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The Role of Emotion Regulation in Video Gaming and Gambling Disorder: A Systematic Review

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ABSTRACT

Behavioral addictions are now recognized as a psychiatric condition. With this recognition came increased research interest, specifically within the video gaming and gambling fields, into the etiology and symptomology of these behavioral addictions. Emotion regulation (ER) has significant implications for mental health, with research highlighting the link between ER and the development of psychopathology. However, the relationship between ER and behavioral addictions remains relatively unknown.

Objectives: This review investigated the recent literature on this relationship.

Methods: Out of an initial sample of 2471 studies, 20 were eligible for inclusion. Data regarding outcome measures, sampling methods, results, and effect sizes of relationships were extracted and critically evaluated.

Results: Results indicated 90% of studies found lower ER to be associated with reports of greater video gaming or gambling disorder symptomology, with 13 studies (65%) reporting medium to large effect sizes.

Conclusion: The findings provide an in-depth analysis of the relationship between ER and behavioral addictions and highlights the key role ER plays in these addictive behaviors. This review provides novel insights into the potential prevention and intervention practices for behavioral addictions as well as recommendations for future directions.

Keywords: Emotion Regulation, Gambling, Video Gaming

Les dépendances comportementales sont maintenant reconnues comme une situation psychiatrique. Cette reconnaissance a entraîné un intérêt accru pour la recherche, en particulier dans les domaines du jeu vidéo et du jeu, dans l'étiologie et la symptomologie de ces dépendances comportementales. La régulation des émotions (RE) a des implications importantes au niveau de la santé mentale, les recherches soulignant le lien entre la RE et le développement de la psychopathologie. Cependant, la relation entre la RE et les dépendances comportementales reste relativement inconnue.

Objectifs: Cette étude a examiné la littérature récente concernant cette relation.

Méthodes: Sur un échantillon initial de 2 471 études, 20 étaient éligibles pour l'inclusion. Les données concernant les mesures de résultats, les méthodes d'échantillonnage, les résultats et l'ampleur de l'effet des relations ont été extraites et évaluées de manière critique.

Résultats: Les résultats ont indiqué que 90% des études démontrent que la baisse de la RE était associée à des rapports faisant état d'une plus grande symptomatologie du jeu vidéo, 13 études (65%) rapportant des effets de taille moyenne à grande.

Conclusions: Les résultats fournissent une analyse approfondie de la relation entre la RE et les dépendances comportementales et mettent en évidence le rôle clé que la RE joue dans ces dépendances comportementales. Cette étude fournit de nouvelles informations sur les pratiques potentielles de prévention et d'intervention pour les dépendances comportementales ainsi que des recommandations pour des orientations futures.

Mots clés: Jeu, Jeux vidéo, Régulation des émotions

INTRODUCTION

With the introduction of a new behavioral addictions category within the Substance-Related and Addictive Disorders section of Diagnostic Statistical Manual—5th edition (DSM-5), there has been increased discussion surrounding non-substance-related addictions.[1] Gambling disorder (GD) is currently the only non-substance-related disorder included within this category. However, there are other behavioral disorders that show similarities to both substance use disorders and GD. Although, research is still in its infancy, one such behavioral addiction is compulsive video gaming or

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Internet gaming disorder (IGD). While, IGD was proposed as a condition meriting further study in the DSM-5,[1] the World Health Organization recently recognized IGD (termed Gaming Disorder) in its 11th edition of the International Classification of Diseases (ICD-11) released in 2018.[2]

Gambling, *placing something of value at risk with the aim of possibly gaining something of greater value*, can be viewed along a continuum ranging from non-gambling to social or occasional gambling and at-risk gambling to problem/disordered gambling.[3] A US study reported that 58% of individuals gambled in the past year, with males gambling more often than females.[4] GD, *persistent and recurrent problematic gambling behavior leading to significant impairment or distress*,[1] has estimated prevalence rates of 0.3% to 2.4% among adults, and 0.2% to 12.4% among adolescents and young adults.[5,6]

Video or digital games[1] include interactive games played on electronic devices used internationally by millions of individuals. According to the Entertainment Software Association,[7] 42% of Americans play video games regularly (3 hours or more per week), and contrary to common stereotypes,[8] the average age of video game players is 35 years old. The ICD-11 defines gaming disorder as a *pattern of persistent or recurrent gaming behavior ("digital gaming" or "video-gaming"), which may be both online and/or offline.*[2] Estimated prevalence rates for video gaming disorder range from 1.7% to 10% among community samples including adolescents and adults.[9] Advances in technology allow gamers to immerse themselves into an increasingly realistic virtual world, often providing an escape to the restrictions of everyday life. For many this form of psychological escape becomes a compelling experience that engulfs their daily activities and responsibilities.[10]

The evidence demonstrating the parallels between gambling and video gaming, both esthetically and structurally, continues to grow. For example, both activities operate on behavioral principles of variable reinforcement schedules to reward and prolong play. Outcomes for both GD and IGD include financial and social challenges, lower academic or vocational performance, isolation, involvement in other risky behaviors (e.g., risky sexual behaviors, substance use), increased comorbidity with mood disorders, and mental health issues.[11,12] In addition, excessive engagement in these activities is often motivated by a desire to escape negative emotions and is closely related to diminished self-control, low self-esteem, loneliness, depression, and state and trait anxiety.[9,13–15]

Although advances have been made in better understanding the behavioral components of GDs and IGDs, research is needed on the mechanisms that may play an important role in the development and maintenance of behavioral addictions. Such research is critical to the production of effective, empirically based prevention and intervention programs for GD and IGD. To date, current research has often focused on the symptomology (e.g., depression/anxiety) rather than addressing underlying mechanisms that may motivate problematic engagement. Given the symptomology of these disorders, the extensive comorbidity with mood disorders, and the motivation to excessively engage in these behaviors to escape experienced negative emotions and affect, deficits in emotion regulation (ER) may represent a critical mechanism by which GD and IGD develop. As such, there exists an essential gap in our current understanding of the relationship between ER and these 2 behavioral addictions.

Emotion Regulation

ER refers to the process by which, how, and when negative and positive emotions are expressed and experienced.[16] Research has suggested that ER may be considered a transdiagnostic construct, given that those who suffer from psychological disorders tend to encounter increased ER deficits.[17,18] According to Gratz and Roemer,[19] difficulties in ER are produced by an inability to experience and differentiate a full range of emotions as well as the inability to modulate stronger negative emotions. Consequently, it is important for individuals to be able to monitor and evaluate their emotional experiences, in addition to managing the expression of these emotions through ER strategies. As such, Gratz and Roemer's[19] theoretical construct suggests that ER encompasses 4 general principles: (1) an *awareness* and *understanding* of one's emotions, (2) an *acceptance* for experiencing one's emotions, (3) the ability to *control impulsive* behaviors, and (4) the ability to be *flexible* with ER strategies dependent on the context. Research has revealed that a failure to meet any of these principles may result in negative mental health outcomes and distress.[18,20] The ability to regulate emotions is often brought forth by using various ER strategies. Examples of adaptive ER strategies include problem solving, accepting/tolerating emotions, and adjusting/reappraisal, while maladaptive ER strategies are typically thought to include suppression, rumination, and avoiding/concealing emotions. Reappraisal and adjusting strategies involve cognitively reformulating the meaning of the situation in order to modify emotions, while suppression consists of inhibiting behaviors associated with emotional responding.[18] Consistent with this approach to ER, research suggests that a lack of emotional acceptance is maladaptive and associated with greater difficulties in ER.[19] In fact, there is continued evidence showing that efforts to avoid or control internal experience (i.e., unwanted emotions) underlies many psychological disorders.[19]

[1] (Although, the World Health Organization distinguishes video-gaming and digital-games as separate forms of gaming, for the purpose of this paper the term video games includes both types of gaming activity, given the ICD-11 definition of *gaming disorder*.).

Previous research has revealed that individuals with gambling problems often report gambling in an attempt to regulate and escape unwanted emotions.[21] Further, Riley[22] found that experiential avoidance was predictive of higher levels of problem gambling among problem gamblers seeking treatment, thus suggesting a lack of acceptance for negative emotions and a focus on strategies that allow avoidance and escape of negative affective states. In addition, problem gamblers have regularly shown impairments in ER strategies that involve looking at long-term over short-term benefits and costs. For example, the Iowa Gambling Task assesses decision-making behavior through the process of learning via monetary rewards and punishment. Problem gamblers have consistently performed worse than controls on this task due to a perseverance in choosing immediate higher magnitude rewards in spite of larger long-term punishments.[23,24] These under-representations of possible ER strategies may be understood as a "myopia for the future," where problem gamblers are unable to see various regulatory strategies that would lead to more beneficial long-term decisions. This consequently suggests a lack of flexibility and an inability to control impulsive behaviors that are often costly to the individual.

Given that individuals presenting with gambling and video gaming problems often report engagement in the behavior as an attempt to regulate and/or escape unwanted emotions,[21,25] it would seem that they utilize these activities as maladaptive ER strategies. However, the relationship between these 2 variables remains relatively unexplored. By understanding the role ER plays on excessive gambling and video gaming engagement, individuals who display poor or maladaptive ER skills could possibly be screened and provided programs to reduce the risk of behavioral addictions. Finally, a validation of the probable connection between deficits in ER and behavioral addictions would contribute to advancements in terms of available treatment options. As such, the primary objective of the following review is to investigate the relationship between ER and problem gambling and video gaming, and to identify gaps and limitations in the literature.

METHODS

The methodology for this review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol in the design, performance, and reporting of results.[26]

Eligibility criteria

Given that a previous systematic review examining research between 1990 and 2009 was conducted on emotional intelligence and gambling[27] the current review included all quantitative studies that were published between January 2010 and March 2019, thereby examining the most recent literature in the area. In addition, articles included had to be in English, published in peer-reviewed journals, and studies examining the relationship between ER (i.e., following Gratz and Roemer's theoretical model) or Emotion Regulation Strategies (i.e., Reappraisal/Suppression) and either problem gambling and/or video gaming to be included in the review. Measures used in the studies that were included had been previously validated in research as having strong psychometric properties. Further, no animal or intervention studies were included.

Search strategy

Studies were identified both by searching electronic databases and conducting a backwards search of relevant articles. Articles were obtained from searching databases which included, PsycINFO, Medline, PubMed, and Web of Science.

The electronic search was executed for 2 groups of keyword combinations. For ER, the following keywords were used: *Emotion OR Regulation, Emotion Dysregulation, Regulation of Emotions, Self-Regulation, Emotional Control, Emotional Management, Emotional Response,* and *Emotional Reactivity.* For video gaming and gambling addictions the following keywords were used: *Gambl*, Gambling Disorder, Gambling Addiction, Pathological Gambling, Gaming, Gaming Disorder, Internet Gaming Disorder, Pathological Gaming,* and *Video Gaming Addiction.*

Data collection

Data extraction from each publication was carried out by the first author and revised by the second author for potential inconsistencies, and included information pertaining to (1) author and publication year, (2) country of study origin, (3) type of behavioral addiction, (4) sampling method, (5) sample characteristics (age, sample size), (6) outcome measures assessing behavioral addictions and ER (measures, constructs assessed), (7) statistical analyses applied, and (8) study results (Table 1). The extracted data was reviewed by the second author.

RESULTS

Study selection

All obtained records were screened for eligibility in 3 phases: (1) initial title and abstract screening, (2) full text screening, and (3) a data extraction phase (refer to Fig. 1 for study identification flow diagram).[2] A total of 20 articles meeting all criteria were included in the review.

[2] (Both the first and second author reviewed the articles with 91% agreement rate. Ten articles were flagged for discussion due to minor disagreements in the reviewer's evaluations. The reviewers met to discuss these disagreements until a unanimous decision was made.).

Table 1: Studies included in systematic review.

	Study	Country	Type of behavioral addiction	Sampling method	Sample characteristics (% female)	Addiction and ER outcome measures	Statistical analysis	Results
1.	Amendola et al (2019)	Italy	Gaming	Convenience General	N = 280 (49%); M_{age} = 13.31 years (SD = 2.33, range = 11–18)	CSAS, DERS	ANOVA; multiple linear regression	DERS strategies subscale was best predictor of IGD; strategies, non-acceptance, and being male accounted for 29% of variance in IGD
2.	Barrault et al (2017)	France	Gambling	Convenience General	N = 416 (2%); M_{age} = 31.4 years (SD = 8.5, range = 18–55)	CPGI, ERQ	ANOVA; Chi-square; multiple linear regression; correlation	Anxiety and depression: linked to PG with higher scores in PG group for depression and anxiety; ERQ: no difference in ER strategies between poker players within each group
3.	Barrault et al (2019)	France	Gambling	Convenience General	N = 287 male; M_{age} = 34.1 years (SD = 10.2)	SOGS, ERQ	Chi-square; the Student *t* test; Spearman correlation; univariate logistic regression	PG not associated with ER; gambling type was a significant moderator between suppression and PG; strategic gamblers used suppression more often than mixed gamblers
4.	Blasi et al (2019)	Italy	Gaming	Convenience WoW players	N = 390 (25.9%); M_{age} = 28.28 (SD = 8.24, range = 18–67)	DERS-18, IAT-WoW	Pearson correlation, SEM analysis	DERS total and subscales were significantly and negatively related to IGD; ER predicted both motives to escape and IGD; motive to escape partially mediated relationship between ER and IGD
5.	Ciccarelli et al (2016)	Italy	Gambling	Convenience General	N = 108 male; M_{age} = 36.80 years (SD = 11.52, range = 21–63)	Modified Posner task, SOGS, DERS	Zero-order correlations; ANOVAs; single sample *t* test	All DERS subscales correlated with gambling severity; compared to NPG, PGs reported higher levels of craving, emotion dysregulation, and negative mood states
6.	Elmas et al (2017)	Turkey	Gambling	Convenience General	N = 246 males; M_{age} = 33.3 years (SD = 11.64, range = 18–64)	TAS-20, DERS, SOGS	*t* Test; hierarchical regression; multiple regression	Difficulties with ER and alexithymia are positive significant predictors of PG; emotion dysregulation had a mediator role between alexithymia and PG
7.	Estevez et al (2017)	Spain	Gaming and gambling	Convenience General	N = 430 (51.6%); M_{age} = 15.6 years (SD = 1.33, range = 13–21 years)	DERS; SOGS-RA; video game-related experience questionnaire	Blockwise regression analysis; the Student *t* test	ER significantly predicted all outcome variables (especially lack of control subscale); ER had a significant negative correlation with VG and GD
8.	Jauregui et al (2016)	Spain	Gambling	Convenience Clinical and control	N = 167 male PGs; M_{age} = 39.29 years (SD = 11.84); N = 107 male non-gamblers; M_{age} = 33.43 years (SD = 11.93)	SOGS, DERS	Stepwise multiple linear regression; SPSS Macro INDIRECT	PGs exhibited greater difficulties with ER; ER difficulties correlated with predicted PG; ER difficulties mediated the relationship between anxiety and pathological gambling controlling the effect of age, both when controlling and not controlling for effect of other substance abuses
9.	Liau et al (2015a)	Singapore	Gaming	Convenience General	Study 1: N = 2714 (28%), M_{age} = 10.93 years (SD = 2.04); Study 2: N = 301 (18.2%), M_{age} = 12.88 years (SD = 0.80)	Video game habits, PSI-2, DSM-4 gambling items (adapted for gaming)	SPSS Macro INDIRECT	Self-regulation was a mediator between impulsivity and pathological video gaming
10.	Liau et al (2015b)	Singapore	Gaming	Convenience General (2 years longitudinal)	N = 2998 (27.3%); grades 3–8	PSI-2, DSM-4 gambling (adapted for video gaming)	Linear and logistic regression; SEM	Increases in levels of ER and family environment warmth were related to decreases in PVGU
11.	Liu et al (2017)	China	Gaming	Convenience General (18-month longitudinal design)	N = 420 (47.6%), M_{age} = 9.74 years (SD = 0.45)	SCDC, pathological video game use questionnaire (adapted), ERQ	Chi-square Path analysis, CFI, TLI, RMSEA	Controlling for age, sex, and sensation seeking, social communication was related to decreased ER, which in turn was related to lower school connectedness which was related to increases in IGA
12.	Navas et al (2017)	Spain	Gambling	Convenience Clinical and control	N = 41 male GDs; M_{age} = 35.22 years (SD = 11.16); N = 45 male HCs, M_{age} = 33.22 years (SD = 7.18)	SOGS, UPPS-P, ERQ	Bayesian *t* tests; bivariate correlations	GDs relative to HCs showed higher levels of emotional suppression; negative urgency correlated positively with emotional suppression
13.	Navas et al (2016)	Spain	Gambling	Convenience Clinical and match control	N = 41 GDs, M_{age} = 35.22 years (SD = 11.16); N = 45 HCs, male M_{age} = 33.22 years (SD = 8.18)	CERQ, GRCS, SOGS	ANOVAs; MANOVAs; linear stepwise/logistic regression; mediation path analysis	GDs were observed to use self-blame and catastrophizing, but also positive refocusing more often than controls; GDs putatively adaptive CERG strategies shared a significant portion of variance with GD severity and gambling-related cognition beliefs

(*continued*)

Table 1
(continued).

	Study	Country	Type of behavioral addiction	Sampling method	Sample characteristics (% female)	Addiction and ER outcome measures	Statistical analysis	Results
14.	Orlowski et al (2018)	Germany	Gambling	Convenience Vocational schools	N = 4928 (37.2%), M_{age} = 19.9 years (SD = 3.72, range = 15–52)	Stinchfield self-report questionnaire based on DSM-5 criteria of GD; ASQ	Linear regression; multinomial logistic regression	Significant association between "Adjusting" and "Tolerating" ER strategies and GD but not for "Concealing"; lower "Tolerating" and "Adjusting" scores increased likelihood of GD classification
15.	Pace et al (2015)	Italy	Gambling	Convenience General	N = 251 (43.4%) M_{age} = 33.02 years (SD = 13.09, range = 21–77)	SOGS, ATQ-SF, ERQ	ANOVAs; discriminant function analysis	Compared to low-risk gamblers PGs had lower levels of internal LoC and cognitive reappraisal and higher levels of chance LoC
16.	Poole et al (2017)	Canada	Gambling	Convenience General (Mturk)	N = 414 (37%); M_{age} = 35.5 years (SD = 11.1, range = 18–71 years)	DERS; PGSI	Binary logistic regressions; mediation analysis	25.7% classified as GD; increase in ACEs significantly predicted PG; increase in ACEs significantly predicted lower ER; lower ER significantly predicted GD, controlling for ACE; significant indirect effect of ACEs on GD via emotion dysregulation
17.	Rogier and Velotti (2018)	Italy	Gambling	Purposive and snowball sampling Clinical and control	N = 178 total M_{age} = 47.24 years (SD = 11.64); control group: N = 105 (23.8%); clinical group: N = 74 (15.1%)	DERS; SOGS	ANOVAs; independent sample *t* test; MANCOVAs, hierarchical multiple regression; mediation analysis	GD had higher DERS total scores and higher scores on all DERS subscales compared to control group; GD severity was significantly correlated with all DERS subscales, except goals; emotion dysregulation significantly mediated relationship between grandiose narcissism and GD severity with direct effect becoming non-significant
18.	Tang et al (2019)	United States	Gambling	Convenience General (Mturk) Full-time employees	N = 1233 (55%); M_{age} = 37.28 years (SD = 9.16, range = 25+ years)	PGSI, DERS-18	Multiple regression analysis; SPSS PROCESS v3	PG related to lower ER; ER was best predictor of PG, followed by gender; ER significant mediator between work stress and gambling; ER was significant mediator between burnout and PG; serial mediation supported in that work stress was related to PG through influence of burnout and ER, with ER being most proximal psychological factor
19.	Williams et al (2012)	Australia	Gambling	Convenience PG group, CC and HC	N = 56 PGs (25%), M_{age} = 37.73 years (SD = 11.36); N = 51 CCs (66.6%), M_{age} = 30.98 years (SD = 12.50); N = 49 HCs (77.5%), M_{age} = 28.97 years (SD = 8.55)	DERS, ERQ, SOGS, SCIP	Zero-order correlations; partial correlations; MANCOVA; univariate tests	PGs and CCs reported significantly less use of reappraisal as ER strategy and reported a greater lack of emotional clarity and more impulsivity than HCs; PGs reported a greater lack of emotional awareness compared to HCs and reported differences in access to effective ER strategies compared to both CCs and HCs
20.	Yen et al (2018)	Taiwan	Gaming	Convenience IGD group and matched HC	N = 174 (20%; 87/87); M_{age} CC = 23.29 years (SD = 2.34), M_{age} HC = 23.38 (SD = 2.40)	DSM-5 criteria for IGD; MINI psychiatric interview; ERQ	Logistic and linear regressions	IGD group had significantly lower scores of reappraisal; IGD group had higher scores on suppression; reappraisal was a significant negative predictor of IGD; suppression was a significant positive predictor of IGD; higher suppression and lower reappraisal significantly predicted comorbid mood disorders in IGD group

ACEs = Adverse Childhood Experiences, ANOVA = Analysis of Variance, ASQ = Affective Style Questionnaire, ATQ-SF = Adult temperament questionnaire-short form, CC = clinical control, CERG = Cognitive emotion regulation questionnaire, CERQ = Cognitive Emotion Regulation Questionnaire, CFI = comparative fit index, CPGI = Canadian Problem Gambling Index, CSAS = Video Game Dependency Scale, DERS = Difficulty in Emotion Regulation Scale, DSM = Diagnostic Statistical Manual, ER = emotion regulation, ERQ = Emotion Regulation Questionnaire, GD = gambling disorder, GRCS = Gambling related cognition scale, HC = Healthy Control, IAT-WoW = Internet Addiction Test- World of Warcraft, IGA = Internet gaming addiction, IGD = Internet gaming disorder, LoC = Locus of Control, MANCOVA = multivariate analysis of covariance, MANOVA = multivariate analysis of variance, MINI = Mini-International Neuropsychiatric interview, NPG = non-problem gamblers, PG = Problem Gambling, PGSI = Problem gambling severity index, PSI-2 = Personal Strengths Inventory, PVGU = problematic video game use, RA = revised adolescent, RMSEA = Root Mean Square Error of Approximation, SCDC = Social and Communication Disorders Checklist, SCIP = Structure Clinical Interview for Pathological Gambling, SEM = Structural Equation Modeling, SOGS = South Oaks Gambling Screen, TLI = Tucker-Lewis Index, UPPS-P = UPPS-P Impulsive Behavior Scale, VG = Video gaming.

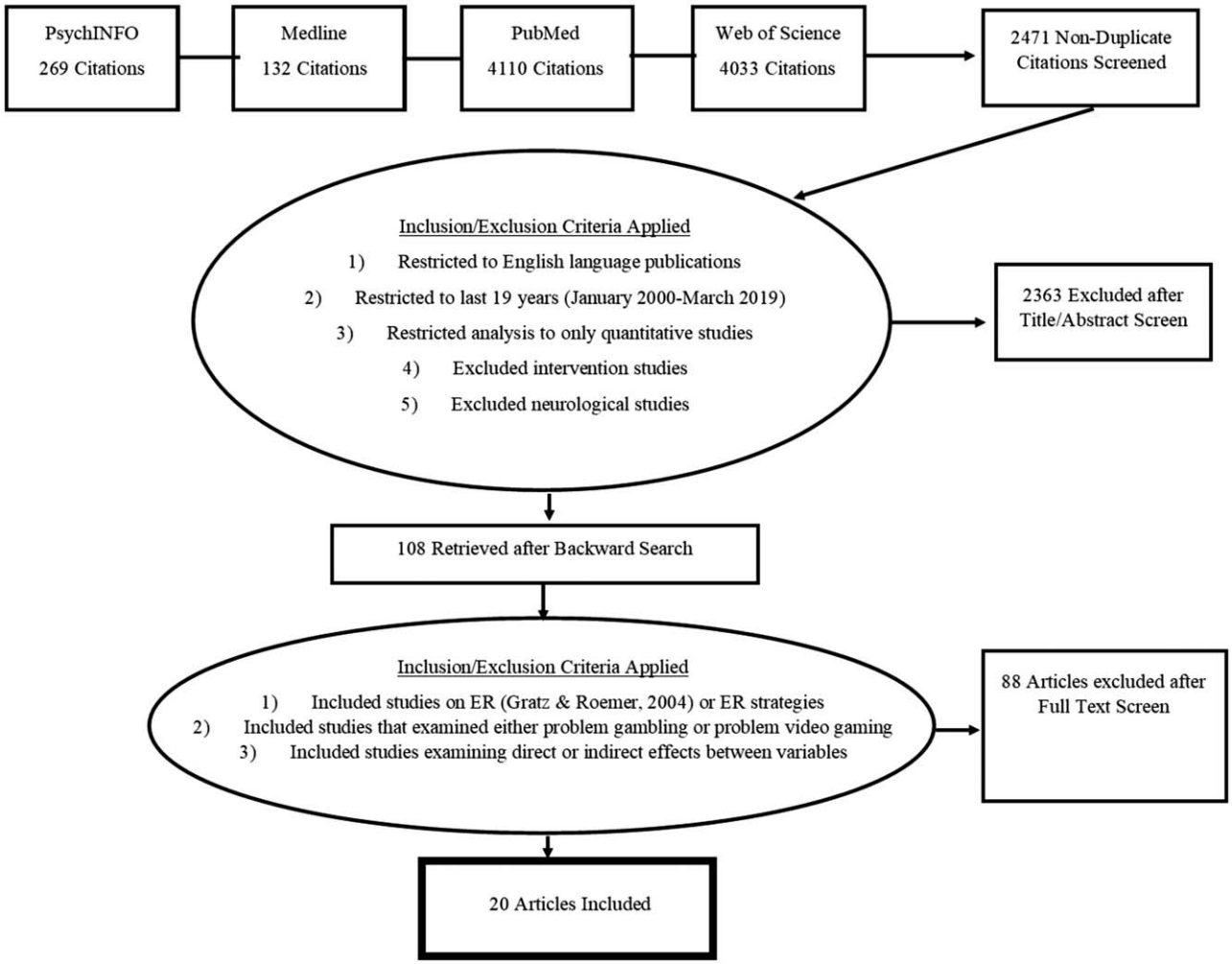

Fig. 1.

Study identification flow diagram.

Study characteristics

The characteristics of selected studies are presented in Table 1. Most of the studies selected (95%) took place during the past 5 years (2014–2019), more than half (65%) were carried out in Europe, and most of the studies (k = 13) examined the relationship between problem gambling behaviors and ER.

Assessment of methodology

Sample characteristics and sampling method

All studies applied convenience sampling methods. In total, data from 12,899 participants (not including duplicate samples) were analyzed across all 20 studies. Most studies (k = 18) used a cross-sectional design, while 2 incorporated longitudinal data (ranging from 18 months to 2 years).

In 15 studies (75%), the participants were adults (18+ years). Among adult participants, 2 studies examined problem video gaming, while the other 13 focused on gambling. Studies with child/adolescent participants all examined video gaming, with 1 study investigating both video gaming and gambling. As such, developmental differences regarding the relation between ER and GD or IGD could not be assessed at this time. Few of the studies included (25%) had samples with comparable numbers of males and females. For instance, 45% were based on samples that included less than 40% of female participants and 6 studies had samples comprised solely of males. All studies used self-report measures.

Behavioral addiction measures

All the included studies (k = 20) used some form of self-report assessment for problematic levels of the behavioral addiction (gambling/video gaming) (e.g., Canadian Problem Gambling Index, South Oaks Gambling Screen, Pathological Video Game Use Questionnaire). Three studies employed a different measure for behavioral addiction in conjunction with self-report questionnaires, 2 employed a diagnostic clinical interview for gambling behaviors,[28,29] while Ciccarelli et al[30] employed a modified version of the "Posner Task" as a behavioral

measure for gambling problems. The *Posner Task* has been previously used to assess GDs by examining whether participants have an attentional bias for "gambling-related" images over "neutral" images.

Emotion regulation measures

All (k = 20) studies incorporated a self-report measure of ER. Twelve studies measured ER through a questionnaire that encompassed all the principles of ER (e.g., Difficulty in Emotion Regulation Scale), or through an ER subscale of a larger measure (e.g., Personal Strengths Inventory). Other studies measured strategies of ER. Seven studies measured levels of suppression, reappraisal, adjusting, tolerating, and concealing [Emotion Regulation Questionnaire, Affective Style Questionnaire, or cognitive ER strategies (Cognitive Emotion Regulation Questionnaire)].

Synthesis of results

The measures of effect sizes varied across studies, with several studies not reporting effect sizes. When effect sizes were not available, where possible, they were estimated using statistical test results (correlations, *t* test, *F* test, means, and SDs) and an effect size calculator.[31] When the information provided in the publication did not allow for this calculation, respective authors were contacted as an attempt to acquire the necessary information. Effect sizes were converted into a Cohen's *d* standardized effect size using effect size converting formulas.[32,33] Cohen[33] suggests the following standard for interpreting the magnitude of an effect size for *d*, whereby 0.20 is small, 0.50 is medium, and 0.80 or greater is large.

Emotion regulation and problem gambling

Of the 14 published articles examining the relationship between ER and problem gambling, 2 failed to find significant results. Barrault et al[34] found no significant difference in ER strategies (i.e., reappraisal and suppression) among problem gamblers in a group of poker players. In addition, Barrault et al[35] reported once again that ER strategies were not associated with GD, but that gambling type was a significant moderator between using suppression as an ER strategy and GD (i.e., the effect of suppression was higher among strategic gamblers compared to mixed gamblers).

Four studies (29%) reported large effect sizes. Specifically, Elmas et al,[36] Jauregui et al,[37] and Williams et al[28] found that higher emotion dysregulation scores were associated with increased levels of problem gambling (Cohen's d = 0.90–1.02). Navas et al[38] reported a large effect size between maladaptive ER strategies (i.e., catastrophizing and self-blame) and problem gambling (Cohen's d = 0.91 and 1.37).

Six studies (43%) reported medium effect sizes; 4 studies reported that higher emotion dysregulation was associated with increased problem gambling (Cohen's d = 0.50–0.70).[30,39–42] Two studies reported that reappraisal was significantly lower among problem gamblers as compared to low-risk gamblers (Cohen's d = 0.71),[43] and that suppression was significantly higher among problem gamblers compared to healthy controls (Cohen's d = 0.50).[39]

Finally, 2 studies (14%) found small effect sizes between these variables. One study found a significant association between problem gambling and higher levels of emotion dysregulation (Cohen's d = 0.30),[44] while Orlowski et al[45] reported a negative association between problem gambling and adjusting (Cohen's d = −0.12) and a positive association between problem gambling and concealing (Cohen's d = 0.14).

Emotion regulation and problem video gaming

Of the 7 studies that examined the relationship between ER and problem video gaming, 2 studies (29%) reported large effect sizes indicating that higher emotion dysregulation led to increased IGD[46,47] and 1 study reported a medium effect size (Cohen's d = 0.60).[44]

Four studies (57%) found small effect sizes reporting that increased ER was related to decreased levels of problem video gaming (Cohen's d = 0.20, 0.29, and 0.30).[48–50] Finally, Yen et al[29] reported that participants in the IGD group had significantly higher levels of suppression scores (Cohen's d = 0.35) and lower levels of reappraisal scores (Cohen's d = 0.41) compared to healthy controls.

Liau et al,[48] in a longitudinal study, reported increases in ER acted as a protective factor for problem video gaming, while impulsivity acted as a risk factor. Liu et al,[50] further reported that social communication predicted problem video gaming directly, as well as indirectly by serial mediation through ER and school connectedness.

DISCUSSION

This review examined the relationship between ER and problem gambling and video gaming. Overall, the information presented in this review provides support for the relationship between ER deficits and behavioral addictions among both child/adolescent and adult samples. Eighteen studies (90%) reported a statistically significant relationship between ER and behavioral addictions, whereby less adaptive ER was associated with a rise in behavioral addiction symptoms. More specifically, 6 studies reported large effect sizes (Cohen's $d \geq 0.80$); while another 7 reported medium effect sizes (Cohen's

$d \geq 0.50$). Thereby demonstrating a consistent pattern in the direction of this relationship. As such, difficulties with ER may be considered a risk factor in the development of behavioral addictions.

In addition, these results continue to support the notion of ER as a transdiagnostic construct.[51] Research with non-clinical samples have generally reported significant relationships between ER and symptoms across various psychopathologies including, depression, anxiety, eating difficulties, bipolar disorder, and other substance use disorders.[17,51–53,55] The current review extends these findings by examining the relationship between ER and behavioral addictions (gambling and video gaming), thereby lending further support to the mounting evidence that suggests difficulties with ER are likely part of the underlying mechanisms of multiple forms of psychopathology. Further, these results suggest that ER should be considered as a crucial and specific target in psychological treatment and prevention measures of behavioral addictions. For instance, programs that focus on teaching how to label emotions and recognize how emotions are manifested in the body (i.e., emotional awareness) will allow individuals to better *understand* and become *aware* of their emotional experiences. While, programs such as, mindfulness-based treatments that target awareness, acceptance, and non-judgment toward experienced emotions, will allow individuals to overcome periods of high emotional intensity without reacting *impulsively* which are characteristics of individuals engaging in excessive gambling and gaming behaviors.

It is possible that conclusions drawn from study results were compromised by several factors including sample characteristics, measurement issues, and various methodological approaches. First, in 75% of studies, participants were over the age of 18, while only 5 studies (all within the gaming field) involved either children or adolescents. This implies a specific need to differentially examine how ER effects behavioral addictions in children, adolescents, and adults, especially given the high levels of stressors frequently observed in adolescence. Specifically, adolescents are often less successful in regulating their emotions,[5] they manifest higher levels of impulsivity, and are more susceptible to addictive behaviors.[52] For instance, research has consistently shown that adolescents are 2 to 4 times more likely to experience gambling problems compared to adults.[5,53–57] In addition, the transitionary points within lifespan development could also be explored as another means of understanding the unique stressors that occur at different development periods (e.g., changing schools, graduating from college, starting a family). The studies included also had an over-representation of male participants, with 30% of studies having samples comprised solely of males. This is likely due to the over-representation of males with gambling and gaming disorders.[9,58] However, studies have shown higher prevalence rates for mood disorders and ER difficulties among females.[59] It is thus possible that effect sizes observed in these studies would have been stronger among samples with higher female representation. Unfortunately, it is impossible to test this hypothesis given that no study had a sufficiently large sample of females. This suggests a need for more definitive research investigating the relationship between ER deficits and behavioral addictions among females. In addition, all studies utilized self-report measures, which may potentially lead to biased estimates of self-assessed behavior, misunderstanding of questions, or social-desirability biases. Social-desirability biases in gambling research is a significant risk to research in the behavioral addictions field as participants may feel uncomfortable reporting on risky or addictive behaviors, especially given the lower social acceptability of excessive engagement.

Finally, only 2 studies (10%) examined the relationship between ER and problem video gaming longitudinally, while no studies to date have investigated the relationship between ER and problem gambling over time. To effectively understand the predictive relationship of ER deficits on developing behavioral addictions, further longitudinal research needs to be conducted.

There are a number of limitations in this review that should be noted. First, the studies included were limited to English publications, excluding published research in other languages. Given that most of the selected studies were conducted in Europe, future research should include other language publications to obtain a more comprehensive review. Second, all types of gambling and video gaming activities were included and combined in this review. It is possible that results may differ depending on the type of gambling or video gaming activity. However, given the limited research in behavioral addictions examining the effect of ER, for the current review it was necessary to combine type of activity. Previous research in the gambling field, has shown that problem gamblers were more likely to be associated with particular forms of gambling activities (i.e., electronic gaming machines, casino games, bingo, and poker), as well as, more likely to participate in more forms of gambling than non-gamblers.[60] Third, we include several diverse measures of ER (e.g., Emotion Regulation Questionnaire and Difficulty in Emotion Regulation Scale) and problem gambling and video gaming within this review. It is also possible that these instruments may measure slightly different constructs. A significant challenge for research in ER and behavioral addictions is the use of standardized instruments and methodologies. For one, video gaming addiction continues to have inconsistencies in conceptualization, and approaches to screening and diagnosis (even post DSM-5 and ICD-11). These inconsistencies have

limited stable and reliable prevalence rates, as well as comparison of results among studies.[61] In addition, although ER is now viewed as an important construct throughout many areas of psychology (i.e., biological, social, development, clinical, etc.), many academics use the term ER in diverse ways, also creating inconsistencies in conceptualization and definitions.[62] Finally, given the high level of comorbidity between behavioral addictions and other psychopathologies (e.g., mood disorders) the relationship found between ER and behavioral addictions could be accounted for by these comorbid disorders that have been previously associated with ER. Nevertheless, significant theoretical and practical implications are expected from such work. However, the limited number of peer-reviewed articles examining ER suggests more extensive research is necessary in order to address the longitudinal appropriateness of using this theoretical construct in predicting behavioral addictions. Future studies should also focus on the role of ER among adolescents and young adults in predicting behavioral addictions, especially if prevention efforts intend to be implemented. Moreover, in order to understand the predictive nature of ER, additional longitudinal studies need to be conducted within the field.

While current research in this domain is still in its infancy, the results of this review provide preliminary evidence suggesting that deficits with ER are significantly associated with behavioral addictions. As a result, individuals suffering from behavioral addictions might benefit from intervention programs that target the development/enhancement of ER skills. In addition, those with ER deficits could be potentially identified as at-risk and take part in prevention programs. Prevention and intervention research has begun to move away from single-disorder programs toward initiatives that target multiple disorders (i.e., focusing on all behavioral addictions, rather than only problem gambling or video gaming). Therefore, programs that adopt increasing protective factors such as ER, rather than focusing merely on symptomology, are likely to be the most effective toward improved mental health outcomes and overall well being.

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