*	*na*
** Washington (2005)	Cross-sectional	125	21.13 (3.21)	70.62	SOGS	RSQ	*na*	*na*
Mindfulness								
* Cavicchioli et al. (2020)	Cross-sectional	319	46.26 (9.08)	58.2	SPQ	MAAS	7	−0.21
* Cavicchioli et al. (2020)	Cross-sectional	319	46.26 (9.08)	58.2	SPQ	FFMQ	7	0.05
* Cavicchioli et al. (2020)	Cross-sectional	319	46.26 (9.08)	58.2	SPQ	FFMQ	7	−0.01
*Dixon et al. (2019)	Cross-sectional	129	60.1 (14.05)	58.91	PGSI	MAAS	6	−0.49
* Kruger et al. (2020)	Cross-sectional	111	59.25 (12.89)	50	PGSI	MAAS	7	−0.44
* Mishra et al. (2019)		327	35.6 (12.6)	41.28	PGSI	FFMQ	9	−0.13

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Author (year)	Design	Sample			GD measure	ER measure	Quality assessment	*r*
		N	Age	Gender % males				
	Cross-sectional							
* Passanisi et al. (2019)	Cross-sectional	326	16.53 (3.34)	57	SOGS	CAMM	7	0.34
* Riley (2014)	Cross-sectional	103	42 (13.99)	49.51	PGSI	MAAS	6	−0.39
* Shead et al. (2020)	Longitudinal	59	21.6 (4.4)	10.2	PGSI	MAAS	7	−0.38
* Van der Tempel et al. (2019)	Longitudinal	21	56.2 (1.84)	0	SOGS	MAAS	7	−0.38
Other strategies							*Outcome*	
** Bilevicius et al. (2019)	Longitudinal	530	18.90	48	PGSI	WOCQ	Escape-avoidance	
**Gomes & Pascual-Leone (2009)	Cross-sectional	50	45	64	PGSI	EAC	Emotion-focused coping	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Self-blame	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Other-blame	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Catastrophizing	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Positive refocusing	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Acceptance	
*** Navas, Verdejo-García, López-Gómez, Maldonado, and Perales (2016)	Cross-sectional	86	34.17 (9.7)	100	SOGS	CERQ	Refocus on planning	
** Rogier et al. (2020)	Cross-sectional	99	47.61 (12.97)	83.8	SOGS	DERS-P	Goals positive	
** Rogier et al. (2020)	Cross-sectional	99	47.61 (12.97)	83.8	SOGS	DERS-P	Acceptance positive	
** Rogier et al. (2020)	Cross-sectional	99	47.61 (12.97)	83.8	SOGS	DERS-P	Impulse positive	
** Rogier et al. (2019)	Cross-sectional	196	47.12 (11.52)	79.6	SOGS	WOSC	Dampening	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Putting into perspective	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Positive refocusing	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Acceptance	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Refocus on planning	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Self-blame	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Other-blame	
** Ruiz de Lara et al. (2019)	Cross-sectional	246	33.14 (13.88)	66.67	SOGS	CERQ	Catastrophizing	
** Sanscartier et al. (2019)	Cross-sectional	624	*na*	47.8	PGSI	WOCQ	Distancing	
** Sanscartier et al. (2019)	Cross-sectional	624	*na*	47.8	PGSI	WOCQ	Escape-avoidance	
** Sanscartier et al. (2019)	Cross-sectional	624	*na*	47.8	PGSI	WOCQ	Problem solving	

Note. *Included only in the meta-analysis; **included only in the systematic review;***included in both the meta-analysis and the systematic review. GD: gambling disorder; ER: emotion regulation; SPQ: Short Promise Questionnaire; RAD: Recognizing Addictive Disorders; SOGS: South Oaks Gambling Screen; SOGS-RA: South Oaks Gambling Screen Revised for Adolescent; DERS: Difficulties in Emotion Regulation Scale; PGSI: Problem Gambling Severity Index; CAGI: Canadian Adolescent Gambling Inventory; TMMS: Trait Meta-Mood Scale; SCI-PG: Structured Clinical Interview for Pathological Gambling; CPGI: Canadian Problem Gambling Index; DSM-5: fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*; LEAS-B: Levels of Emotional Awareness Scale; na: not available; ERQ: Emotion Regulation Questionnaire; WBSI: White Bear Suppression Inventory; CERQ: Cognitive Emotion Regulation Questionnaire; RRQ: Rumination-Reflection Questionnaire; CIDI: Composite International Diagnostic Interview; RSQ: Response Style Questionnaire; MAAS: Mindfulness Attention Awareness Scale; FFMQ: Five Facet Mindfulness Questionnaire; CAMM: Child and Adolescent Mindfulness Measure; EAC: Emotion Approach Coping; WOCQ: Ways of Coping Questionnaire; WOSC: Ways of Savoring Checklist.

Appendix C. References of the studies included in the systematic review and meta-analysis

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