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Problem Gambling Poker Players: Do They Fit into Blaszczynski and Nower's Pathways Model?

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Abstract
Blaszczynski and Nower's (Addiction 97:487–499, 2002) Pathways Model, an integrative model based on problem gamblers' paths and comorbidities, aids in understanding the heterogeneity of problem gamblers' profiles by classifying them into three subgroups. The profiles of problem gamblers may be linked to the type of gambling practiced. Poker is a popular game, primarily due to the involvement of both chance and strategy in its outcome. However, no study has attempted to fit poker players into the Pathways Model. We recruited an online sample of 245 regular poker players (including 146 non-problem gamblers, 83 problem-gambling poker players, and 16 probable pathological gamblers). We assessed multiple variables (impulsivity, sensation seeking, alcohol and tobacco consumption, anxiety, depression, cognitive distortions) from the Pathways Model to determine whether the profiles of poker players fit into one or more gambler subgroups. Cluster analysis showed that poker players had a unique profile with a gambling practice intensity gradient. Compared to non-problem gamblers, problem gamblers displayed significantly higher levels of depression, impulsivity, gambling-related cognitive distortions, and alcohol consumption. Our results suggest that problem-gambling poker players fit into Blaszczynski and Nower's behaviorally conditioned gamblers group. This study opens avenues for both research into and treatment for problem gambling among poker players.

Keywords Pathways Model · Problem gambling · Poker · Comorbidities · Cognitive distortions

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Introduction

In 2002, Blaszczynski and Nower proposed a typological model of problem gambling that integrated biological, developmental, cognitive, environmental, personality, and learning theory factors, which was revised in 2021 (Nower et al., 2021). This model, the Pathways Model, encompasses the complexity of problem gambling and provides an explanation for the heterogeneity of the literature regarding the characteristics of problem gamblers (PG). Specifically, the model shows that PG have heterogenous profiles, underpinned by their pathways (etiological factors). The Pathways Model initially postulates three subgroups of PG. The first subgroup comprises behaviorally conditioned PG, for whom loss of control in gambling is linked to ecological factors (availability, accessibility), classical and operant conditioning (arousal, dysfunctional cognitive schemas) and habituation. This group presents fewer comorbidities; when present, comorbidities (anxiety, depression) are typically secondary to problem gambling. The second subgroup of PG consists of the emotionally vulnerable. While ecological factors are present, the path to conditioning is influenced by emotional vulnerability (personality, mood disturbances, poor coping and problem-solving skills) and biological vulnerability (biochemical and cortical). The third subgroup, antisocial-impulsivist PG, is characterized by the presence of impulsivity traits (impulsivity, neuropsychological disturbances such as ADHD), antisocial behaviors and substance misuse. In the revision of the model, Nower et al. (2021) added antecedents of childhood maltreatment in Pathway 2 and removed ADHD and substance misuse but added the use of gambling as a stress-coping strategy (search for meaning and purpose) in Pathway 3.

This typology of PGs has several implications, particularly for treatment, as therapeutic options may be adapted according to PGs' profiles. For instance, for emotionally vulnerable gamblers, mood disturbances should be addressed jointly with problem gambling. Behaviorally conditioned gamblers may benefit from cognitive and behavioral therapy, as their gambling problems are largely underpinned by conditioning and cognitive distortions. The group of antisocial-impulsivist PG may be the most difficult to treat, as the severity of their gambling problem is mediated by an impulsivity/psychopathy construct (Blaszczynski & Nower, 2002; Blaszczynski et al., 1997), which makes them less compliant with treatment. For them, intervention may target impulsivity.

The Pathways Model is considered the standard reference for the typology of PG. Several studies have empirically supported the existence of these three groups, both among treatment-seeking gamblers (Ledgerwood & Petry, 2010) and among PG in a community sample (Moon et al., 2017). Ledgerwood and Petry (2010) showed that those in the behaviorally conditioned subgroup experienced less severe problem gambling and less severe psychosocial difficulties than those in the other groups, and suggested that along with impulsivity, anxiety, and depression levels, gambling severity was the best predictor for treatment outcome. In a comprehensive review of the literature, Milosevic and Ledgerwood (2010) confirmed the existence of the three subgroups of PG. However, in 2020, Devos et al. identified, two additional subgroups: impulsive gamblers without gambling-related cognitions and gamblers without impulsivity or gambling-related cognitions.

Another factor may also account for the heterogeneity of PG' profiles: the type of game practiced. The literature (Blaszczynski et al., 1986; Bonnaire et al., 2006) has shown that the type of gambling practiced is linked to specific variables, such as personality traits and comorbidities. In 2009, Bonnaire et al. described three subgroups of people who gamble according to the type of game practiced. The first group includes people who play active games (i.e., games in which gamblers have real involvement in

the game's outcome, such as horse racing). Individuals in this group have high levels of sensation seeking and alexithymia and can be compared to those in the antisocial-impulsivist subgroup from the Pathways Model. The second group includes people who play passive games, such as games on slot machines (i.e., games in which gamblers have no role in the game's outcome, which is based on chance). This group is characterized by low levels of sensation seeking but high levels of depression and can be compared to the Pathways Model's emotionally vulnerable subgroup. The third group includes people who play strategic games (e.g., roulette). Individuals in this group display low levels of alexithymia, sensation seeking, and depression and match the behaviorally conditioned subgroup.

The main goal of Bonnaire et al.'s (2009) study was to confirm the existence of the three subgroups described by Blaszczynski and Nower (2002) and to establish a direct link between the subgroups and the type of game played. The study showed that the heterogeneity of gamblers' profiles could be linked to the heterogeneity of gambling types. However, the study did not assess all variables described in the Pathways Model; in particular, it excluded impulsivity and cognitive distortions. Indeed, not only the type of gambling practiced but also the number of games practiced should be taken into account for both the research and the treatment of PG. The idea that the risk of problem gambling increases as the number of types of gambling engaged in increases is well documented in the literature (Barrault et al., 2018; Welte et al., 2001) and referred to as the involvement effect. In 2018, Barrault et al. showed that gambling type moderates the relationship between problem gambling and emotional regulation, depression, and gambling motives. It thus seems relevant to study the characteristics of PG by distinguishing them according to the type of game they practice.

Among gambling types, poker seems to display particular features that may influence the development and expression of problem gambling (Barrault et al., 2014; Bjerg, 2010). The most specific of these features may be the involvement of both chance and strategy in the game's outcome, which may complexify individuals' perception of chance and lead to the development of specific cognitive distortions (Barrault & Varescon, 2013a; Barrault et al., 2014; Browne, 1989). Moreover, some types of thoughts that can be considered cognitive distortions among people playing games of chance may reflect skills, probabilities knowledge and learning/experience among poker players (Leveque et al., 2017). Poker is one of the most popular types of gambling, especially online (Barrault et al., 2014; Shead et al., 2008; Wood et al., 2007), a media-based platform known to facilitate and hasten the development of gambling problems (Griffiths & Barnes, 2008). In fact, Dufour et al. (2020) showed that, among poker players, the strongest problem-gambling predictor was playing primarily on the Internet. In their study, the risk factors for gambling problems among poker players were not the classical ones described in the literature for other gambling types (illusion of control, at-risk drug or alcohol use or anxiety), but rather related to the structural characteristics of online gambling (in particular the possibility to play at several poker tables simultaneously) and the number of games played. Depression and impulsivity were also identified as risk factors.

Several studies have assessed the psychological and psychopathological characteristics of problem-gambling poker players, showing in particular the influences of impulsivity (Barrault & Varescon, 2013b; Hopley & Nicki, 2010), cognitive distortions (Barrault & Varescon, 2013a; Bjerg, 2010; Linnet et al., 2010), and mood disturbances such as depression and anxiety (Barrault & Varescon, 2013a). However, to date, no study has attempted to determine whether poker players fit into Blaszczynski and Nower's Pathways Model, and, if so, how.

The principal aim of this study is to determine whether subgroups of poker players can be found among our sample. Consistent with data from the literature showing a link between PGs' profiles and types of games played (Bonnaire et al., 2009), we hypothesized that these players would match at least one of the Pathways Model's subgroups. To test this hypothesis, we aimed to describe the profile of problem-gambling poker players, particularly in terms of comorbidities (anxiety, depression, and substance misuse) and personality characteristics (impulsivity, sensation seeking).

Methods

Procedure

Participants were recruited from one of the most active online poker-related forums in France with the permission of the website's webmaster. We posted an announcement explaining the study that included a hyperlink people could click to participate. The hyperlink led to a webpage detailing the research goals and methods where potential participants could complete the consent form and then access the online questionnaire. Participants were informed that their involvement in the research was voluntary, anonymous, and unpaid, and that they were free to withdraw at any time. Data were screened to exclude potential multiple responses and incomplete answers ($n=47$). Some of the data used in this study have already been used in other publications (GRCS and ImpSS data); the data were analyzed differently here and used conjointly, which had not been done previously. Thus, this study is a secondary analysis of an existing data set. This study was conducted in accordance with the Declaration of Helsinki ethical principles. Participants were self-selected and volunteers. They received full information about the study's method, goals, and ethical aspects (freedom to withdraw, data access, etc.) and completed and signed an informed consent form.

Participants

Our sample consisted of regular mixed (i.e. online and land-based) poker players, defined as those who had played at least once a week for a minimum duration of one year. Participants were required to be over 18 years of age. We excluded participants who partook in any regular gambling practices other than poker ($n=2$). Furthermore, we chose not to include PG seeking or receiving treatment. As only 10% of PG undergo treatment, they may not be representative of the pathological gambler population (Loy et al., 2019).

Measures

- In a sociodemographic questionnaire, participants were asked to provide their age, marital status, and professional status.
- The South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987; French version by Lejoyeux, 1999) is a 20-item self-report questionnaire that includes criterion measures of a counselor's judgment of patients' gambling behaviors and DSM-III-R criteria for pathological gambling. The SOGS has proven to be a reliable instrument and is the problem gambling screening tool most frequently used in research (Shaffer et al., 1999). In this study, we used cutoffs typically employed in epidemiological research

(Cox et al., 2004): a score of 3 or 4 indicates problem gambling and a score of 5 or more indicates probable pathological gambling. The internal consistency is 0.86 in pathological gamblers (0.69 in the general population), the sensitivity rate is 0.94, and the specificity rate is 0.99 (in both the general population and pathological gamblers; Stinchfield, 2002). For the present study, internal consistency was good (α: 0.72).

- The Hospital Anxiety and Depression Scale (HADS; Snaith, 2003; French version by Lépine, 1985) is a 14-item self-report scale that assesses anxiety (HADS-A, 7 items) and depression (HADS-D, 7 items). Widely used in research, it provides good psychometric qualities: internal consistency varies from 0.68 to 0.93 for anxiety and from 0.67 to 0.90 for depression (Bjelland et al., 2002). A cutoff score of 8 indicates a probable anxiety or depression disorder. For the present study, internal consistency was satisfactory (α:0.77).
- The Gambling-Related Cognition Scale (GRCS; Raylu & Oei, 2004; French version by Grall-Bronnec et al., 2012) is a 23-item self-report scale that assesses five types of cognitive distortion: interpretative bias (IB), illusion of control (IC), predictive control (PC), gambling-related expectancies (GE), and perceived inability to stop gambling (IS). The GRCS has good psychometric qualities, including predictive validity, excellent criterion-related validity (discriminant function correctly classified 85% of participants) and an internal consistency of 0.93 (Raylu & Oei, 2004). In this study, we used a shortened version of the original scale. Poker is a game that involves real strategy, which may lead the player to develop beliefs about knowledge, probability mastery, and experience, for instance, who may not be irrational. Therefore, we decided to follow Lévesque et al.'s (2017) recommendation to remove items that they identified as biased among players (i.e., items 5, 9, and 15). In our sample, internal consistency was excellent (α: 0.83).
- The Impulsive Sensation Seeking Scale (ImpSS; Zuckerman et al., 1993; French version by Rossier et al., 2008) is an adaptation of the Sensation Seeking Scale (SSS form V; Zuckerman et al., 1978) that includes the dimension of impulsivity. It is one of the five subscales of the Zuckerman–Kuhlman Personality Questionnaire (ZKPQ, 1993). It includes two subscales: impulsivity (9 items) and sensation seeking (11 items). The impulsivity items refer to lack of planning and tendency to act impulsively without thinking. The sensation seeking items cover experience seeking and willingness to take risks to experience excitement or novelty. Validation studies show good psychometric qualities: the reliability of the ImpSS total scale is 0.82 (Zuckerman & Kuhlman, 1993), and subscale reliabilities range from 0.84 (in a student sample) to 0.87 (in a non-student sample) (McDaniel & Mahan, 2008). Internal consistency in our sample was 0.61.
- The Alcohol Use Disorder Identification Test (AUDIT; World Health Organization, Saunders et al., 1993; French version by Gache et al., 2005) is a 10-item self-rating scale used to assess the intensity of drinking. Scores range from to 0 to 40; the cutoff score for hazardous drinking is 8 (7 for women); a score of 20 or more is consistent with alcohol use disorder. AUDIT has good psychometric properties: internal consistency was 0.87 in the validation study (Gache et al., 2005) and 0.76 in our study.
- The Fagerström Test for Nicotine Dependance (FTND; Heatherton et al., 1991; French version by Etter et al., 1999) is a 6-item self-rating scale used to assess tobacco consumption and dependence. Scores range from 0 to 10. A score of 3 or 4 indicates light dependence, a score of 5 medium dependence, a score of 6 or 7 severe dependence, and a score of 8 or more very severe dependence. The validation study stated that the weak internal consistency (0.51) may be explained by the low number of items. Internal con-

sistency was low in our study (α:0.43). FTND is one of the most used tools for assessing tobacco dependence.

Statistical Analysis

The Statistica® version 13.3 software was used for the statistical analyses. Normality was assessed with the Kaplan–Meier test and homoscedasticity with the Browne–Forsythe test. Both were satisfactory. In the first step of our analysis, we conducted a hierarchical cluster analysis (HCA) cluster using Ward's method, including all study variables (excluding redundant ones, such as scales scores composed of included subscales scores), to determine whether our sample could be divided into relevant clusters. We chose Ward's method, which uses the F value to maximize the significance of differences between cluster, which gives it the highest statistical power of all methods. This method also permits the identification of the most useful variables for clustering. Then, we compared the continuous variable scores of the three clusters founded using a one-way analysis of variance (ANOVA), followed by a post-hoc analysis (Scheffe's test) to determine the direction of differences. Partial eta-squared was used to measure effect sizes. Post-hoc analysis (Scheffe's test) was used to control for type I errors and to conduct pairwise comparisons. A p value of <0.05 was set for statistical significance.

Results

Sociodemographic Data

Our sample included 245 regular poker players. We used SOGS scores to categorize participants into groups according to intensity of gambling practice. In our sample, 146 players were non-PG (SOGS <3), 83 were problem poker players (SOGS 3 or 4), and 16 were probable pathological gamblers (SOGS ≥ 5). There were no differences in sociodemographic data between pathological, problem, and non-problem poker players. Our sample was primarily men (97%), with a mean age of 29.1 years ($SD=7.8$; minimum age $=18$; maximum age $=60$). Half of our sample (51.8%) worked full time and 22.1% were students. The most represented socio-professional category was executives (31.4%). More than half of the sample were single (58.3%), and 76% had no children.

Cluster Analysis

The first step in our analysis was a cluster analysis of problem-gambling poker players to determine whether groups with specific features could be identified. Cluster analysis is a statistical method that allows a sample to be divided into groups based on their similarities.

Predictor importance analysis (Table 1) showed that the most significant predictors for cluster appurtenance were specific cognitive distortions (predictive control, interpretation bias, and illusion of control), FTQ scores, and impulsivity. Cluster analysis showed the existence of three distinct clusters (Table 2; Fig. 1).

Cluster 1 comprised 78 participants who did not present gambling problems (SOGS mean for this group was 1.59 ± 1.64). Cluster 2 comprised 139 participants who did not present gambling problems either but who had higher SOGS scores than those in Cluster 1 (SOGS mean was 2.28 ± 1.92). Cluster 3 comprised 28 participants with a gambling problem (SOGS

Table 1 Predictor importance (C&RT model)

	Variable range	Importance
PC	100	1.00
IB	92	0.91
IC	83	0.83
FTND	66	0.65
IMP	64	0.64
GE	64	0.64
SOGS	62	0.62
HADS-D	54	0.54
AUDIT	52	0.52
IS	48	0.47
HADS-A	46	0.45
SS	23	0.22

SOGS South Oaks Gambling Screen, *HADS-A* anxiety subscale, *HADS-D* depression subscale, *IMP* impulsivity, *SS* sensation seeking, *IB* interpretation bias, *IC* illusion of control, *PC* predictive control, *GE* gambling expectancies, *IS* inability to stop gambling, *FTND* Fagerström Test for Nicotine Dependance, *AUDIT* Alcohol Use Disorder Identification Test

Table 2 Scale means and cluster comparison (ANOVA)

	Cluster 1 (n = 78) Mean (SD)	Cluster 2 (n = 139) Mean (SD)	Cluster 3 (n = 28) Mean (SD)	F	Effect size	*p*
Age	29.99 (6.88)	28.79 (8.37)	28.57 (7.94)	0.66	0.07	0.51
SOGS	1.59 (1.64)	2.28 (1.92)	6.68 (3.01)	70.41	0.66	< 0.001*
HADS	6.21 (3.91)	7.70 (3.72)	15.14 (6.06)	49.80	0.56	< 0.001*
HADS-A	4.27 (2.96)	4.81 (2.50)	9.00 (3.82)	30.78	0.45	< 0.001*
HADS-D	1.94 (1.64)	2.88 (2.23)	6.14 (3.35)	36.97	0.48	< 0.001*
ImpSS	7.38 (4.05)	7.24 (3.78)	11.96 (4.18)	17.71	0.37	< 0.001*
IMP	1.74 (1.67)	1.94 (1.71)	4.29 (2.55)	22.37	0.38	< 0.001*
SS	5.64 (3.08)	5.31 (2.82)	7.68 (2.51)	7.95	0.26	< 0.001*
GRCS	50.37 (11.10)	70.88 (10.47)	85.82 (12.25)	140.78	1.03	< 0.001*
IB	12.88 (5.26)	16.84 (4.14)	17.75 (3.83)	22.68	0.43	< 0.001*
IC	5.32 (1.94)	7.15 (3.31)	12.11 (4.60)	48.46	0.56	< 0.001*
PC	11.59 (3.74)	16.32 (4.65)	20.82 (6.08)	49.47	0.59	< 0.001*
GE	10.64 (3.29)	14.60 (3.74)	15.39 (4.85)	32.22	0.47	< 0.001*
IS	9.68 (3.27)	16.21 (5.75)	21.04 (4.99)	68.09	0.77	< 0.001*
FTND	1.45 (1.75)	0.49 (0.87)	2.00 (1.61)	23.52	0.39	< 0.001*
AUDIT	6.03 (4.08)	4.36 (3.46)	9.11 (6.21)	17.20	0.32	< 0.001*

SOGS South Oaks Gambling Screen, *HADS* Hospital Anxiety and Depression Scale, *HADS-A* anxiety subscale, *HADS-D* depression subscale, *ImpSS* impulsive sensation seeking, *IMP* impulsivity, *SS* sensation seeking, *GRCS* Gambling-Related Cognition Scale, *IB* interpretation bias, *IC* illusion of control, *PC* predictive control, *GE* gambling expectancies, *IS* inability to stop gambling, *FTND* Fagerström Test for Nicotine Dependance, *AUDIT* Alcohol Use Disorder Identification Test

*$p < 0.05$

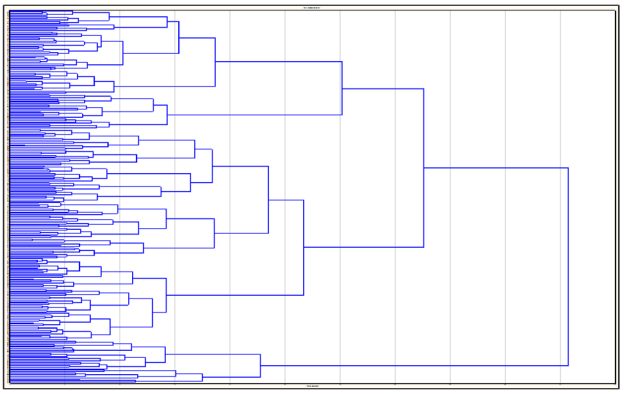

Fig. 1 Cluster analysis dendogram

mean was 6.68 ± 3.01). These participants had higher scores for every variable than those in Clusters 1 and 2.

After examining these clusters, we concluded that they were differentiated by the severity of the gambling practice. Accordingly, we labelled Cluster 1 the "no problem gambling group," Cluster 2 the "at-risk problem gambling group," and Cluster 3 the "problem gambling group." We used a one-way ANOVA to evaluate the differences between the three clusters. The results showed that these groups significantly differed on all variables ($p < 0.001$) except for age (Table 2).

To see if there were differences when comparing groups two-by-two, we performed post-hoc analysis (Table 3).

SOGS scores were significantly different between Cluster 1 and Cluster 3 on the one hand, and between Cluster 2 and Cluster 3 on the other hand ($p < 0.001$ for both). The total HADS and HADS depression subscale scores were significantly different between the three clusters ($p < 0.01$), but the HADS anxiety subscale only distinguished Cluster 3 from the other two ($p < 0.001$). Cluster 3 also had significantly higher scores on the ImpSS (total scores and subscales) than Clusters 1 and 2 ($p < 0.01$ for the three scores). For cognitive distortions, comparisons were significant between the three groups for the GRCS total ($p < 0.001$), predictive control ($p < 0.001$), illusion of control ($p < 0.001$), and incapacity to stop gambling ($p < 0.001$). The gambling expectancies item was significantly lower among Cluster 1 compared to Clusters 2 and 3 ($p < 0.01$). Finally, interpretation bias was lower in Cluster 1 than in Clusters 2 and 3 ($p < 0.001$ for both).

For AUDIT, Cluster 3 had significantly higher scores than the two other clusters ($p < 0.01$ for both), whereas Cluster 2 had lower scores than Cluster 1 ($p = 0.01$). For FTQ scores, Cluster 2 had significantly lower scores than the other two clusters ($p < 0.001$). We found no significant difference between Cluster 1 and Cluster 3.

Table 3 Clusters comparison (Scheffés Test)

	Cluster 1/Cluster 2	Cluster 1/Cluster 3	Cluster 2/Cluster 3
Age	0.56	0.71	0.99
SOGS	0.51	< 0.001*	< 0.001*
HADS	0.03*	< 0.001*	< 0.001*
HADS-A	0.39	< 0.001*	< 0.001*
HADS-D	0.01*	< 0.001*	< 0.001*
ImpSS	0.96	< 0.001*	< 0.001*
IMP	0.75	< 0.001*	< 0.001*
SS	0.71	0.006*	< 0.001*
GRCS	< 0.001*	< 0.001*	< 0.001*
IB	< 0.001*	< 0.001*	0.62
IC	< 0.001*	< 0.001*	< 0.001*
PC	< 0.001*	< 0.001*	< 0.001*
GE	< 0.001*	< 0.001*	0.59
IS	< 0.001*	< 0.001*	< 0.001*
FTND	< 0.001*	0.15	< 0.001*
AUDIT	0.01*	0.003*	< 0.001*

SOGS South Oaks Gambling Screen, *HADS* Hospital Anxiety and Depression Scale, *HADS-A* anxiety subscale, *HADS-D* depression subscale, *ImpSS* impulsive sensation seeking, *IMP* impulsivity, *SS* sensation seeking, *GRCS* Gambling-Related Cognition Scale, *IB* interpretation bias, *IC* illusion of control, *PC* predictive control, *GE* gambling expectancies, *IS* inability to stop gambling, *FTND* Fagerström Test for Nicotine Dependance, *AUDIT* Alcohol Use Disorder Identification Test

*$p < 0.05$

Discussion

Blaszczynski and Nower's (2002) Pathways Model celebrates its 20th anniversary tin 2022, the year of edition of this article. Over the last two decades, numerous studies have been dedicated to the empirical validation of this model and supported the existence of the three clusters of gamblers identified by Blaszczynski and Nower, including the revised model (Nower et al., 2021). Furthermore, several studies (e.g., Blaszczynski et al., 1986; Bonnaire et al., 2009) showed that the type of game practiced was linked to PGs' psychological profiles. However, to date, no study has examined the specific profile of poker players in light of the Pathways Model. The aim of the present study is to fill this gap by examining problem-gambling poker players' profiles to determine whether they fit into the Pathways Model and, if so, how.

First, we examined the sociodemographic data of poker players. We found no differences in terms of the severity of gambling practice, which permitted us to describe the poker players, regardless of the intensity of gambling practice, as male (97.2% of our sample), often single with no child, relatively young (mean age 29), and a student or executive. This profile seems relatively different to the one of PG classically described in the literature (Grall-Bronnec et al., 2010). By contrast, the profile is closer to the profile of people who gamble online found by Griffiths et al. (2010) and Gainsbury et al. (2012), who described them as young men, single, well-educated, and employed in a position of responsibility. However, as the poker players in our sample were not all online gamblers, it seems these

characteristics may be not only imputed to the form of media used to gamble, but also to the choice of the game of poker. Poker is a specific type of game that may attract this profile due to its prestigious aspect—particularly (but not only) a result of the involvement of celebrities in poker-playing (Wood et al., 2007)—and the real component of strategy in the game's outcome coupled with the possibility to train for free (or at very low costs) on the Internet (Shead et al., 2008; Wood et al., 2007).

In this study, we first attempted to determine whether people who play poker would fit into several subgroups. To that end, we conducted a Ward cluster analysis that permitted us to identify three distinct clusters. The examination of the clusters led us to conclude that the cluster analysis allowed our sample to be distinguished according to the degree of severity of their gambling practice. The clusters showed no qualitative differences between groups, only quantitative ones; namely, we observed a gradation of most our variable scores according to the severity of the gambling practice. Thus, we labelled Cluster 1 the "no problem gambling group," Cluster 2 the "at-risk problem gambling group," and Cluster 3 the "problem gambling group." This result is consistent with the findings of Dufour et al. (2020), who identified, over a three-year follow-up study, three problem gambling trajectories among poker players: (1) non-problematic-diminishing, (2) low risk-stable, and (3) problem gambling-increasing.

For most variables, Cluster 1 had lower scores than Cluster 2, and Cluster 3 had the highest scores. Comparisons between clusters showed that this gradation was significant for all cognitive distortions (except for interpretation bias and gambling expectancies, which did not distinguish Clusters 2 and 3), depression, and alcohol consumption. This result accords with a previous study, which showed a significant difference in cognitive distortions and depression among poker players between problem and non-PGs, suggesting that these variables play a major role in poker-playing-related problem gambling (Barrault & Varescon, 2013a). Our results extend this idea to the severity of poker addiction. For depression, we found that the more severe the problem gambling is, the more severe the depressive symptoms are. However, even in Cluster 3, the mean depression score is relatively low (m = 6.14) and did not reach the cutoff score of 8, indicating a probable depressive disorder. This result contradicts the literature on problem gambling, which shows frequent comorbidity between problem gambling and depression (for a review, see Won Kim et al., 2006). Conversely, it is consistent with the literature on card players, which has failed to find a link between PG and depression (Petry, 2003) and on poker players, suggesting that this specific type of PG tends to be more anxious than depressive (Barrault & Varescon, 2013a). Indeed, anxiety increased with severity of PG and significantly distinguished Cluster 3 from the other two clusters. However, only Cluster 3 reached the mean cutoff for a probable anxious disorder. Previous research had already shown the links between anxiety and PG among poker players (Barrault & Varescon, 2013a; Hopley & Nicki, 2010). As our study is cross-sectional, we cannot draw any conclusions regarding the involvement of preexistent anxiety in the development of problem gambling. Two hypotheses are plausible: (1) Anxiety is primary to PG and PG gamble to cope with negative affect, which is consistent with Mathieu et al.'s (2018) study showing that the coping motive to gamble was more frequent among PG than non-PG poker players; and (2) anxiety is secondary to PG and is caused by financial losses and other gambling consequences, which may explain why increases in PG severity led to increases in anxiety.

Regarding impulsive sensation seeking, our results are mainly in agreement with the existing literature. Literature about the links between sensation seeking and problem gambling is split, showing either a link between them (Demaree et al., 2008; Smith et al., 2010) or the absence of links (Bonnaire et al., 2009; Parke et al., 2004). These results may be

explained by the heterogeneity of gambling, as more recent literature has shown that sensation seeking may be involved in problem gambling in some, but not all, types of gambling (Bonnaire et al., 2009). In 2013, Barrault and Varescon compared sensation seeking among problem and non-problem-gambling poker players and found a high level of sensation seeking in both groups but no differences between them. Our results are not congruent with theirs, instead showing that sensation seeking is significantly higher among individuals in Cluster 3 than among those in the other two clusters, suggesting that this dimension may play a role in the severity of gambling practice. We can hypothesize that the need for stimulation, novelty, and intense sensations that characterizes high sensation seekers may lead PGs to engage more frequently in gambling behaviors and to do so in more risky ways. Sensation seeking, as we assessed it, includes the willingness to take risks for the sake of novelty or excitement. Impulsivity was also significantly higher in Cluster 3 than in Clusters 1 and 2 and was a good predictor for cluster belonging. This finding is consistent with the literature showing that impulsivity is a predictor of PG (Slutske et al., 2005; Vitaro et al., 1999), including among poker players (Barrault & Varescon, 2013b; Dufour et al., 2020; Hopley & Nicki, 2010). Indeed, lack of planning and the tendency to act impulsively without considering mid- and long-term consequences may partly explain why people continue gambling despite the negative consequences.

Regarding addiction-related comorbidities, we found that tobacco dependence was significantly higher in Clusters 3 and 1 than in Cluster 2. Alcohol consumption increased with the severity of gambling practice. These results are consistent with the literature, showing that PG is strongly associated with hazardous drinking (for a review and meta-analysis, see Lorains et al., 2011), but they fail to establish a link between PG and tobacco consumption.

Cluster analysis permitted us to identify a specific profile for problem-gambling poker players, according to which characteristics such as cognitive distortions, impulsivity, and depression may increase according to the severity of the gambling practice. Thus, we tried to determine a profile for problem-gambling poker players according to the Pathways Model subgroups.

Altogether, the results of this study led us to hypothesize a unique profile for poker players according to Blaszczynski and Nower's (2002) Pathways Model. The low levels of depression and relatively mild levels of anxiety we found led us to exclude the emotionally vulnerable subgroup. The presence of impulsivity in problem gambling among poker players may suggest that they could fall within the antisocial-impulsivist subgroup. However, we lack data, especially about antisocial personality disorder, to support this conclusion. Moreover, some clues led us to doubt this hypothesis, particularly the sociodemographic profile of those players, which indicates high rates of employment and good integration in society. In their description of antisocial-impulsivist gamblers, Blaszczynski and Nower (2002) emphasize the early onset, speed of development, and severity of problem gambling. Our results did not permit us to assess age of onset or speed of development, but they allowed us to characterize problem gambling in our sample of PG as mild, as even Cluster 3 did not obtain a SOGS score of 9, which is considered high severity problem gambling (the Cluster 3 mean was 6.68). An analysis of our data allowed us to hypothesize that problem-gambling poker players may fit into the behaviorally conditioned subgroup. Indeed, our results underline the involvement of cognitive distortions in problem gambling among poker players. This result is consistent with the literature about PG in general (Miller & Currie, 2008) and poker in particular (Barrault & Varescon, 2013a; Linnet et al., 2010; Mitrovic & Brown, 2009). The three most important predictors for cluster belonging were cognitive distortions (predictive control, interpretative bias, and illusion of control). Moreover, cluster analysis showed

that as the intensity of the gambling practice increased, the strength of the cognitive distortions likewise increased. This finding suggests that those distortions are central in the development, maintenance, and severity of problem gambling among poker players. Plus, our sample was recruited from an active poker forum, which can be linked to the conditioning aspect of the maintenance of participants' gambling practice. Participants did not present preexistent psychopathologies (at least, not anxious or depressive ones), but were characterized by the presence and high intensity of cognitive distortions and the presence of impulsivity, which could account for the poor decision-making ability mentioned by Blaszczynski and Nower (2002). According to Blaszczynski and Nower (2002), comorbidities of anxiety, depression, and addiction are frequent in this subgroup but secondary to problem gambling and its social, financial, and affective consequences. Our hypothesis is consistent with Bonnaire et al.'s (2009) idea that gamblers of traditional games (which include poker) may belong to the behaviorally conditioned subgroup.

This study has several limitations that impact the interpretation and generalization of the results. First, this was an online study with self-selected participants who may not be representative of the poker player population. The assessment of problem gambling would have been more reliable using a hetero-evaluation screening, such as the DSM-5 criteria (American Psychiatric Association, 2013), particularly because SOGS is known to favor false positives in general populations (Stinchfield, 2002). Further, the absence of some variables prevented a full assessment of the Pathways Model: antisocial personality disorder and ADHD symptoms should have been assessed to rule out the hypothesis that poker players fit into the antisocial-impulsivist subgroup, as well as coping skills (emotionally vulnerable subgroup) and family history (behaviorally conditioned subgroup). Above all, to include poker players in one of the Pathways Model subgroups, the use of the Gambling Pathways Questionnaire (Nower & Blaszczynski, 2017) would have been more relevant. Finally, although the sample size ($N=245$) was large enough for statistical analysis, the results would have been more reliable with a larger sample.

Despite these limitations, this study provides a better understanding of the profile of poker players. The lack of data, in particular about family history, the occurrence of disorders, and the presence of ADHD and antisocial personality disorder, does not allow us to confirm with certitude that problem-gambling poker players fit into the behaviorally conditioned subgroup, but our data strongly support this hypothesis. Further research with larger samples should be conducted to fill in the gaps. Moreover, our results have both research and clinical implications. Regarding research, future studies should focus on personality and personality disorders, as they are known to be clinical complexity factors. Additionally, future studies should examine the pathways of PGs to determine the order of occurrence of problem gambling and other disorders, in particular anxiety and depressive disorders. The principal clinical implication of our study, as well as others focusing on the typology of PGs, is to emphasize the need to identify the profile of PGs so as to propose adapted therapeutic interventions. Poker players, due to the strong involvement of cognitive distortions in problem gambling, appear to be good candidates for cognitive behavioral therapy, especially programs focusing on cognitive restructuring. Moreover, the presence of anxious and depressive comorbidities, whether they are primary or secondary to the addictive behavior, should be assessed and addressed conjointly in therapy programs because those disorders can influence each other.

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Data Availability Data available on request from the authors.

Declarations

Conflict of interest The authors declare no conflict of interest.

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