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Exploring the pathways model in a sample of patients with gambling disorder

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ABSTRACT

From clinical and research perspectives, the Pathways Model has been supported in adolescent and adult populations as a theoretical explanatory framework for considering gambling disorder (GD). However, it has been less well explored in clinical samples. Therefore, the aim of this study was to explore the Pathways Model, specifically pathways 2 (emotionally vulnerable) and 3 (antisocial impulsivist), in 241 consecutive treatment-seeking adults with GD. Structural equation modeling was used. Path analyses that considered continuous variables provided, in general, support for the Pathways Model in this clinical population, albeit with some caveats. The results suggest the presence of different profiles of gamblers, with some having emotions and others impulsivity-related factors more prominently involved. Additional associations, not raised by the model, were also found. For example, a greater role for anxiety as compared with depression was observed in pathway 2, and important mediating roles for cognitive distortions and habituation were observed across pathways. Using an approach that considered variables dimensionally may help aid in understanding clinically relevant relationships. The current findings suggest complexities regarding relationships between factors involved in GD clinical samples. These findings have implications for characterizing subtypes of GD and development of optimal prevention and treatment approaches.

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Gambling; impulsivity; addictive behavior; depression; substance abuse

1. Introduction

Gambling disorder (GD) is characterized by a recurrent and persistent pattern of gambling behavior that leads to clinically significant distress (American Psychiatric Association [APA], 2013). GD is a complex disorder with multiple associated biological, environmental, developmental, cognitive, psychopathological and personality factors

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(M. N. Potenza et al., 2019; Yau & Potenza, 2015). Multiple possible causal pathways for GD suggest multiple GD typologies (Valleur et al., 2016). The different gambling typologies may share excessive/interfering patterns of gambling, but could differ in etiologies, motivations and other factors (Milosevic & Ledgerwood, 2010).

Although different theoretical models of GD and its etiology have been proposed, the Pathways Model (Blaszczynski & Nower, 2002) is arguably the most prominent in explaining heterogeneity among individuals with GD. This theoretical model divides gamblers into three main groups: behaviorally conditioned (pathways 1), emotionally vulnerable (pathways 2), and 'antisocial impulsivist' (pathways 3). Each group presents with different sets of proposed predisposing risk factors and GD consequences. However, some current theories/approaches (e.g. the Research Domain Criteria or R-DoC) suggest an importance of considering dimensional aspects within populations, including clinical ones like patients with gambling disorder. Considering dimensional variables may thus provide additional insight into clinically relevant phenomena and inter-relationships or pathways.

In the original Pathways Model, the behaviorally conditioned group was proposed to be characterized by lower GD severity and absence of co-occurring mental disorders. These individuals may not show affective predispositions, although emotional problems may result from gambling. In this vein, gambling behavior may be promoted by external factors, such as social pressure, and involve behavioral conditioning.

The emotionally vulnerable group may present with anxiety and/or depression predating GD, coping and problem-solving impairments, and adverse family and developmental experiences. These factors may then generate negative emotions, with gambling used as a emotional regulatory strategy.

Finally, the antisocial impulsivist group may present with greater interference related to gambling. These individuals may have specific vulnerabilities (genetic predispositions, neurocognitive impairments, hyperactivity, inattention, early age at gambling onset, or poor socialization), numerous maladaptive behaviors (e.g. substance abuse, criminal behaviors, suicidality) and high levels of impulsivity. These individuals may use gambling to increase arousal levels and/or reduce feelings of boredom.

Although the three groups have been posited as discrete entities, they may not be mutually exclusive. That is, there could be an overlap of symptoms and motivations among the different pathways (Milosevic & Ledgerwood, 2010).

A recent systematic review examined 14 studies that had examined the Pathways Model (Kurilla, 2021). Although these studies appear to support the theoretical model, the author highlighted the lack of studies on clinical populations. Although the Pathways Model was proposed in clinical populations, most studies have used community samples. In addition, Kurilla (2021) highlights the lack of studies involving samples from outside English-speaking countries. To address the present limitations, the central objective of this study was to test the Pathways Model in a Spanish clinical sample of consecutive treatment-seeking individuals diagnosed with GD. We specifically focused on pathways 2 (emotionally vulnerable) and 3 (antisocial impulsivist) because it has been suggested that these are the pathways associated with the greatest clinical severities. We hypothesized that both pathways, as analyzed by structural equation modeling (SEM), would obtain adequate fit.

2. Material and methods

2.1. Participants and procedure

The study sample included 241 patients diagnosed with GD who were being treated at the GD Unit within the Department of Psychiatry at a University Hospital. Patients voluntarily sought treatment for GD and were referred to the Unit by general practitioners or other health care professionals. Patients were consecutive referrals for assessment and treatment from January 2016 to October 2019. Exclusion criteria included the presence of intellectual disabilities, active psychotic disorders, or neurodegenerative conditions such as Parkinson's disease. Face-to-face clinical interviews were conducted by experienced psychologists and psychiatrists with more than 20 years of experience in the field to determine GD diagnoses, and only patients who sought treatment for GD as their primary mental health concern and who met the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria for GD (APA, 2013) were included. Additional clinical and sociodemographic information was obtained during the interview process, and patients individually completed all instruments included in this study before initiating outpatient treatment. At this stage, qualified clinicians in the treatment program helped patients to understand possibly confusing terms and answer all items to guarantee the absence of missing data.

All Pathways Model variables evaluated in the present study have been underlined in Figure 1.

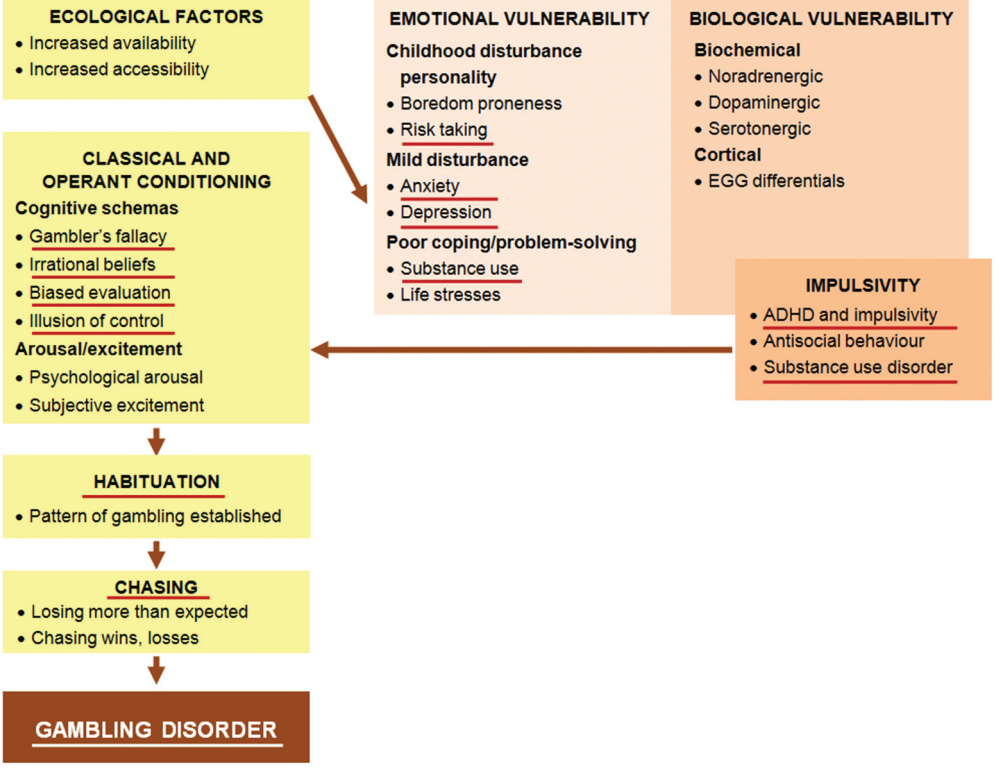

Figure 1. Pathways model.

2.2. Measures

The following measures were completed before initiating outpatient treatment.

2.1.1. Emotional vulnerability

2.1.1.1. Personality. The Pathways Model includes two factors within the personality traits: 'risk-taking' and 'boredom proneness.' Our study evaluated these factors using the Temperament and Character Inventory-Revised (TCI-R; Cloninger, 1999). It is a reliable and valid 240-item self-reported questionnaire which assesses seven personality dimensions through a 5-point Likert-type scale: four temperament (novelty-seeking, harm avoidance, reward dependence and persistence) and three character dimensions (self-directedness, cooperativeness and self-transcendence). In the present study, a validated Spanish version was used (Gutiérrez-Zotes et al., 2004) and only the novelty-seeking dimension was analyzed. The scales in the Spanish revised version showed adequate internal consistency (Cronbach's alpha α mean value of 0.87). In the study sample, internal consistency was α = 0.719 for novelty-seeking.

2.1.1.2. Mood disturbance. The Pathways Model considers 'anxiety' and 'depression' as key factors within the 'mood disturbance' category. In this study, both factors have been assessed using the Symptom Checklist-Revised (SCL-90-R; Derogatis, 1994). This self-reported 90-item questionnaire assesses psychological problems and psychopathological symptoms. It includes nine primary symptom dimensions: somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. In the present study, the Spanish scale (with good psychometrical indexes, and with a mean internal consistency of 0.75 (Cronbach's alpha); Derogatis, 2002) was used and only the anxiety and depression dimensions were analyzed. The internal consistency estimated in the study sample was α = 0.896 for anxiety and α = 0.924 for depression.

2.1.2. Impulsivity-related measures

2.1.2.1. Attention deficit hyperactivity disorder (ADHD). ADHD symptomatology was measured using the Adult ADHD Self-Report Scale (ASRS-v1.1). The ASRSv1.1 includes six of the most predictive items of the Adult ADHD Self-Report Scale (ASRS; Adler et al., 2006). It is a self-administered scale with adequate psychometric properties, which is based on the Diagnostic and Statistical Manual of Mental Disorders (4th ed.; DSM-IV; APA, 1994) criteria and adjusted to reflect ADHD symptoms as seen in adults (Rösler et al., 2006). This study used the Spanish of the ASRSv1.1 brief version based on the six items rating ADHD symptom frequencies on a 5-point Likert-type scale (0–4), with the cutoff being set at 12 (Ramos-Quiroga et al., 2009). The total score was used in the present study, with α = 0.746 internal consistency estimated.

2.1.2.2. Impulsivity. Impulsivity was assessed using the UPPS-P scale (Whiteside et al., 2005). The UPPS-P scale is a 59-item self-report questionnaire that measures five facets of impulsivity: negative urgency, positive urgency, lack of premeditation, lack of perseverance,

and sensation-seeking. The Spanish language adaptation showed good reliability (Cronbach's α between 0.79 and 0.93) and external validity (Verdejo-García et al., 2010). The total score was used in the present study, and consistency in the study sample was α = 0.927.

2.1.2.3. Substance use. To evaluate alcohol-use severity, the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) was administered. The AUDIT was developed as a simple screening method for hazardous alcohol consumption and it consists of 10 items about the level of consumption, symptoms of dependence and alcohol-related consequences. Internal consistency has been found to be high, and test-retest data have suggested a high reliability (0.86) and sensitivity around 0.90. The total score was used in the present study, and consistency was in the moderate range (α = .74).

To evaluate drug-use severity, the Drug Use Disorders Identification Test (DUDIT) was used. It is a 11-item self-report assessment that assesses illicit drug use and related consequences over the past year. This questionnaire collects data in the following areas: (1) frequency of drug use, (2) drug-related problems, and (3) drug dependence symptoms. Consistency in the study was excellent (α = 0.95).

2.1.3. Classical and operant conditioning

2.1.3.1. Cognitive schemas. Cognitive schemas were evaluated using the Gambling-Related Cognitions Scale (GRCS; Raylu & Oei, 2004). The GRCS is a 23-item self-report tool that evaluates irrational cognitions related to gambling on a seven-point Likert scale. The GRCS classifies cognitive distortions into five subscales: gambling-related expectancies, illusion of control, predictive control, perceived inability to stop gambling, and interpretive bias. The questionnaire provides good psychometric properties both in its original version and in its Spanish adaptation (Del Prete et al., 2017). The total score was included in the present study, with α = 0.91 internal consistency estimated.

2.1.4. Habituation

Habituation was evaluated using the DSM-5 criterion assessing tolerance: 'A need to gamble with increasing amounts of money in order to achieve the desired level of excitement' (APA, 2013).

2.1.5. Chasing

Chasing was evaluated using the DSM-5 chasing criterion: 'After losing money gambling, often returns another day to get even ("chasing" one's losses)' (APA, 2013).

2.1.6. Problem and pathological gambling

Probable pathological gambling was assessed using the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). The SOGS is a self-report 20-item screening questionnaire that discriminates between probable pathological, problem and non-problem gambling. The Spanish validation used in this work showed excellent internal consistency (α = 0.94) and test-retest reliability (r = 0.98; Echeburúa et al., 1994).

While the SOGS has been frequently used as a screening tool in population-based samples, this questionnaire was used here not to diagnose GD but rather to obtain a dimensional assessment of problem-gambling severity as has been done previously

(M.N. Potenza et al., 2003). Additionally, SOGS scores and DSM-5 determinations of GD are not equivalent as they measure different albeit in part overlapping domains, with the SOGS weighing more heavily financial-related aspects and the DSM including addiction-related criteria (i.e. assessing tolerance and withdrawal).

2.2. Statistical analysis

Path analyses were implemented through SEM, with Stata17 for Windows (Stata-Corp, 2019). Path analysis procedures constitute a straightforward extension of multiple regression modeling, used with the aim of estimating the magnitude and significance of hypothesized associations into a set of multiple variables and relationships, including mediational links (direct and indirect effects). It allows for testing patterns of effects within a system of variables, assessing the impact of a set of predictors/independent variables, a set of mediating variables and multiple dependent variables. This procedure has been historically used, for example, to disprove or support models that postulate potential causal relations among variables, but it cannot prove causality. More current studies suggest that this procedure can be used for both exploratory and confirmatory modeling, and therefore it facilitates theory testing and theory development (MacCallum & Austin, 2000).

The model specification and rationale for the path diagram were based on the theoretical model of planned behavior provided by the accumulated empirical evidence (background summarized in Figure 1), and this information is displayed in the Figure S1 (supplementary material). All parameters in the analysis were freely estimated (that is, they could assume any value and were estimated by the SEM). Next, with the aim to obtain a more parsimonious model and increase the statistical power, parameters with non-significant tests results were deleted, and the model was re-specified and re-adjusted with the requirement to guarantee adequate goodness-of-fit. The only exceptions for showing only significant results were for two parameters relating chasing to habituation and GD severity. These were retained in the final models although they achieved results that were not statistically significant because these relationships represented key components of the theoretical model being tested in the path analyses.

In this work, the maximum-likelihood method was used to estimate path coefficients (Kline, 2005) and goodness of fit was tested with the standard fitting indexes: χ^2 test, root mean square error of approximation (RMSEA), Bentler's Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and standardized root mean square residual (SRMR). Adequate fitting was considered for non-significant result in the χ^2 test, RMSEA<0.08, TLI>0.90, CFI>0.90 and SRMR<0.10 (Barrett, 2007). The global predictive capacity of the model was measured by the coefficient of determination (CD).

2.3. Ethics

The present study was carried out in accordance with the latest version of the Declaration of Helsinki. The University Hospital Clinical Research Ethics Committee approved the study, and signed informed consent was obtained from all participants.

3. Results

3.1. Characteristics of the sample

The gender distribution in the sample was n = 223 (92.5%) men versus n = 18 (7.5%) women. Most patients were single (n = 125, 51.9%) or married (n = 92, 38.2%) (versus n = 24 divorced, 10.0%), achieved primary (n = 121, 50.2%) or secondary (n = 100, 41.5%) education levels, were employed (n = 162, 67.2%) and had mean-low (n = 96, 39.8%) to low (n = 103, 46.9%) social position indexes. Mean age was 39.3 years (SD = 12.6), mean age of onset of GD was 27.4 years (SD = 10.9) and mean duration of the disorder was 6.1 years (SD = 6.5). Other variables analyzed in the study are described in Table 1.

3.2. Path analysis: pathway 2 (emotionally vulnerable)

Figure 2 shows the path diagram with the variables related to the emotionally vulnerable profile, including the entire sample (all 241 patients diagnosed with GD). Adequate fit was achieved (χ^2 = 24.95 (p = .204); RMSEA = 0.045; CFI = 0.932; TLI = 0.912 and SRMR = 0.080), and global predictive capacity of this final model was CD = 0.127. The results of this model indicated that higher anxiety levels contributed to more dysfunctional cognitive schemas, and higher drug-use severity contributed to increased likelihood of habituation. Habituation contributed directly to chasing and GD severity. Two indirect links also were found: a) habituation was a mediational link between cognitive schemas and GD severity; and, b) chasing was a mediational link between habituation and GD severity. While no direct effects were observed for depression, alcohol and novelty-seeking measures, these variables correlated strongly with anxiety and drug-use measures: specifically, a strong association was observed between anxiety and depression, and drug-use severity positively correlated with alcohol-use severity and novelty-seeking.

3.3. Path analysis: pathway 3 (antisocial impulsive)

Figure 3 shows the path diagram with the variables related to the antisocial impulsive profile, including the entire sample (all 241 patients diagnosed with GD). Adequate fit was achieved (χ^2 = 7.55 (p = .753); RMSEA = 0.005;

Table 1. Descriptive for the variables analyzed in the study.

Construct	Measurement	*Mean*	*SD*	*Perc(25)*	*Perc(50)*	*Perc(75)*
Impulsivity	UPPS-P total	136.58	(26.43)	117.00	139.00	154.00
ADHD	ASRS total	9.05	(4.10)	7.00	9.00	11.00
Anxiety	SCL-90 R anxiety	1.02	(0.82)	0.40	0.90	1.45
Depression	SCL-90 R depression	1.54	(0.97)	0.69	1.54	2.15
Alcohol	AUDIT total	4.88	(5.78)	1.00	3.00	6.00
Drugs	DUDIT total	2.39	(5.57)	0.00	0.00	2.00
Novelty seeking	TCI-R novelty seeking	109.17	(13.32)	100.50	111.00	118.00
Cognitive schemes	GRCS total	66.62	(20.55)	61.00	67.00	67.00
GD severity	SOGS total	10.58	(3.17)	8.00	11.00	13.00
		n	*%*			
Habituation	DSM-5 criterion	138	(57.3%)			
Chasing	DSM-5 criterion	199	(82.6%)			

ADHD: attention deficit and hyperactivity disorder. SD: standard deviation.
Perc(25): percentile 25. Perc(50): percentile 50 (median). Perc(75): percentile 75.

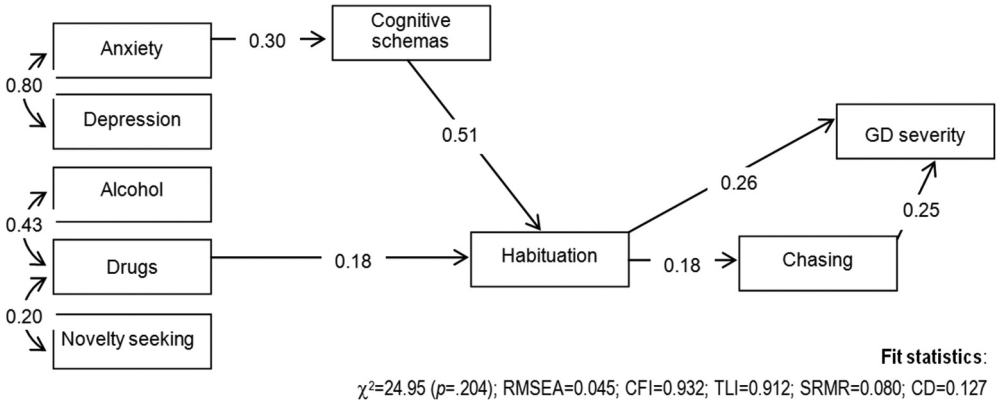

Figure 2. Pathway 2: standardized coefficients. Note. Continuous line: significant coefficient. Dash line: non-significant coefficient. Sample size: *n = 241*.RMSEA: Root Mean Squared Error of Approximation. CFI: Comparative Fit Index. TLI: Tucker-Lewis Index.SRMR: Standardized Root Mean Squared Residual. CD: Coefficient of Determination

CFI = 0.999; TLI = 0.998 and SRMR = 0.044), and global predictive capacity of this final model was CD = 0.371. This model showed direct contributions of habituation and impulsivity on GD severity (the presence of habituation and higher UPPS-P total scores were linked to higher SOGS total scores). Habituation was also directly related to ADHD severity, higher alcohol-use severity and more biases in cognitive schemas. Habituation was a mediational link in the three paths between ADHD severity, alcohol-use severity, and cognitive distortions measures with GD severity. In this model, chasing was not related with other variables included in the SEM. Regarding the role of drug-use severity, this variable did not directly contribute to the other dependent variables in the path diagram, but it positively correlated with alcohol-use severity and impulsivity levels.

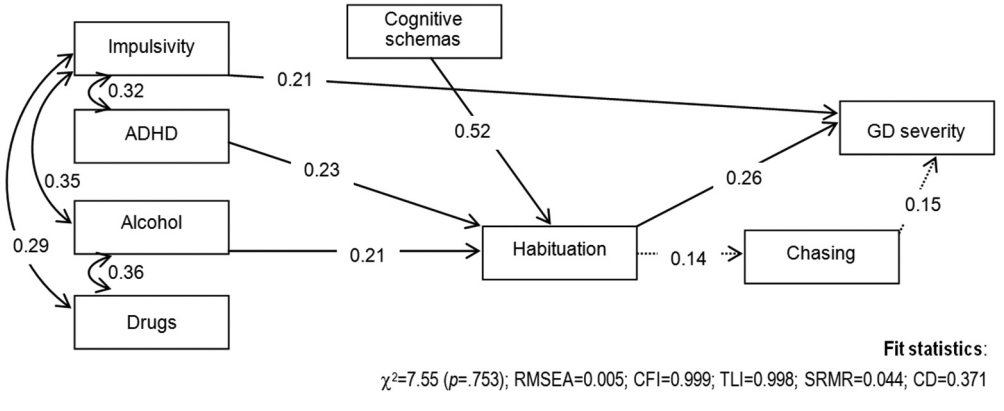

Figure 3. Pathway 3: standardized coefficients. Note. Continuous line: significant coefficient. Dash line: non-significant coefficient. Sample size: n = 241.RMSEA: Root Mean Squared Error of Approximation. CFI: Comparative Fit Index. TLI: Tucker-Lewis Index.SRMR: Standardized Root Mean Squared Residual. CD: Coefficient of Determination

3.4. Path analysis: pathway 2 and 3

Figure 4 shows the path diagram including both the emotionally vulnerable and antisocial impulsive profiles. Adequate fit was achieved (χ^2 = 19.90 (p = .796); RMSEA = 0.062; CFI = 0.998; TLI = 0.987 and SRMR = 0.056), and global predictive capacity of this final model was CD = 0.268. The results of this final model suggested that: a) higher GD severity level was directly associated with impulsivity and habituation; b) habituation was increased in patients with higher ADHD severity, greater alcohol-use severity and more cognitive distortions; c) cognitive distortions mediated relationships between anxiety and habituation (greater anxiety leading to greater cognitive biases, and this profile contributing to habituation); and, d) habituation mediated multiple links with GD severity (ADHD severity, cognitive distortions and greater alcohol-use severity were linked to GD severity through habituation). Chasing did not contribute to GD severity. Regarding the correlation profiles for the independent variables of the model, impulsivity levels positively correlated with ADHD severity, substance-use severity and novelty-seeking; ADHD severity correlated with severities of anxiety and depression; anxiety and depression levels achieved the strongest correlation in the model; and drug-use severity was associated with both alcohol-use severity and novelty-seeking.

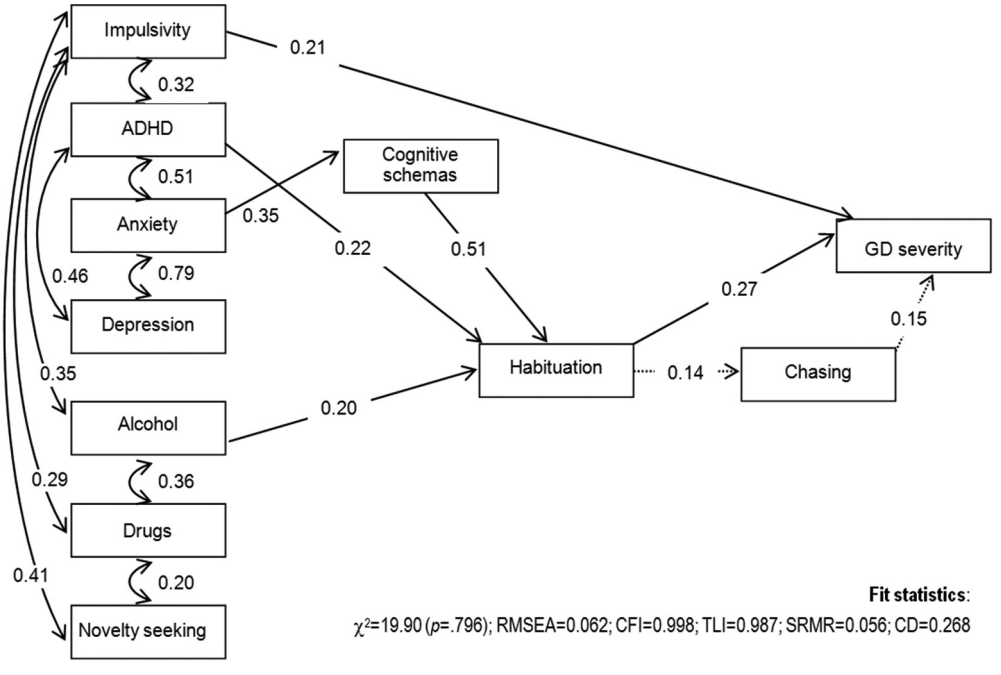

Figure 4. Pathways 2 and 3: standardized coefficients. Note. Continuous line: significant coefficient. Dash line: non-significant coefficient. Sample size: n = *241*.RMSEA: Root Mean Squared Error of Approximation. CFI: Comparative Fit Index. TLI: Tucker-Lewis Index.SRMR: Standardized Root Mean Squared Residual. CD: Coefficient of Determination

4. Discussion

The main aim of this study was to test the Pathways Model, specifically pathways 2 (emotionally vulnerable) and 3 (antisocial impulsive) in a clinical sample of treatment-seeking individuals diagnosed with GD.

4.1. Pathway 2 (emotionally vulnerable)

The Pathways Model (Blaszczynski & Nower, 2002) suggests the following structure for pathways 2 (emotionally vulnerable): emotional vulnerability -including personality factors (such as risk-taking), mood disturbance (anxiety and depression), and substance use, among other factors- may be associated with classical and operant conditioning (including cognitive distortions), which may influence habituation. The latter may influence chasing, which may predict GD.

The finding that the SEM obtained adequate fit, as hypothesized, suggests that pathway 2 is supported in clinical GD samples. However, not all factors were associated precisely as the theoretical model proposed. Of all the factors included in the emotional vulnerability dimension, the only one that showed a clear association with cognitive schemas was anxiety. Both anxiety and cognitive distortions have been posited in previous studies as predictors of GD and factors that contribute importantly to the development and maintenance of GD (Barrault & Varescon, 2013). Moreover, cognitive schemas were associated, as proposed by the Pathways Model, with habituation which, in turn, was associated with chasing. Finally, chasing was associated with GD. Although both chasing and habituation have been proposed as important features of GD and their roles in the development of GD have been highlighted, there is little literature concurrently analyzing both constructs (Gainsbury et al., 2014; Nigro et al., 2018). Habituation in GD, also termed tolerance, refers to the need to increase bets in order to obtain similar or higher levels of arousal (APA, 2013). However, it is not entirely clear whether such habitual behavior reflects a desire for arousal or misguided strategies to reduce debts or other factors (Blaszczynski et al., 2008). If debt reduction is a goal, habituation should share similarities with chasing, which consists of continuing gambling to recoup previous losses (Lesieur, 1979). It is not strange, therefore, that these two factors are associated and, at the same time, are also associated with GD severity. From a different perspective and based on negative reinforcement processes, habituation could also reflect increased attempts to attenuate discomfort or negative emotions. From this perspective, gambling could increase over time in the setting of worsening negative mood states. However, the path analyses did not identify direct links between depression and habituation, suggesting perhaps other mechanisms may be more prominent.

In addition, we found indirect links not explicated in the Pathways Model, suggesting that relationships between factors may be more complex than the Pathways Model proposed. For example, our results showed that habituation mediated the link between cognitive schemas and GD severity. Multiple studies describe associations between irrational cognitions and cognitive distortions and GD severity (Jiménez-Murcia et al., 2020; Schluter et al., 2019). However, in the present study, it was possible to identify another variable, habituation, through which this relationship may operate. In this vein, patients who increased gambling to achieve desired effects may present with greater cognitive distortion which, in turn, may lead to greater GD severity.

In addition, a direct association between substance use and habituation was found. This link is not surprising, given that habituation is an important clinical feature of both substance use disorders and GD, and numerous authors have suggested neurobiological commonalities between the conditions (Blaszczynski et al., 2008).

In summary, emotional states, specifically anxiety, may influence gambling-related cognitive distortions, such as illusion of control. Furthermore, these cognitions may be directly associated with habituation. Both habituation and chasing are associated with GD severity. Therefore, these results support the existence of a group of people with GD who use gambling to regulate negative emotional states, particularly anxiety. Gambling behavior may therefore represent a maladaptive emotional coping strategy, consistent with the Pathways Model.

4.2. Pathway 3 (antisocial impulsive)

Pathway 3 of the Pathways Model (Blaszczynski & Nower, 2002) considers impulsive and antisocial features. These domains include specific and related factors we examined such as ADHD severity, impulsive tendencies, and substance-use severity. Impulsivity may associate with distorted cognitive schemas which, in turn, could lead to habituation. Habituation could then promote chasing, which would lead to increased GD severity.

The finding that the SEM obtained adequate fit, as hypothesized, suggests that pathway 3 is at least partially supported in clinical GD samples. It should be noted, however, that although the Pathways Model suggests that this pathway may also include emotional vulnerability, this SEM did not include such measures, in order to focus specifically on the contribution of impulsivity-related factors.

Not all the factors analyzed in the present study were associated precisely as the Pathways Model proposed. In fact, none of the factors included in the impulsivity-related domains analyzed in the present study (ADHD, impulsivity, and substance use measures) were associated with cognitive schemas. Therefore, impulsivity-related domains do not appear to have a clear influence on cognitive distortions presented by individuals with GD. Previous studies have highlighted an association between some dimensions of the UPPS-P model of impulsivity (urgency and sensation-seeking) and cognitive distortions in GD, whereas they have failed to find an association between these cognitive distortions and other dimensions of impulsivity (such as lack of perseverance and lack of premeditation; Del Prete et al., 2017). Therefore, the use of the total score of the UPPS-P may have influenced this outcome.

Cognitive schemas were associated with habituation, as the Pathways Model suggests. Chasing, however, was not associated with either habituation or GD severity, contrary to what was hypothesized by the Pathways Model. Moreover, additional associations were observed that were not explicitly explicated in the Pathways Model. For example, ADHD and alcohol-use severities were directly associated with habituation. Likewise, habituation was directly associated with GD severity, as was the case in pathway 2 analyses. These additional links demonstrate the complexity of factors interacting and associated with GD.

4.3. Pathways 2 and 3

In the present study, when analyzing factors together, higher GD severity level was directly associated with higher impulsivity levels and by habituation. These findings are consistent with previous studies which highlighted similar associations (Mestre-Bach et al., 2020). Finally, cognitive distortions mediated the association between anxiety and habituation. Although this association has not been explored in depth in previous studies, some authors have reported that emotional regulation strategies (used to regulate anxiety, as well as other emotional states) are associated with gambling-related cognitions (Navas et al., 2016).

4.4. Limitations and future research

The results of this study should be considered in light of its limitations. The central limitation of the study is that not all the constructs included in pathways 2 and 3 of the theoretical model were evaluated. For example, coping and problem-solving strategies or arousal/excitement were not included. Future studies should analyze all the factors proposed by the Pathways Model. Moreover, by conducting path analyses on the whole sample, it is not surprising that Pathway 2 variables are less predictive of GD severity. Considering that Pathway 3 is considered to lead to the most severe cases of GD, one would expect its variables (impulsivity, ADHD) to overshadow those that characterize Pathway 2. Additionally, the measures used may not have precisely captured the domains described in the Pathways Model. Factors in the present study were evaluated by means of self-report instruments, and these are prone to biases (e.g. recall). In addition, the study was focused on a treatment-seeking population, and future studies could also include non-treatment-seeking individuals with GD. In any case, some of the issues related to the methodological differences between this study and the initial model presented by Blaszczynski and Nower (2002) must also be interpreted taking into account that this is not a strict validation study. On the contrary, the goal of this work was to assess the performance of the initial model in a data sample from a more recent time period, different measurement tools, and data closely aligned with the current environment in which the model will be used within treatment units (in this case, specialized on gambling disorder). In this sense, our study provides new empirical evidence to further evaluate the robustness of model, its capacity to remain unaffected by variations in the sample composition and other methodological issues, and the stability of the indexes among the clinical population.Another limitation was the cross-sectional nature of the study. It is difficult to draw conclusions about temporal relationships when all measures were assessed simultaneously. For example, in Pathway 2, individuals are expected to exhibit anxiety/depression before developing GD, but GD may also increase anxiety/depression. Finally, the sample was not balanced by gender, with more men than women included. Although this reflects a clinical reality, future studies should include larger proportions of women and investigate gender-related differences within the framework of the Pathways Model.

Although the Pathways Model can simplify clinical practice and help categorize individuals with GD, the clinical reality is likely more complex than the model proposes. In line with this possibility, Kurilla (2021) suggested that factors that the

model had proposed as specific to a particular GD subtype, such as ADHD symptoms and substance use, could be general risk factors for all groups. In addition, it is also important to note that other factors that may be influencing these results may have not been taken into account. For example, the main type of problem gambling may be important to consider. Several studies have shown the relationship between variables such as impulsivity, emotional regulation, cognitive distortions and GD severity may relate differently according to type of gambling preferred by people with GD (Mathieu et al., 2020; Orlowski et al., 2020). Therefore, future studies may wish to consider type of gambling.

5. Conclusions

The present study provides greater understanding of the pathways 2 and 3 proposed by the Pathways Model. Our findings suggest that both pathways appear to operate in clinical samples with GD. However, our SEMs suggest additional relationships that were not proposed in the Pathways Model, which suggests that the different factors operating in clinical samples are interacting in more complex manners than previously theorized.

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Preregistration statement

No preregistration was declared by the authors in relation to this manuscript.

Data availability statement

The data will be available through a direct request to the authors, who will evaluate the type of information requested with the Clinical Research Ethics Committee at the University Hospital of Bellvitge.

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