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An empirical investigation of the Pathways Model of problem gambling through the conjoint use of self-reports and behavioural tasks

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FULL-LENGTH REPORT

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ABSTRACT

Background and aims: Blaszczynski and Nower (2002) conceptualized their Pathways Model by postulating the existence of three subtypes of problem gamblers who share common characteristics, but also present specific ones. *Methods:* This study investigated how the psychological mechanisms postulated in the Pathways Model predict clinical status in a sample that combined treatment-seeking gamblers ($n = 59$) and non-problematic community gamblers ($n = 107$). To test the Pathways Model, we computed a hierarchic logistic regression in which variables associated with each postulated pathway were entered sequentially to predict the status of the treatment-seeking gambler. Self-report questionnaires measured gambling-related cognitions, alexithymia, emotional reactivity, emotion regulation strategies and impulsivity. Behavioural tasks measured gambling persistence (slot machine task), decision-making under uncertainty (Iowa Gambling Task) and decision-making under risk (Game of Dice Task). *Results:* We showed that specific factors theorized as underlying mechanisms for each pathway predicted the status of clinical gambler. For each pathway, significant predictors included gambling-related cognitive distortions and behaviourally measured gambling persistence (behaviourally conditioned pathway), emotional reactivity and emotion regulation strategies (emotionally vulnerable pathway), and lack of premeditation impulsivity facet (impulsivist-antisocial pathway). *Discussion and conclusions:* Our study adds to the body of literature confirming the validity of the Pathways Model and hold important implications in terms of assessment and treatment of problem gambling. In particular, a standardized assessment based on the Pathways Model should promote individualized treatment strategies to allow clinicians to take into account the high heterogeneity that characterizes gambling disorder.

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KEYWORDS

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INTRODUCTION

Twenty years ago, in their seminal paper, Blaszczynski and Nower (2002) presented an integrative model (encompassing biological, personality, developmental, cognitive, learning theory and environmental factors) of gambling disorder by postulating the existence of three distinct etiological pathways. These pathways shared common dimensions (e.g. ecological determinants such as availability and access to gambling), as well as specific characteristics (sociodemographic features, vulnerability factors, involved psychological factors). According to Blaszczynski and Nower (2002; see also Nower & Blaszczynski, 2017), the characteristics of the first pathway are included in the second and third pathways, whereas the characteristics of the second pathway are included in the third pathway. This implies that all pathways are distinct but also that Pathways 2 and 3 incorporate some factors involved in the previous pathway (i.e. Pathways 2 and 3 incorporate Pathway 1 and Pathway 3 is a subgroup of Pathway 2). This brought the authors to conceptualize the first pathway as being less severe and the third one as being most severe in terms of disordered gambling patterns (Nower, Martins, Lin, & Blanco, 2013). This model has been the conceptual framework of many studies that have refined and expanded these pathways, especially in terms of the psychological processes implicated in the development and maintenance of gambling disorder.

The first pathway is composed of so-called 'behaviourally conditioned problem gamblers'. These gamblers have been described as presenting specific gambling-related cognitive distortions or beliefs. Several of these cognitive distortions are derived from the heuristics defined by Kahneman and Tversky (1972), mainly availability (e.g. illusory correlations or inherent memory bias; see Fortune & Goodie, 2012) and representativeness (e.g. overconfidence; see Koriat, Lichtenstein, & Fischhoff, 1980), or trends in number picking (Haigh, 1997; Holtgraves & Skeel, 1992; Rogers & Webley, 2001). Other cognitive distortions such as the illusion of control (Langer, 1975) or near-miss effects (Clark, Lawrence, Astley-Jones, & Gray, 2009) have been shown but are not clearly related to established heuristics (Goodie & Fortune, 2013). Numerous studies have shown the role of cognitive biases or distortions in the development, maintenance and severity of gambling disorder (Cunningham, Hodgins, & Toneatto, 2014; Devos et al., 2020; Labrador, Labrador, Crespo, Echeburúa, & Becoña, 2020; Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011; Raylu & Oei, 2004). Most of these studies have capitalized on self-report questionnaires to evaluate cognitive distortions in problem gamblers (PGs; Labrador et al., 2020; Marmurek, Switzer, & D'Alvise, 2014; Michalczuk et al., 2011; Navas, Billieux et al., 2017). Nevertheless, this approach has been criticized and some scholars have argued about the need to rely on behavioural measures or the ecological environment to study gambling-related cognitive distortions (Clark et al., 2009). For example, previous research by Gaboury and Ladouceur (1989) or Ladouceur and Walker (1998) has shown that gamblers' verbalizations were erroneous during gambling even though they accurately comprehended that the outcome of the game was determined by chance. To our knowledge, no study to date has modelled the first pathway described by Blaszczynski and Nower (2002) by conjointly capitalizing on self-reported psychometric questionnaires and behavioural gambling tasks designed to promote cognitive distortions. A good candidate paradigm for such an approach could be the slot machine task (SMT) developed by Clark et al. (2009), which combines elements that promote perceived active control (e.g. the player can choose the symbols to play with) with specific structural characteristics (e.g. the task used experimentally manipulated near-miss trials) known to foster the illusion of control. In particular, previous studies have shown that objectively measured persistent playing at this task correlates with specific cognitive distortions theorized as underlying the behaviourally conditioned pathway (Billieux, Van der Linden, Khazaal, Zullino, & Clark, 2012).

The second pathway comprises 'emotionally vulnerable problem gamblers'. For these gamblers, gambling has a primary function of escapism through a negative reinforcement process (i.e. it modulates affective states or compensates for unmet psychological needs). This pathway has typically been related to specific risk factors such as comorbid psychopathology (e.g. anxiety, depression) and emotional (dys)regulation processes (Bonnaire, Bungener, & Varescon, 2009; Milosevic & Ledgerwood, 2010; Moon, Lister, Milosevic, & Ledgerwood, 2016), which can broadly be defined as the ability to modulate the valence, intensity and time course of emotional experiences (Gross, 1998; Thompson, 1990). A recent systematic review and meta-analysis suggests that emotion dysregulation plays a pivotal role in the aetiology of gambling disorder, although further research is needed to clarify the specific cognitive and affective factors involved (Velotti, Rogier, Beomonte Zobel, & Billieux, 2021). Other constructs related to emotion dysregulation have also been related to gambling disorder (Bonnaire, Bungener, & Varescon, 2013; Estévez, Jauregui, Macía, & Martín-Pérez, 2022; Marchetti, Verrocchio, & Porcelli, 2019), for example, alexithymia, a multi-dimensional personality construct that has three major facets: (1) difficulty identifying one's feelings and distinguishing them from bodily sensations, (2) difficulty describing one's feelings to others, and 3) an externally oriented cognitive style that is utilitarian and does not include affective responses when one is facing stressful situations (Luminet, Nielson, & Ridout, 2021). Other potentially relevant constructs, such as emotion reactivity – a personality trait related to individual differences in emotion sensitivity, intensity and duration (Nock, Wedig, Holmberg, & Hooley, 2008) – have, in contrast, never been considered in problem gambling research. Nevertheless, uncertainty still abounds regarding the psychological processes underlying gambling as a dysfunctional emotion regulation strategy. Indeed, although previous literature reported that specific components of emotion dysregulation characterized PGs (e.g. specific emotion regulation strategies; see Velotti et al., 2021), their specific role in regulated and unregulated gambling behaviours remains to date unexplored. For instance, the somatic markers theory of addiction (Olsen, Lugo, & Sutterlin, 2015) postulated that difficulties in emotion processing account for impaired decision-making in gambling disorder. Indeed, decision-making abilities require the efficient processing of emotional feedback (Bechara, Tranel, & Damasio, 2000). A typical task for assessing such emotionally laden decision-making is the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), which has been extensively used in the context of problem gambling research (Brevers, Bechara, Cleeremans, & Noël, 2013) and is generally considered to measure decision-making under uncertainty. Interestingly for our purpose, it was shown in a previous study that PGs with high trait-alexithymia display less advantageous choices in the IGT (Aïte et al., 2014). To our knowledge, no study to date has considered the relationship between emotion regulation, emotional reactivity, alexithymia and decision-making under uncertainty when modelling the emotionally vulnerable pathway.

The third pathway includes 'antisocial-impulsivist problem gamblers' and is generally considered to encompass the more severe cases of gambling disorder. One of the main characteristics of these gamblers is heightened impulsivity traits. They generally present with various behavioural problems unrelated to gambling (e.g. substance abuse, suicidality, irritability, low tolerance for boredom and criminal behaviours). It is well established that impulsivity is associated with the development and severity of gambling disorder (Grall-Bronnec, Wainstein et al., 2012; Maccallum, Blaszczynski, Ladouceur, & Nower, 2007; Mallorquí-Bagué et al., 2019; Rogier, Beomonte Zobel, & Velotti, 2020; Mestre-Bach, Granero, Fernández-Aranda, Potenza, & Jiménez-Murcia, 2022). In addition, several studies have found a link between gambling disorder and specific impulsivity traits, including urgency (Billieux, Rochat et al., 2012; Canale, Vieno, Griffiths, Rubaltelli, & Santinello, 2015; Cyders & Smith, 2008; Savvidou et al., 2017; Whiteside, Lynam, Miller, & Reynolds, 2005), lack of perseverance (Mallorquí-Bagué et al., 2019; Wang, Cunningham-Erdogdu, Steers, Weinstein, & Neighbors, 2020), lack of premeditation (Cyders & Smith, 2008; Wang et al., 2020) and sensation seeking (Cyders & Smith, 2008; Savvidou et al., 2017). Furthermore, impulsivity was also found to contribute to impaired decision-making in gambling disorder (Kräplin et al., 2014; Mallorquí-Bagué et al., 2018; Sharman et al., 2019). It can be hypothesized that decision-making deficits encountered in the antisocial-impulsivist pathway are explained by a reduction in self-control abilities and deliberative (controlled) processes. From such a perspective, a sound behavioural measure to assess such deficits could be the Game of Dice Task (GDT; Brand, Fujiwara, Borsutzky, Kalbe, & Kessler, 2005), which indexes decision-making under risk (i.e. the extent to which individuals make a disadvantageous decision when all information required to make the decision is explicit) and was frequently used in gambling research (Brand, Kalbe et al., 2005; Donati, Frosini, Izzo, & Primi, 2019).

In accordance with the Pathways Model, previous studies have demonstrated the existence of three pathways: (a) a behaviourally conditioned type (characterized by cognitive distortions; Devos et al., 2020; Turner, Jain, Spence, & Zangeneh, 2008), (b) an emotionally vulnerable type (e.g. characterized by emotional instability and comorbid emotional disorders; Álvarez-Moya et al., 2010; Moon et al., 2016; Suomi, Dowling, & Jackson, 2014; Turner et al., 2008) and (c) an antisocial-impulsivist type (e.g. characterized by heightened impulsivity traits and comorbid impulse control disorders; Álvarez-Moya et al., 2010; Chamberlain, Stochl, Redden, Odlaug, & Grant, 2017; Devos et al., 2020; Mestre-Bach et al., 2022; Moon et al., 2016; Valleur et al., 2015). These studies used either latent class analysis or cluster analysis to identify subtypes of PGs, generally assuming that a 3 class solution should provide the best fit to the data (see Billieux, Bonnaire, Bowden-Jones, & Clark, 2022, for a critical account). However, to test the model as it was initially conceptualized (i.e. three distinct yet potentially integrated pathways), we deemed it appropriate to disentangle the predictive value of the various factors postulated to underlie each pathway through a hierarchical logistic regression analysis, in which variables associated with each postulated pathway were entered sequentially to predict the status of being a treatment-seeking gambler. An important caveat of many studies that relied on the Pathways Model is that they neglected to assume that Blaszczynski and Nower (2002) conceptualized their model to account for clinically relevant patterns of problem gambling. In accordance with this important premise of the Pathways Model, we aimed to identify which specific psychological processes supporting the various pathways contribute to distinguishing treatment-seeking PGs from non-problematic community gamblers. Another strength of our research design is that it combined self-reported questionnaires and behavioural gambling tasks (designed to promote cognitive distortions), an approach that has to date not been used in previous research conducted on the Pathways Model.

MATERIAL AND METHODS

Participants and procedure

Individuals (men and women) between 18 and 65 years old were included in the study. The study was conducted between January 2017 and April 2019.

Treatment-seeking problem gamblers were recruited in several French Addiction Care Centers (two in Paris, one in Tours, one in Nantes). Face-to-face interviews were conducted by an experienced clinical psychologist. Patients were included if they were seeking treatment for a gambling problem and excluded if they presented with a possible comorbid psychotic disorder (based on the L module of the Mini International Neuropsychiatric Interview, Sheehan et al., 1998). Only the treatment-seeking gamblers who met DSM-5 criteria for gambling disorder were included in the study. Participants were informed about the possibility to be enrolled in the study by the healthcare professional receiving them at their initial appointment. Contact details of participants interested in participating in the study were recorded and transmitted to the responsible researcher, who then contacted the potential participants and explained the study procedures (e.g. type of assessment, duration) to them in more detail. Specific appointments (not related to their treatments as usual) were then planned with interested participants. The recruitment procedure has been standardized and applied in the same way in each Addiction Care Center.

The PG sub-sample was composed of 59 participants (10 females [16.9%] and 49 males [83.1%]), with a mean age of 41.37 years (SD = 11.42). The majority were employed (69.5%), 23.7% were unemployed, 3.4% were retired and 3.4% reported being in another situation. The mean number of years of school education was 11.19 (SD = 4.76). Most participants were single (49.2%), 35.6% were married or part of a couple, and 15.3% were divorced. Their mean score on the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001a; Young & Wohl, 2011; French version: Ferris & Wynne, 2001b) was 17.54 (SD = 5.48). Regarding their preferred gambling type, 17 (28.8%) gambled only on chance-based games (i.e. lottery, scratch cards, slot machine), 11 (18.6%) on skills-based games (i.e. poker, sport betting, horse race betting) and 31 (52.5%) on both chance- and skill-based games.

Non-problem gamblers (NPGs) were recruited via the RISC platform (Information Relay on Cognitive Sciences from the National Center of Scientific Research, https://www.risc.cnrs.fr/), in which the study was advertised and described (aim and inclusion criteria). Face-to-face interviews were conducted by an experienced clinical psychologist in order to confirm the absence of gambling disorder (based on the DSM-5 diagnostic criteria) and possible psychotic disorder (based on thee L module of the Mini International Neuropsychiatric Interview, Sheehan et al., 1998). Three participants were excluded as they endorsed DSM-5 criteria without being treatment-seeking gamblers. Interested participants were instructed to contact the responsible researcher by email, who then reached them by phone to explain the details of the study. Participants who agreed to participate were then scheduled to come to the Institute of Psychology of the University of Paris and assessed in a research laboratory. For the NPGs, a single researcher carried out all the evaluations.

The NPG sub-sample was composed of 107 participants (41 females [38.3%] and 66 males [61.7%]), with a mean age of 38.74 years (SD = 9.42). The majority were employed (81.3%), 11.2% were unemployed and 7.5% reported being in another situation. The mean number of years of school education was 15.00 (SD = 4.04). Most of them were married or part of a couple (55.1%), 30.8% were single, 13.1% were divorced and 0.9 were widowed. Their mean score on the PGSI was 1.87 (SD = 2.76) and none of them had a score corresponding to clinically relevant gambling (i.e. a score above 7 on the PGSI). In the NPG group, 29 (41.4%) gambled regularly (more than once a week) only on chance-based games, 3 (4.3%) on skills-based games, and 38 (54.3%) on both types of games.

All participants who completed the full study protocol received compensation of 30 euros in a gift voucher.

Instruments used to assess Pathway 1

The Gambling Related Cognitions Scale (GRCS; Raylu & Oei, 2004; French version: Grall-Bronnec, Bouju et al., 2012). This scale evaluates gambling-related cognitions and comprises 23 items that participants answer on a 7-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher scores correspond to more marked gambling-related cognitions. The French adaptation of the GRCS has good psychometric properties (good internal consistency and convergent validity, and solid factorial structure, see Grall-Bronnec, Bouju et al., 2012). The GRCS assesses five different constructs: gambling-related expectancies (e.g. 'Gambling makes me happier'), illusion of control (e.g. 'Praying helps me win'), predictive control (e.g. 'Losses when gambling are bound to be followed by a series of wins'), perceived inability to stop gambling (e.g. 'My desire to gamble is so overpowering') and interpretative bias (e.g. 'Remembering how much money I won last time makes me continue gambling'). In our study, Cronbach's alphas were 0.83, 0.78, 0.83, 0.93 and 0.88, respectively. Two subscales, gambling-related expectancies (which corresponds to motivational aspects) and perceived inability to stop gambling (which corresponds to meta-cognitive rather than cognitive beliefs), were not taken into account in the hierarchical logistic regression analysis, as they measure beliefs about the self in relation to gambling and not gambling-related cognitive distortions per se (for a discussion, see Billieux, Van der Linden et al., 2012).

Slot machine task (SMT; Clark et al., 2009). The slot machine task (SMT; Clark et al., 2009) was originally designed to compare three types of gambling outcomes: wins, near-misses (i.e. unsuccessful outcomes close to the jackpot) and full-misses. The task used for this study is a modified version of the task proposed by Clark et al. (2009), which was used in previous research (Devos, Clark, Maurage, & Billieux, 2018). The task uses a three-reel slot machine that is judged to be more ecologically valid than the original two-reel version developed by Clark et al. (2009). The frequency of near-miss is comparable to real-world slot machines and in line with previous work having shown optimal gambling persistence at a 30% frequency of near-misses, in comparison to 15% and 45% frequencies (Kassinove & Schare, 2001). The task is composed of two phases: one mandatory (comprising 25 trials) and one optional (comprising up to 25 additional trials). In the second phase, participants can decide to quit the task at any time. Three types of outcomes are delivered in each phase of this task: wins (4/25 trials), near-misses (9/25 trials) and losses (12/25 trials). As developed in detail in Clark et al. (2009), near-misses are used in this task to foster the illusion of control, which makes the task ideal for behaviourally measuring the impact of gambling-related cognitions. Participants received 6 euros at the beginning of the task. Each spin of the SMT automatically deducted 5 cents from the participant's amount, and each win was awarded 50 cents. Before starting each spin, participants had a "double-up" option to double their bet (i.e. betting 10 cents for a 1-euro win). The 'double-up' option was added to increase the feeling of perceived control and promote gambling persistence (Devos et al., 2018). Participants finished the mandatory phase of the task with between 6.75 and 7.50 euros of extra money (depending on how they used the double-up option). The choice to finish the mandatory phase with a positive outcome was made to encourage participants to continue playing in the persistence phase. In the current study, we used the choice to persist playing ('yes' or 'no' dichotomic variable) to index gambling persistence. This choice was made because, among those participants who persisted in playing, only a few played numerous additional trials, which could have biased the results if the number of trials played was used as the index of gambling persistence. The task also comprises inter-trial subjective ratings (measuring, for example, pleasure experiences following a specific outcome; see Clark et al., 2009, for more details). These subjective ratings were not used in the current study, as we used laboratory tasks with the aim of obtaining behavioural measures only.

Instruments used to assess Pathway 2

The Toronto Alexithymia Scale-20 (TAS-20; Bagby, Parker, & Taylor, 1994; French version: Loas, Fremaux, & Marchand, 1995). This scale is the most frequently used scale to assess alexithymia and contains 20 items. Participants rated each item on 5-point Likert scales ranging from 1 (strongly disagree) to 5 (strongly agree), resulting in a total score from 20 to 100. Displaying a three-factor structure, the TAS-20 measures, besides the total alexithymia score, difficulties in identifying feelings (e.g. 'I am often confused about what emotion I am feeling'), difficulties in describing feelings to other people (e.g. 'It is difficult for me to find the right words for my feelings') and externally oriented thinking (e.g. 'I prefer talking to people about their daily activities rather than their feelings'). The TAS-20 possesses well-established psychometric properties in both clinical and non-clinical samples (Preece, Becerra, Robinson, & Dandy, 2018) and in our study, the internal consistencies of the subscales were 0.85, 0.77 and 0.63, respectively.

The Emotion Reactivity Scale (ERS; Nock et al., 2008; French version: Lannoy et al., 2014). This 21-item scale is a self-report measure of emotional reactivity that is rated on a 5-point Likert scale ranging from 1 (not at all like to me) to 5 (completely like me). Emotional reactivity refers to how an individual experiences an emotion, with what intensity and for what duration (Davidson, 1998). Items measure three factors: emotional sensitivity (e.g. 'I tend to get emotional very easily'), emotional intensity (e.g. 'When I experience emotions, I feel them very strongly/intensely') and emotional persistence (e.g. 'When I am angry/upset, it takes me much longer than most people to calm down'). Items are rated on a 5-point scale ranging from 0 (not at all like me) to 4 (completely like me). Factor analysis underlined a single factor of overall reactivity (Nock et al., 2008). In our study, the scale showed high internal consistency with a Cronbach's alpha of 0.94.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003; French version: Christophe, Antoine, Leroy, & Delelis, 2009). This 10-item scale is a self-report measure of two distinct strategies of emotion regulation: cognitive reappraisal (e.g. 'When I want to feel more positive [such as joy or amusement], I change what I'm thinking about') and expressive suppression (e.g. 'I keep my emotions to myself'). Both the original version and the French version have good psychometric properties (Christophe et al., 2009; Gross & John, 2003), showing that the ERQ is a reliable tool for assessing these emotion regulation strategies. Factorial and confirmatory analysis revealed a two-factor structure: six items assess cognitive reappraisal and four assess expressive suppression. In the current study, the internal consistencies of the subscales were 0.85 and 0.75, respectively.

Iowa Gambling Task (IGT; Bechara et al., 1994). In this task, which has been designed to assess decision-making under uncertainty, participants have to choose one card at a time from four available decks (A, B, C and D). The task requires the participant to make 100 choices (100 trials). In each trial, participants may win or lose a certain amount of fictive money. The explicit aim is to gain as much virtual money as possible. At the beginning of the task, participants are given $2,000 in fake money to start. They are told that some decks are more advantageous than others, but they do not know which decks are better. Two of the four decks (A and B) produce immediate large rewards but higher punishment, at unpredictable points, than do the other two decks. In the long run, decks A and B are disadvantageous. The other two decks (C and D) produce immediate modest rewards, but lower punishment. These two decks can be considered as advantageous in the long run. To calculate an index that takes into account the evolution of participants' choices, we divided their performance into five blocks, representing five periods of 20-card selection. In each block of 20 cards, the number of cards selected from advantageous decks was calculated (C and D). A total score of adaptive decision-making under emotional context was obtained.

Instruments used to assess pathway 3

The short UPPS-P Impulsive Behavior Scale (UPPS–P; Billieux, Rochat et al., 2012). This self-report questionnaire assesses five dimensions underlying impulsive behaviour through a 4-point Likert-type scale ranging from 1 (absolutely agree) to 4 (strongly disagree). The negative urgency (e.g. 'When I am upset, I often act without thinking') and positive urgency (e.g. ‘When I am really excited, I tend not to think on the consequences of my actions’) subscales measure the tendency to act rashly when experiencing intense emotional states (either negative or positive). As recent psychometric work showed that positive and negative urgency form a single and coherent construct, we computed a single urgency score by merging positive and negative urgency items (Billieux et al., 2021). Lack of premeditation corresponds to difficulty in planning the consequences of one’s behaviour (e.g. ‘Before making up my mind, I consider all the advantages and disadvantages’). Lack of perseverance corresponds to difficulty in focusing on a boring or difficult task (e.g. ‘I finish what I start’). Finally, the sensation-seeking subscale measures the proneness to seek new and exciting experiences (e.g. ‘I sometimes like doing things that are a bit frightening’). The short version of the UPPS-P has acceptable to good internal consistency (Cronbach’s alpha ranging from 0.61 to 0.88), good to very good test-retest reliability, good external validity, and a similar factorial structure to the original version (Billieux, Rochat et al., 2012; Cyders, Littlefield, Coffey, & Karyadi, 2014). Cronbach’s alpha ranged from 0.78 (positive urgency) to 0.84 (lack of perseverance) in the current study.

Game of Dice Task (GDT; Brand, Fujiwara et al., 2005). This computerized task is designed to assess the possible influence of executive functions and controlled processes on decision-making in a gambling situation. The GDT assesses decision-making under risk (i.e. when all information to make an ‘informed choice’ is available). At the beginning of the task, participants receive explicit information about the gains and losses associated with a given choice. Participants have to bet which side of the dice will come out on each trial. They have four possibilities. They can bet: (1) on one side of the dice and either win 1,000 euros if they have the right number (probability 1/6) or lose 1,000 euros; (2) on two sides of the dice and win or lose 500 euros (probability 2/6); (3) on three sides of the dice and win or lose 200 euros (probability 3/6) and finally (4) on four sides of the dice and win or lose 100 euros (probability 4/6). Participants are asked to increase their fictive starting capital (1,000 euros) within 18 throws of the dice. After each trial, they receive feedback about whether they lost or won. The net score was calculated by the number of advantageous decisions (three or four sides of dice selection: probability equal to or higher than a 50% chance of winning) minus disadvantageous decisions (one or two sides of dice selection).

Data analytic strategy

Pearson’s correlations were used to evaluate the relationships between variables. We tested the Pathways Model through a hierarchical logistic regression analysis. To reduce the potential impact of multi-collinearity, we created new variables for subscales of a single questionnaire that are highly correlated. Following the approach undertaken previously by Billieux, Van der Linden et al. (2012), we created a new variable of ‘predictive and interpretative control/bias’ by merging the GRCS subscales ‘interpretive bias’ and ‘predictive control’, which presented a very high correlation ($r = 0.82$). The variable ‘difficulties in identifying and describing feelings’ was also created by merging the ‘difficulty identifying feelings’ and ‘difficulty describing feelings’ of the TAS-20, which also presented a very high correlation ($r = 0.76$). The dependent variable was the status of the treatment-seeking PG (dichotomic variable). Four successive steps were set up: (1) Step 1 included socio-demographic factors not specifically related to the Pathways Model, (2) Step 2 included variables related to Pathway 1 (behaviourally conditioned PGs), (3) Step 3 included variables related to Pathway 2 (emotionally vulnerable gamblers) and (4) Step 4 included variables related to Pathway 3 (antisocial-impulsivist gamblers). Notably, each additional step of the regression analysis also included the variables in the previous steps, which thus adequately model the Pathways Model (i.e. Pathways 2 and 3 incorporate Pathway 1 and Pathway 3 is a subgroup of Pathway 2).

More specifically, the following variables were entered at each step of the hierarchical logistic regression analysis. All variables used as predictors in the hierarchical regression were standardized:

- Step 1: Age, years of school education and gender (female as the reference)
- Step 2 (Pathway 1): Predictive and interpretative control/bias (GRCS), illusion of control (GRCS) and behaviourally measured gambling persistence (Yes/No of the SMT, with ‘No’ as the reference)
- Step 3 (Pathway 2): Difficulties in identifying and describing feelings (TAS-20), externally oriented thinking (TAS-20), emotional reactivity (ERS), cognitive reappraisal and expressive suppression (ERQ) and decision-making under uncertainty (IGT)
- Step 4 (Pathway 3): Impulsivity subscales (UPPS-P) and decision under risk (GDT)

All statistical analyses were carried out with SPSS software (version 20).

Ethics

The Ethics Committee of Paris Descartes University approved the study (ref number IRB: 20154900001072), and signed informed consent was obtained from all participants.

RESULTS

Comparison of PGs and NPGs groups

Descriptive data for the whole sample are presented in Table 1. Furthermore, except for the illusion of control subscale of the GRCS, the sensation seeking subscale of the UPPS-P and the Gambling Dice Task, PGs differed from NPGs on all dimensions included in the logistic regression model.

Table 1. Data of the whole sample, problem gamblers seeking treatment and non-problem gamblers

Variable	Total (n = 166)		Problem gamblers (n = 59)		Non-Problem gamblers (n = 107)		
	M	SD	M	SD	M	SD	P
Age	39.67	10.22	41.37	11.42	38.74	9.42	0.112
Years of education	13.65	4.66	11.19	4.76	15.00	4.03	<0.001
GRCS							
Interpretative bias	13.61	7.16	17.31	6.18	11.58	6.86	<0.001
Predictive control	18.59	8.64	20.93	7.87	17.30	8.81	0.009
Illusion of control	9.22	5.45	24.32	6.05	10.40	6.99	0.130
Gambling expectancies	12.78	6.40	15.32	6.04	11.38	6.18	<0.001
Inability to stop gambling	15.35	9.43	24.32	6.06	10.40	6.99	<0.001
TAS-20							
Difficulties identifying feelings	16.36	6.87	18.56	7.16	15.14	6.43	0.002
Difficulties describing feelings	13.07	4.43	14.31	4.53	12.38	4.24	0.007
Externally oriented thinking	17.75	4.67	19.64	4.81	16.70	4.27	<0.001
ERS	30.67	18.12	38.54	19.23	26.33	15.98	<0.001
ERQ							
Cognitive reappraisal	25.56	8.73	22.81	8.89	27.07	8.31	0.002
Expressive suppression	15.17	5.75	16.46	6.54	14.46	5.16	0.032
UPPS-P							
Negative urgency	9.80	3.20	10.78	3.02	9.25	3.18	0.003
Positive urgency	10.90	2.83	11.44	2.67	10.60	2.89	0.067
Lack of premeditation	7.32	2.47	8.22	2.61	6.82	2.25	<0.001
Lack of perseverance	6.99	2.59	7.56	2.73	6.67	2.47	0.034
Sensation seeking	10.98	3.02	11.00	3.17	10.97	2.95	0.955
SMT- Persistence							
Yes	54	34.0	25	43.9	29	28.4	0.037
No	105	66.0	32	56.1	76	71.6	
Iowa Gambling Task	14.47	31.47	3.93	30.19	20.06	30.83	0.002
Gambling Dice Task	9.06	6.68	7.43	9.62	9.93	9.64	0.125

PGSI = Problem Gambling Severity Index; GRCS = Gambling Related Cognitions Scale; TAS-20 = Toronto Alexithymia Scale; ERS = Emotional Reactivity Scale; ERQ = Emotion Regulation Questionnaire; UPPS-P = Short UPPS-P Impulsive Behavior Scale; SMT = slot machine task.

Hierarchical logistic regression analysis

Correlations among all study variables are reported in Table 2. Results of the logistic regression analysis are presented in Table 3.

Step 1: sociodemographic variables

Participants' sociodemographic variables (age, years of school education and gender) were entered at Step 1 and explained 27.7% of the variance of clinical status, F (3,166 = 33.659, P < 0.001. Years of school education (odds ratio (OR) = 0.41) and gender (OR = 3.01) contributed significantly to this step, with gender contributing the most.

Step 2: Pathway 1

Gambling-related cognitive distortions (predictive and interpretative control/bias (GRCS), illusion of control (GRCS) and persistence at the GDT task) were entered at Step 2, additionally explaining 11.6% of the variance of clinical status, ΔR^2 = 0.116, F6 (166 = 50.31), P < 0.001. Predictive and interpretative control/bias (OR = 2.46) and persistence (yes, OR = 3.31) contributed the most among selected variables.

Step 3: Pathway 2

Emotional variables (difficulties in identifying and describing feelings (TAS-20)), externally oriented thinking (TAS-20), emotional reactivity (ERS), cognitive reappraisal and expressive suppression (ERQ), and emotional decision-making (IGT) were entered at Step 3, additionally explaining 18.3% of the variance of clinical status, ΔR^2 = 0.183, F (12,166 = 81.181), P < 0.001. Expressive suppression contributed the most among these variables. ERS (OR = 1.91), cognitive reappraisal of the ERQ (OR = 0.42) and expressive suppression of the ERQ (OR = 2.13) contributed significantly in Step 3. Emotional decision-making (IGT) helped account for clinical status, but its effect should be considered a non-significant trend (OR = 0.59, P = 0.056).

Step 3: Pathway 3

Impulsivity subscales (UPPS-P) and decision under risk (GDT) were entered at Step 4, and additionally explained 7.0% of the variance of clinical status (ΔR^2 = 0.07). UPPS-P – Lack of premeditation contributed the most. Following entry of all independent variables at Step 4, the total variance explained by the model as a whole was 64.6%, F (17,165 =

Table 2. Correlation coefficients between study variables

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Age	_																
2	Years of education	−0.20**	_															
3	GRCS – IPC	0.04	−0.24**	_														
4	GRCS – IC	0.06	−0.08	0.76**	_													
5	Persistence	−0.02	0.07	0.11	0.14	_												
6	TAS – Difficulties identifying and describing feelings	−0.08	−0.13	0.19*	0.13	0.04	_											
7	TAS – Externally oriented thinking	0.10	−0.28**	0.28**	0.21**	0.03	0.33**	_										
8	ERS	−0.04	−0.07	0.36**	0.28**	−0.06	0.42**	0.11	_									
9	ERQ – cognitive reappraisal	−0.10	0.07	0.04	0.05	0.11	0.12	−0.25**	−0.14	_								
10	ERQ – expressive suppression	−0.00	−0.10	0.24**	0.18*	0.17*	0.42**	0.13	0.11	0.47**	_							
11	IGT	−0.06	0.14	0.02	−0.03	−0.03	−0.14	−0.08	−0.06	0.17*	−0.02	_						
12	UPPS-P – Urgency	−0.06	−0.09	0.28**	0.17*	0.00	0.14	0.31**	0.38**	−0.34**	−0.20**	−0.10	_					
13	UPPS-P – Lack of premeditation	0.06	−0.11	0.16*	0.10	0.09	0.32**	0.09	0.24**	0.13	0.20**	−0.06	0.18*	_				
14	UPPS-P – Lack of perseverance	−0.05	0.06	0.04	0.05	−0.09	0.30**	−0.02	0.13	0.17*	0.22*	0.10	−0.08	0.51**	_			
15	UPPS-P – Sensation seeking	−0.16*	0.02	0.23**	0.13	0.11	−0.03	0.10	0.11	−0.15	−0.19*	0.06	0.58**	0.01	−0.15*	_		
16	GDT	−0.11	0.03	−0.01	−0.04	−0.06	0.00	−0.06	−0.08	0.09	0.09	0.22**	−0.05	−0.03	0.11	0.01	_	
17	PGs/NPGs	0.12	−0.39**	0.30**	0.12	−0.16*	0.24**	0.30**	0.32**	−0.23**	0.17*	−0.24**	0.21**	0.27**	0.16*	0.00	−0.12	_

GRCS-IPC = Gambling Related Cognitions Scale - Predictive and interpretative control/bias; GRCS-IC = Gambling Related Cognitions Scale - Illusion of control distorted cognitions; Persistence (Y/N); TAS = Toronto Alexithymia Scale; ERS = Emotional Reactivity Scale; ERQ = Emotion Regulation Questionnaire; IGT= Iowa Gambling Task; UPPS-P = Short UPPS-P Impulsive Behavior Scale; GDT = Game of Dice Task; PGs/NPGs = problem gamblers/non-problem gamblers.

**$P < 0.01$. *$P < 0.05$.

Table 3. Factors associated with disordered gambling (four-step multiple logistic regressions)

Variables	Step 1		Step 2		Step 3		Step 4	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Age	1.32 (0.90–1.92)	0.152	1.38 (0.92–2.07)	0.12	1.44 (0.89–2.33)	0.124	1.35 (0.80–2.27)	0.257
Years of education	0.41 (0.26–0.63)	0.000	0.46 (0.29–0.74)	0.001	0.49 (0.29–0.83)	0.007	0.44 (0.24–0.80	0.007
Gender (ref: female)	3.01 (1.21–7.50)	0.018	3.31 (1.19–9.24)	0.022	3.64 (1.06–12.50)	0.040	4.91 (1.03–23.46)	0.046
GRCS – IPC			2.46 (1.23–4.94)	0.011	2.27 (0.97–5.33)	0.059	2.68 (1.03–6.97	0.043
GRCS – IC			0.85 (0.45–1.60)	0.61	0.75 (0.36–1.57)	0.449	0.73 (0.32–1.66)	0.455
Persistence (ref: No)			3.31 (1.36–8.04)	0.008	4.37 (1.50–12.76)	0.007	5.48 (1.61–18.66)	0.006
TAS - Difficulties identifying and describing feelings					1.18 (0.62–2.23)	0.612	1.14 (0.54–2.41)	0.726
TAS - Externally oriented thinking					1.17 (0.65–2.13)	0.593	1.00 (0.50–1.97)	0.994
ERS					1.91 (1.05–3.49)	0.035	1.91 (0.91–4.01)	0.085
ERQ - cognitive reappraisal					0.42 (0.20–0.86)	0.018	0.41 (0.19–0.91)	0.028
ERQ - expressive suppression					2.13 (1.10–4.13)	0.025	2.16 (1.03–4.51)	0.040
IGT					0.59 (0.35–1.01)	0.056	0.65 (0.35–1.18)	0.157
UPPS-P – Urgency							0.72 (0.30–1.73)	0.458
UPPS-P - Lack of premeditation							2.37 (1.11–5.10)	0.026
UPPS-P - Lack of perseverance							1.27 (0.67–2.41)	0.456
UPPS-P-Sensation seeking							0.68 (0.33–1.39)	0.288
GDT							0.67 (0.39–1.14)	0.140
Variance explained by model	R^2 = 0.277 (27.7%)		R^2 = 0.393 (39.3%)		R^2 = 0.576 (56.6%)		R^2 = 0.646 (64.6%)	
Statistical significance of model	F (3, 166) = 33.659, P = 0.000		F (6, 166) = 50.312, P = 0.000		F (12, 166) = 81.181, P = 0.000		F (17, 166) = 94.693, P = 0.000	
Change in variance by next step			ΔR^2 = 0.116 (11.6%)		ΔR^2 = 0.183 (18.3%)		ΔR^2 = 0.070 (7.0%)	

OR = odds ratio; CI = confidence interval; GRCS-IPC= Gambling Related Cognitions Scale - Predictive and interpretative control/bias; GRCS-IC = Gambling Related Cognitions Scale - Illusion of control distorted cognitions; Persistence (Y/N); TAS = Toronto Alexithymia Scale; ERS = Emotional Reactivity Scale; ERQ = Emotion Regulation Questionnaire; IGT= Iowa Gambling Task; UPPS-P = Short UPPS-P Impulsive Behavior Scale; GDT= Game of Dice Task; bold font indicates statistical significance; R^2 = squared multiple correlation coefficient; ΔR^2 = change in R^2 between steps; F = F value with corresponding degrees of freedom.

94.693), $P < 0.001$, which is very high and supports the validity of the Pathways Model to account for clinically-relevant forms of gambling behaviours. In the final model, years of school education (OR = 0.44) and ERQ-cognitive reappraisal (OR = 0.41) were negatively associated with treatment-seeking PGs, whereas gender (being male, OR = 4.91), predictive and interpretative control/bias of the GRCS (OR = 2.68), persistence at the SMT (yes, OR = 5.48), expressive suppression of the ERQ (OR = 2.11) and lack of premeditation of the UPPS-P (OR = 2.37) all contributed to significantly and positively predict clinical status.

DISCUSSION

In the present study, we aimed to empirically test the validity of the Pathways Model. To this end, we sought to determine how the psychological factors underlying each of the pathways described by Blaszczynski and Nower (2002) contribute to the prediction of gambling disorder. Beyond classic demographic associations (i.e. male gender and low education predict gambling disorder), our study successfully identifies various psychological dimensions included in the Pathways Model to predict the status of being a treatment-seeking gambler. Generally speaking, our study further supports the validity and clinical relevance of the Pathways Model theorized 20 years ago by Blaszczynski and Nower (2002).

Results showed that among factors selected to model the behaviourally conditioned gamblers' pathway, persistence at the slot machine had the strongest predictive value. Persistence in playing is an important aspect of problematic gaming patterns, which is also linked in clinical gambling with 'chasing behaviours' (i.e. persistent patterns of gambling promoted by the desire to recoup previous losses). Predictive and interpretative control/bias also constituted an important risk factor in the present study. These specific gambling-related cognitions refer to the beliefs that personal skills or knowledge may be acquired to increase the likelihood of winning in a game of chance (e.g. 'A series of losses will provide me with a learning experience that will help me win later'). Such cognitive distortions are not comparable with the 'illusory control' assessed by the illusion of control GRCS subscale, which reflects gambling cognitions related to external factors such as luck, superstitions and rituals. In our study, only skill-oriented cognitions predicted the status of being a treatment-seeking gambler (illusion of control as assessed by the GRCS did not predict clinical status in our study). This result is consistent with previous research that showed that PGs feel that they can influence gambling outcomes and that they tended to misattribute cause-and-effect relationships to unrelated events (Ciccarelli, Griffiths, Nigro, & Cosenza, 2017; Joukhador, Maccallum, & Blaszczynski, 2003; Mallorquí-Bagué et al., 2019), suggesting that the type of gambling-related cognitive distortion matters. These results echo those of a previous study in which skill-based cognitions (but not luck-based cognitions) predicted persistent playing and the desire to play again under extinction (i.e. when no win outcomes are delivered) in a comparable laboratory SMT (Billieux, Van der Linden et al., 2012).

Among the factors retained to model the specific factors involved in the emotionally vulnerable pathway, several emotional (dys)regulation processes (emotional reactivity, expressive suppression and cognitive reappraisal) significantly predicted clinical status. These results are in line with those of several studies suggesting that PGs are more likely to use maladaptive emotion regulation strategies (Navas, Verdejo-García, López-Gómez, Maldonado, & Perales, 2017), such as expressive suppression (Navas, Contreras-Rodriguez et al., 2017; Pace, Zappulla, Di Maggio, Passanisi, & Craparo, 2015; Rogier, Beomonte Zobel, & Velotti, 2020), and are less likely to use adaptive strategies, such as reappraisal (Williams, Grisham, Erskine, & Cassedy, 2012). Disordered gambling – used itself as an emotion regulation strategy (Barrada et al., 2019; Wood & Griffiths, 2007) – can thus be viewed as maladaptive coping fuelled by difficulties in regulating negative emotional states (Rogier & Velotti, 2018), as well as positive states (Rogier, Colombi, & Velotti, 2022; Velotti & Rogier, 2020). Emotional reactivity and the ability to effectively regulate emotions have close and reciprocal links (Becerra, Preece, Campitelli, & Scott-Pillow, 2019). Indeed, intense emotional experiences (such as those experienced by individuals with high emotion reactivity) are harder to regulate and, in turn, dysfunctional emotion regulation strategies contribute to the perpetuation of more intense emotional responses (Gross, 2014; Gross & Barrett, 2011; Gross, Sheppes, & Urry, 2011). These interrelated emotional processes appear to be strongly related to gambling disorder. Indeed, chance-related gambling is likely to result in financial losses and thus to promote negative affect, whereas gambling per se might be displayed as a coping strategy in order to face adverse emotional states. Similarly, gambling can promote positive affect (when the gambler is winning or spending a lot of time), and preliminary evidence suggests that the dysregulation of positive emotion is associated with problematic gambling behaviours (Rogier et al., 2022). Although not reaching the significance level ($P = 0.056$), our results suggest that poor decision-making under uncertainty might be a predictor of clinical status. This result, which may have reached significance in a more powered study, is in line with previous research on decision-making in gambling (Brevers et al., 2013). As taking into account emotional feedback is central to adapted decision-making (Bechara et al., 2000), it is possible that expressive suppression prevents reliance on internal emotional information to make informed and adaptive decisions. In our model, and in contrast to what could have been expected based on previous studies (e.g. Aïte et al., 2014), alexithymia traits did not predict the clinical status of an individual with gambling disorder. This might be because other emotion regulation-related constructs play a more important role.

Regarding variables retained to test the specific factors involved in the antisocial-impulsivist pathway, only the lack of premeditation (UPPS-P scale) predicted the status of being a treatment-seeking gambler. Numerous studies have identified the pivotal role of impulsivity traits in the onset and maintenance of gambling disorder (MacLaren, Fugelsang, Harrigan, & Dixon, 2011; MacKillop et al., 2014), and its contributions to gambling disorder severity (Mestre-Bach et al., 2022), and several emphasized that lack of premeditation, among UPPS-P traits, is in particular related to problem gambling (Cyders & Smith, 2008; Devos et al., 2020; Michalczuk et al., 2011; Wang et al., 2020). For example, Billieux, Lagrange et al. (2012) showed that among a treatment-seeking sample of patients with gambling disorder comparable to those included in the present study, lack of premeditation was the most prominent impulsivity trait displayed. We did not find, in contrast to previous research that was mainly conducted in community samples, an association between problem gambling and the emotional and motivational aspects of impulsivity (sensation seeking, positive urgency and negative urgency).

When all variables are taken into account simultaneously, which corresponds to testing factors underlying all of the pathways simultaneously, the significant predictors of clinical status are as follows: gender (being a male), low education, skill-oriented cognitions (predictive and interpretative control/bias), playing persistence (behaviourally indexed through the SMT), expressive suppression (i.e. maladaptive emotion regulation strategy), cognitive reappraisal (adaptive emotion regulation strategy) and lack of premeditation (impulsivity trait). In the final model, behaviourally assessed persistence is the strongest factor associated with gambling disorder. Emotional reactivity, together with emotional decision-making, failed to reach significance when all variables of the model were taken into account. Although it is probable that with a higher statistical power these constructs would have remained significant, our results suggest that other psychological dimensions from the Pathways Model have a higher predictive value for clinical status.

Limitations

This study comes with several limitations. First, the cross-sectional nature of the study hinders any causality statement. Second, the recruitment procedure was such that participants self-selected themselves, implying that our sample is not fully representative of the gambler and PG populations. Third, our sample is relatively small ($n = 166$). As suggested by some authors, a small sample increases the risk that the relevance of specific factors remains undiscovered (Rehbein & Baier, 2013). Despite our sample being relatively small, however, it included a significant proportion of treatment-seeking gamblers ($n = 59$). Nonetheless, our results should be replicated in a larger group of participants. Fourth, by selecting only a few questionnaires and one behavioural task per pathway, we were not able to comprehensively assess all of the factors postulated in the model, especially ecological or environmental ones like social pressure or gambling availability. Nonetheless, our assessment battery covers several key factors for each pathway, thus providing a valid estimation of the model. Along the same lines, other scales might have been retained to assess the mechanisms involved in the three pathways, typically in relation to the multi-dimensional and heterogeneous impulsivity and emotion-regulation constructs. For example, the more comprehensive Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004) or Cognitive Emotion Regulation Questionnaire (Garnefski, Kraaij, & Spinhoven, 2001) could have been used to assess emotion regulation instead of the ERQ. However, for reasons of parsimony, we had to limit the number of assessment tools retained. Finally, given the influence of gambling type (i.e. strategic vs. non-strategic) in the relationship between gambling disorder and alexithymia (Bonnaire et al., 2013, 2017) or impulsivity (Mallorquí-Bagué et al., 2019), it would have been useful to take into account gambling preferences in our investigation. In our sample, however, the small number of gamblers involved in strategic gambling did not allow us to take this variable into account in the predictive model.

Conclusion

Despite its inherent limitations, our study adds to the body of literature that has confirmed the validity of the Pathways Model. The main strengths of our approach were (1) the nature of the sample (which combined clinical and non-clinical participants), (2) the data-analytic strategy (which allowed us to consider the pathways in an integrated way rather than as representing discrete subtypes of gamblers), and (3) the assessment approach, which combines self-reported and behavioural variables. Our findings hold important implications in terms of assessment and treatment of problem gambling. In particular, a standardized assessment based on the Pathways Model should promote individualized treatment strategies to allow clinicians to take into account the high heterogeneity that characterizes gambling disorder (Billieux, Lagrange et al., 2012; Devos et al., 2020) and the various psychological mechanisms underlying each pathway theorized by Blaszczynski and Nower (2002). The clinical assessment of PGs should thus include questionnaires that measure key psychological factors from the Pathways Model, such as impulsivity traits and gambling-related cognitive distortions, or a more focused assessment tool, such as the Gambling Pathways Questionnaire (Nower & Blaszczynski, 2017). Nevertheless, while the Pathways Model is useful in clinical practice as its help to subtype patients with gambling disorder, some authors suggested that the clinical reality is more complex as the different factors operating in clinical samples are interacting in a more complex manner than it is theorized in the Pathways Model (Mestre-Bach et al., 2022). Furthermore, as suggested by Kurilla (2021) in his systematic review, some factors that are stipulated to be pathway-specific in the model could actually be viewed as general risk factors in the context of problem gambling. Thus, further studies are needed to further refine and specify the Pathways Model.

Our findings, in line with what was initially suggested by Blaszczynski and Nower (2002), call for a pathway-dependent approach to treatment. PGs from Pathway 1 would particularly benefit from cognitive techniques that aim at mitigating gambling-related cognitive distortions (Ladouceur et al., 2001; Petry et al., 2006). PGs from Pathway 2 would probably benefit from a combination of cognitive interventions (such as in Pathway 1) and interventions targeting the improvement of emotion regulation and/or emotional acceptance (e.g. Barlow et al., 2017; Elliott, Watson, Goldman, & Greenberg, 2004; Greenberg, Malberg, & Tompkins, 2019). Finally, PGs from Pathway 3 might benefit from the interventions proposed for the other two pathways augmented with interventions directly targeting impulsive behaviours and lack of premeditation. This includes therapeutic approaches that help impulsive gamblers to pursue specific goals, improve problem-solving skills, and optimize self-control and inhibitory control (e.g. Gollwitzer, 1999; Friese, Hofmann, & Wiers, 2011; Timulak & Koegh, 2021).

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