Comparison of gambling profiles based on strategic versus non-strategic preferences

Susana Jiménez-Murcia*[a,b,c], Roser Granero[b,d], Fernando Fernández-Aranda[a,b,c], José M. Menchón[a,c,e]

[a]*Department of Psychiatry, University Hospital of Bellvitge-IDIBELL, Barcelona, Spain*

[b]*Ciber Fisiopatología Obesidad y Nutrición (CIBERObn), Instituto de Salud Carlos III. Madrid, Spain*

[c]*Department of Clinical Sciences, School of Medicine and Health Sciences, University of Barcelona, Barcelona, Spain*

[d]*Department of Psychobiology and Methodology, Autonomous University of Barcelona, Barcelona, Spain*

[e]*Ciber Salut Mental (CIBERSam), Instituto de Salud Carlos III. Madrid, Spain*

Abstract

Gambling disorder (GD) has been associated with significantly impaired functioning. However, the empirical evidence available on gambling phenomenology based on the preferred forms of gambling, including the factors that are responsible for the choice of games and the clinical correlates of the preferred subtypes, is very limited. The few studies comparing clusters of GD patients defined by their preferred gambling activities usually classify games into two broad categories, thus distinguishing between strategic and non-strategic gamblers. The data available suggest that sociodemographic variables (sex, age, level of education and socioeconomic status) and personality traits (mainly sensation/novelty-seeking and impulsivity) may influence gambling activity, and that this preference may be clinically significant. This cumulate evidence may pave the way for a better characterization of the GD subtypes, and may help to design solid, well-founded prevention and treatment programs that take into account the individual variability in patients' clinical profiles.

Introduction

Gambling disorder (GD) is a behavioral addiction characterized by maladaptive patterns of gambling that individuals cannot give up despite their negative consequences – such as family and work disruption, having to lie about the extent of one's gambling habit, or financial difficulties. It is the only behavioral addiction currently included in the new category of the Diagnostic and Statistical Manual of Mental Disorders labeled "Substance-related and addictive disorders" (DSM-5; (1)). Epidemiological studies have noted the significant increases in the prevalence of GD worldwide, with cross-sectional estimates (over the previous 12 months) in the range of 0.1% to 6% in the general population in developed countries (2,3).

Individuals engage in gambling behaviors either on their own or in social settings, most of them available through multiple offline and online platforms (e.g., card games, betting on sports events and races, bingo, lotteries, slot-machines and casinos). The preferred form of gambling seems to be associated with many variables that explain why an individual chooses a specific game and also identify the clinical correlates of this selection (4,5). However, few empirical studies have explored the underlying mechanisms of the gambling preferences inside the GD phenomenology.

Classification of GD based on gambling preference

The attempts to classify the subtypes of GD and the study of its correlates are not new. A pioneering study from 1970 defined five clusters based on the characteristics of 50 patients with gambling problems (neurotic, impulsive, psychopathic, symptomatic and sub-cultural) (6), and four primary groups were later obtained from a principal component analysis study (psychological distress, sensation seeking, crime and liveliness, and impulsive/antisocial behavior) (7). The main characteristic of these studies is the role of emotional impairment, considered as a key indicator in the grouping. More recent classification studies have also used psychological state and the level of the disordered gambling as key factors for identifying empirical subgroups among GD patients (inside a broad age range, from adolescence to old age). Researchers have also systematically identified groups ordered according to the level of dysfunctional distress [the most severe cluster being characterized by high levels of emotional vulnerability accompanied by higher psychopathological alterations (mainly depressive and anxiety symptoms, substance-related disorders and other impulse control disorders), poor coping skills and greater severity of the gambling behaviors] (8,9,18,19,10–17). In these studies, this specific highly dysfunctional cluster has usually included a higher proportion of participants reporting many different forms of gambling preferences, but as a whole it seems that gambling

subtypes differ mainly in relation to severity rather than to the type of the symptoms experienced or the gambling activities in which the subjects engaged.

In these classification studies, gambling preference was only a matched trait related to the emerging empirical categorization, and was not used as an indicator for the clustering. Therefore, it is not clear that simultaneously considering the level and/or the type of emotional alterations and the preferred forms of gambling might allow the identification of more specific and accurate subgroups of patients, or that it might provide an empirical standardized operative definition for gambling activities based on the complete GD phenomenology rather than only on the specific characteristics of the games. Studies published to date simply consider gambling subtypes as a broad categorization according to the particularities of the games, classifying them into groups depending on: a) the role of chance in the result of the games (non-strategic versus strategic gamblers), b) the immediate or delayed gambling rewards (active versus passive gamblers), or c) the gambling setting (land-based versus online gamblers, based on the internet connection). The differentiation of the games based on the level of the influence of chance has aroused the most interest during recent years in the clinical and research areas (20).

Non-strategic gambling (also called chance-based games) includes games which involve little deliberation or skill (e.g. slot-machines, bingo or lotteries); in these games, the potential result is 100% dependent on chance. Strategic gambling (also called skill-based games) allows gamblers to attempt to use game-related knowledge to predict the potential results (e.g., dice, poker and other cards, betting on sports events or races, craps, or the stock market); in these games, although chance remains a key factor in the results, players' decisions and behaviors (i.e., strategies and techniques learned from prior experience with the games) exert some influence.

Variables related to the selection of the gambling preference

Traditionally, it was considered that access to gambling (in addition to the technical and structural features of the games) had the greatest influence on the frequency and type of gambling that an individual might engage in (21,22). Today, however, multiple different games are freely available to many sectors of the population, and so accessibility to gambling is only a "starting point" which provides the opportunity to gamble, but which is accompanied by a range of other factors that lead individuals to select a preferred gambling activity.

Within the neuroscience of decision-making under risk, which postulates that potential contextual reward statistics and brain systems shape behavior toward or against particular choices (thereby contributing to the adjustment of the individuals' actions), it has been observed that the subjective value of a specific risk preference (such as the selection of a gambling subtype) may be attributed to a range of factors: one's own baseline gambling propensity, the

reward amount related to one's own gambling preference and the moderation effect of the distinct mappings between the components of the chosen options and neural value-sensitive brain regions (23). Studies in this area also propose that specific decision-making (such as the preferred forms of gambling) reflects more than just a compensatory interaction of choice-related regions (24), in the sense that gambling decisions may be influenced by the activity of some brain areas (infralimbic, prelimbic, or rostral agranular insular cortex), the activity of dopamine receptors and the presence of cues (elements that seem to potentiate the final choices depending upon strategies, traits and contexts) (25). But this promising evidence of a latent connection between the preferred forms of gambling and brain activity is limited, mainly because this research area is in its initial exploratory stages and the effect and the direction of the associations are not clear. In fact, the results of some studies point in the opposite direction, arguing that even though gambling preference may be strongly related with specific psycho-social correlates, it may not be dissociable in terms of the cognitive functioning: both groups of non-strategic and strategic gamblers appear to show similar impairments in inhibitory control and cognitive flexibility to matched healthy volunteer groups (26).

There is a growing body of empirical evidence on this issue in the area of epidemiological research, which highlights that two socioeconomic factors significantly increase the odds of reporting non-strategic high-chance games (versus strategic gambling): lower educational level and disadvantaged socioeconomic status (27,28). Studies in this field also stress that the individuals' chronological age and sex are also crucial demographic variables for predicting the preferred forms of gambling. Etiological research focusing on the psychological domain has also concluded that gambling preference is not only explained by socio-demographic variables, but is a more complex mechanism that includes several personality traits (primarily novelty/sensation seeking, impulsivity, self-directedness or cooperativeness).

Regarding chronological age, non-strategic gambling is usually associated with older individuals, who tend to select low-skill chance-based games (29–33). This evidence is reinforced by findings that show that non-strategic gambling involves quick, unplanned reward-driven decisions, which are comprised by the link between gambling disorder and disadvantageous cost-benefit decision-making (20); while non-strategic gamblers show greater deficits in decision-making than strategic gamblers (34). Neurological studies support the argument that the non-strategic preference could be related to the specific age-related vulnerabilities of the brain, which shows a particular impairment in the frontal structures with subsequent effects on cognitive functioning (e.g., reasoning slowness). The analysis of the neural correlates of feedback cognitive processing during risky decision-making tasks reinforces this supposition, since it has been observed that older adults are less willing to shift attention from

positive to negative information, and thus present poorer neuropsychological performance than younger individuals (35,36). The decrease in cognitive performance in older age has also been associated with a restricted ability to gain explicit insight into the rules of ambiguous decision tasks, and with difficulty in choosing the less risky events once the rules have been completely understood (37).

Gender has also been systematically associated with gambling preference: while women tend to report a preference for non-strategic games, a higher proportion of men select strategic ones (20,26,29,38–41). Several hypotheses have been put forward to explain the association between sex and gambling preference. On the one hand, higher rates of excitement or arousal-seeking behavior and better performance in coping strategies are potential reasons for the higher likelihood that men will select strategic forms of gambling (such as cards or sports betting) (26,40,42). Secondly, the higher co-occurrence of depression and anxiety symptoms among women who meet diagnosis for GD (compared to men) may lead females to choose games that promote isolation (such as slot-machines or lotteries, two non-strategic gambling activities) as a way to avoid the high levels of emotional/stress impairment without the need to interact directly with others (as is required by many strategic gambling activities) (43). Thirdly, the association between strategic gambling preference and male sex has also been more accurately explained by a model which simultaneously considers both gender and cognitive variables (44): analytical cognitive style (versus intuitive), high need for cognition (versus low) and male sex (versus female) are the characteristics of strategic gamblers (versus non-strategic). Finally, a fourth factor explaining the difference in gambling activities depending on patients' sex might involve sociability and the cultural influences related to the diverse forms of gambling: since certain strategic games may be more culturally acceptable among men (for example, dice or poker), women would tend to avoid them (45,46). The role of social acceptability in the choice of gambling activity according to sex is reinforced by the results of other studies which have concluded that men are more likely to participate in strategic games in a public setting, while women are more likely to participate in the same chance-based games in a domestic setting (47), and that cultural values (understood as the beliefs, moral principles and standards accepted by groups related to the games) have an impact on the different decisions that men and women make regarding their gambling activities (48,49).

With regard to the contribution of personality traits to the preferred form of gambling (non-strategic versus strategic), it has been observed that individuals with high scores on the novelty/sensation seeking and impulsivity domains usually prefer skill-based/strategic gambling, while higher levels in harm avoidance, reward dependence and cooperativeness are more typical of non-strategic gamblers (43,50–52). Interestingly, the recent study by Jiménez-Murcia and

colleagues exploring the clustering of patients in a large sample (n=2,570) of individuals seeking treatment for GD, which used a wide set of variables as indicators for the grouping (sociodemographic, gambling-related factors, general psychopathology and personality traits), observed a specific cluster defined by the highest prevalence of skill-based games and new forms of gambling activities (such as online gambling) which was strongly related to younger age, male sex, higher levels of education, well-paid employment, and high sensation and novelty-seeking scores (14). This particular new subtype identified among a large sample of gamblers had a similar profile to the Type-I subgroup also reported in the study of Navas et colleagues (53), characterized by individuals who reported a gambling preference for cards, casino and skill-based bets, and who achieved high arousal and reward sensitivity levels. As a whole, these two studies reinforce the association between high impulsivity and novelty-seeking and a preference for strategic games.

Clinical correlates of gambling preference

Several variables of individuals' clinical history have been associated with the preferred forms of gambling. Firstly, it seems that some games contribute to the progression from the beginning of the gambling activity to the onset of the GD. For example, it has been observed that gamblers who select slot-machines (54) and electronic gambling machines (39) report a faster progression (and consequently a shorter duration of gambling problems prior to treatment seeking) than other non-strategic games such as lotteries and bingo. Other studies have also observed that, compared to skill-based games, some non-strategic games report greater severity of the gambling addiction, particularly slot-machine and fixed-odds betting terminal gamblers (55). Relationships in the opposite direction have also been reported. A recent study obtained a positive association between the presence of busts (defined as surpassing one's self-imposed limits on gambling activities) and the amount of money spent recently (particularly, losing money too quickly), high levels of negative emotion, needing to win money, chasing losses, wins or spins, lapses in the intention to set a limit and self-perceptions of gambling-related harm (56). This study also concluded that repeated busts are typical of individuals with higher levels of loss of control and may involve a faster progression towards problem gambling. On the basis of this new evidence, one might assume that some strategic games characterized by high incentives (such as sports betting, casinos or poker) may motivate subjects to make riskier bets and thus quickly accumulate high levels of debt; these gamblers may also decide to increase the frequency of their gambling episodes with the aim of recovering what was lost, thus favoring a faster evolution towards GD. But the accumulated evidence of associations between gambling subtypes and the progression and severity of the gambling behavior should be assessed with caution, since

it has also been pointed out that the potentially significant relationships between these variables are substantially reduced or even eliminated when the level of gambling involvement is controlled statistically (57).

Regarding comorbid mental conditions co-occurring with GD, a number of studies carried out in treatment-seeking problem gambler samples have obtained high prevalence of substance-related disorders, other impulsive control disorders, depression and anxiety (58–60). When considering the influence of preferred forms of gambling on the likelihood of presenting specific forms and levels of mental comorbid problems, it has also been observed that non-strategic games are more strongly associated with worse overall psychopathology, with the depressive and anxiety disorders being the most frequent comorbid forms in this subgroup; in contrast, strategic games are associated with a better overall psychological state but with a higher risk of comorbid substance use disorders (38,39,47,61,62). One explanation proposed for this difference is the possible moderating role of sex in the relationship between gambling type and the overall psychological state: while female gamblers may present lower risk of onset, they usually have poorer mental health and a higher risk of emotional and psychiatric comorbidities than their male peers (who usually report higher use of alcohol and other drugs) (63–65).

The above results are consistent with the proposal of a new subtype of pathological gamblers identified in the clustering study of Jiménez-Murcia and colleagues (the group defined by the highest prevalence of skill-based games and new forms of gambling activities), which achieved a moderate level of emotional distress but the highest gambling addiction severity (defined as the bets per gambling episode and the debts accumulated due to gambling) (these patients were (*online strategic gamblers with severe affectation*) (14). Other studies have found that groups defined by strategic games and new forms of gambling activities show greater gambling severity than non-strategic gamblers, particularly in terms of the amount of money spent (since money is spent faster in skill-based games) and the debts accumulated due to gambling (the fact that debts are acquired in a shorter period of time intensifies the financial problems during the progression of the disorder) (66–69).

Therapeutic outcomes related to gambling preference

Systematic reviews in problem gambling have concluded that cognitive behavioral therapy (CBT) can be considered the “gold standard” in the area of psychotherapy (70). A large number of publications (and many practicing professionals) suggest that the evidence-base for this therapeutic approach is strong. As a whole, the results reported in clinical studies have proved the efficacy of CBT among individuals seeking treatment for problem gambling, at least

in the short and medium terms (71–73). Benefits of CBT have also been observed with regard to the comorbidities that may accompany the gambling disorder (72).

However, little is known about the specific contribution of gambling preference to the efficacy of CBT. To our knowledge, the only systematic review available on this topic is the study carried out by Merkouris and colleagues, which considered and simultaneously analyzed a large set of independent variables (74). These authors found that the strongest and most consistent predictors of success/efficacy across multiple time-points were male sex and low levels of depression, followed closely by older age, lower gambling symptom severity, lower comorbid alcohol use and higher treatment adherence. Preferred gambling activity did not contribute significantly to the therapy outcomes in this study. But this review also confirms that the evidence of the potential predictive capacity of gambling preference on the progression of problem gambling is limited, and that further studies in this area are needed to assess effects other than the direct ones; for example, moderating or mediating effects cannot be ruled out.

Regarding original empirical studies, the recent research published by Mallorquí-Bagué and colleagues concluded that differences between strategic and non-strategic gamblers in impulsivity and cognitive functioning were related to therapy outcome (75). Concretely, this study found that strategic gamblers reported higher lack of perseverance and higher level in two cognitive biases (gambling-related expectancies and illusion of control), which were predictors of a poorer progression to recovery. This study also observed that patients with online and strategic GD phenotypes achieved heightened gambling related biases, and that this cognitive impairment was associated with premature treatment cessation and relapse. In their study, the authors concluded that skill-based gamblers may need tailored treatment approaches to reduce specific cognitive distortions and impulsive facets related to the gambling preference.

Conclusions

Although gambling preferences appear to be highly relevant to the study of GD phenotypes and individual profiles, few studies have analyzed the pathways and mechanisms underlying the categorization into non-strategic versus strategic gamblers and the clinical and therapeutic correlates of this differentiation. Pioneering studies in this area have noted that the simultaneous consideration of gambling preference with the other variables of the sociodemographic and clinical profile may provide a powerful way to subtype disordered gambling patients. Empirical studies also show that specific sociodemographic and personality variables may favor a preferred style of gambling, that gambling subtype may also be associated with the overall clinical state (including the level of severity of the gambling disorder and psychopathological disorders) and that the preferred form of gambling may even contribute to

the therapeutic outcomes. Figure 1 summarizes the main results reported in the literature that explain the picture of gambling subtype inside the GD phenomenology.

--- Insert Figure 1 ---

Future research is now required to determine the correlates of considering the differentiation between skill- and chance-based games in the study of GD. The advent of new forms of online gambling will also contribute to the reliability/validity of the traditional classification of strategic versus non-strategic gambling and its correlates in the GD phenotypes (e.g. the classical consideration of chance-based gamblers being more severe could be inappropriate and should be shifted due the ubiquitous availability of easy access to multiple strategic forms of gambling on the internet). The new accumulated evidence-base will allow for more targeted preventive and treatment interventions focused on the particular characteristics of the individuals involved. The few available evidences suggest that GD phenotypes characterized by strategic gambling may need tailored treatment approaches to reduce specific cognitive distortions and impulsive facets.

Funding

We thank the CERCA Programme / Generalitat de Catalunya for institutional support. This manuscript and research was supported by grants from the Ministerio de Economía y Competitividad (PSI2015-68701-R). The research was funded by the Delegación del Gobierno para el Plan Nacional sobre Drogas (2017I067), Instituto de Salud Carlos III (ISCIII) (FIS PI14/00290 and PI17/01167) and co-funded by FEDER funds /European Regional Development Fund (ERDF), a way to build Europe. CIBERobn and CIBERSAM are both initiatives of ISCIII. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript. The study received the support of the Secretariat for Universities and Research of the Ministry of Business and Knowledge of the Government of Catalonia. TMM, CVA and MLM are supported by a predoctoral Grant of the Ministerio de Educación, Cultura y Deporte (FPU16/02087; FPU16/01453; FPU15/02911). HLG is supported by the Beatriu de Pinos programme of the Secretariat for Universities and Research of the Department of Business and Knowledge of the Government of Catalonia (grant number 2017 BP00035).

Conflict of interest

None of the authors have any conflicts of interest to declare.

Annotated references

Chamberlain SR, Stochl J, Redden SA, Odlaug BL, Grant JE. Latent class analysis of gambling subtypes and impulsive/compulsive associations: Time to rethink diagnostic boundaries for gambling disorder? Addict Behav. 2017;72:79–85. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460317301314

This study identified subtypes of adult gamblers and assessed the relationships of the three empirical classes that emerged (with different levels of gambling severity) with clinical and cognitive measures. Problematic gamblers and disordered gamblers reported impaired cognitive performance in decision-making, comorbid mental disorders and impaired quality of life. Chasing losses was the symptom with the highest capacity for discriminating between recreational and problematic gamblers, and social-financial-work impairment was the variable with the highest endorsement for identifying the presence of problems related to the gambling activities.

Jiménez-Murcia S, Granero R, Fernández-Aranda F, Stinchfield R, Tremblay J, Steward T, et al. Phenotypes in Gambling Disorder Using Sociodemographic and Clinical Clustering Analysis: An Unidentified New Subtype? Front Psychiatry. 2019;10:173. Available from: https://www.frontiersin.org/article/10.3389/fpsyt.2019.00173/full

Clustering procedures identified three groups of GD patients highly differentiated in the level of emotional distress: a) “high emotional distress” contained the oldest patients with the longest duration of gambling problems, the highest GD severity, and the most severe comorbid psychopathological state; b) “mild emotional distress” included patients with the lowest levels of GD severity and the lowest levels of psychopathology; and c) “moderate emotional distress” included the youngest patients with the shortest illness duration, the highest level of education and moderate levels of psychopathology. This last cluster was probably responsible for the pattern of correlations between the different types of high arousal, large-stake games (bets, casino games, skill-based games) and even after controlling for age and other potential confounders it included the highest sensation- or novelty-seeking scores and strongest gambling-related cognitive distortions. This group also showed general self-regulatory executive functioning, and high-order cognitive processing, as well as the highest level of education, highest self-directedness scores, and lowest risk of suffering from a comorbid addictive disorder.

Mouneyrac A, Lemercier C, Le Floch V, Challet-Bouju G, Moreau A, Jacques C, et al. Cognitive Characteristics of Strategic and Non-strategic Gamblers. J Gambl Stud. 2018;34(1):199–208. Available from: http://link.springer.com/10.1007/s10899-017-9710-6

This study assessed the incremental predictive capacity of cognitive style (analytical/intuitive) and the need for cognition (motivation to engage in effortful activities) for discriminating between gambling preference (strategic versus non-strategic). The likelihood of strategic gambling (compared to non-strategic activities) was higher for men (vs. women), analytical cognitive style (vs. intuitive) and high need for cognition (vs. low). This study highlighted the relevance of considering cognitive features in the pathways explaining the gambling picture (and more specifically the gambling activity preference).

Navas JF, Billieux J, Perandrés-Gómez A, López-Torrecillas F, Cándido A, Perales JC. Impulsivity traits and gambling cognitions associated with gambling preferences and clinical status. Int Gambl Stud. 2017;17:102-124

This study identified two empirical factors based on impulsivity measures, cognitive bias related to gambling and gambling severity. Both dimensions were next used to classify gambling disorder patients (GDP) and non-problematic recreational gamblers (RG) into two gambling types: a) type I (preferring cards, casino games and skill-based bets); and b) type II (preferring slot-machines, lotteries/pools and bingo). GDP showed higher levels on impulsivity measures (positive and negative urgency), reward sensitivity, delay discounting and gambling related cognitions than their recreational counterparts. Type II gamblers also had more difficulty in delaying gratification, whereas type I gamblers showed higher cognitive distortion and reward sensitivity levels. No differences in type I and type II disordered gamblers emerged, however, in affect-driven impulsivity.

Rodda SN, Bagot KL, Manning V, Lubman DI. "It was terrible. I didn't set a limit": Proximal and Distal Prevention Strategies for Reducing the Risk of a Bust in Gambling Venues. J Gambl Stud. 2019;in press. Available from: http://link.springer.com/10.1007/s10899-019-09829-0

This study explored variables associated with the presence of a bust (defined as the breaching of limits on gambling activities) in a sample of gamblers recruited from gambling venues. The risk of a bust was positively predicted by the amount of money spent in the past month, greater gambling severity, and higher perception of harm related to the gambling activity. Reasons for busts included higher levels of negative affect, lapse in intentions to set a limit, needing to win money, chasing losses, wins or spins, social facilitation and losing money too quickly. These results evidenced that gamblers at any level of gambling severity are at a high risk of experiencing a bust, and that repeated busts may be an indicator of loss of control and a progression towards problem gambling.

References

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington D.C.: Author; 2013

(**) 2. Calado F, Griffiths MD. Problem gambling worldwide: An update and systematic review of empirical research (2000–2015). J Behav Addict. 2016;5(4):592–613. Available from: http://www.ncbi.nlm.nih.gov/pubmed/27784180

3. Subramaniam M, Wang P, Soh P, Vaingankar JA, Chong SA, Browning CJ, et al. Prevalence and determinants of gambling disorder among older adults: A systematic review. Addict Behav. 2015;41:199–209. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25452066

(*)4. Moragas L, Granero R, Stinchfield R, Fernández-Aranda F, Fröberg F, Aymamí N, et al. Comparative analysis of distinct phenotypes in gambling disorder based on gambling preferences. BMC Psychiatry. 2015;15(1):86.

5. Stevens M, Young M. Who plays what? Participation profiles in chance versus skill-based gambling. J Gambl Stud. 2010;26(1):89–103. Available from: http://link.springer.com/10.1007/s10899-009-9143-y

6. Moran E. Varieties of pathological gambling. Br J Psychiatry. 1970;116(535):593–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/5452361

7. Steel Z, Blaszczynski A. The factorial structure of pathological gambling. J Gambl Stud. 1996;12(1):3–20. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24233843

8. Álvarez-Moya EM, Jiménez-Murcia S, Aymamí MN, Gómez-Peña M, Granero R, Santamaría J, et al. Subtyping study of a pathological gamblers sample. Can J Psychiatry. 2010;55(8).

9. Aragay N, Barrios M, Ramirez-Gendrau I, Garcia-Caballero A, Garrido G, Ramos-Grille I, et al. Impulsivity profiles in pathological slot machine gamblers. Compr Psychiatry. 2018;83:79–83. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29625378

10. Blaszczynski A, Nower L. A pathways model of problem and pathological gambling. Addiction. 2002;97(5):487–99. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12033650

(**)11. Chamberlain SR, Stochl J, Redden SA, Odlaug BL, Grant JE. Latent class analysis of gambling subtypes and impulsive/compulsive associations: Time to rethink diagnostic boundaries for gambling disorder? Addict Behav. 2017;72:79–85. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460317301314

12. Granero R, Fernández-Aranda F, Mestre-Bach G, Steward T, García-Caro B, Prever F, et al. Clustering of treatment-seeking women with gambling disorder. J Behav Addict. 2018;7(3):770-780

13. Jiménez-Murcia S, Granero R, Stinchfield R, Fernández-Aranda F, Penelo E, Savvidou LG, et al. Typologies of young pathological gamblers based on sociodemographic and clinical characteristics. Compr Psychiatry. 2013;54(8):1153-1160.

(**)14. Jiménez-Murcia S, Granero R, Fernández-Aranda F, Stinchfield R, Tremblay J, Steward T, et al.

Phenotypes in Gambling Disorder Using Sociodemographic and Clinical Clustering Analysis: An Unidentified New Subtype? Front Psychiatry. 2019;10:173. Available from: https://www.frontiersin.org/article/10.3389/fpsyt.2019.00173/full

15. Kong G, Tsai J, Krishnan-Sarin S, Cavallo DA, Hoff RA, Steinberg MA, et al. A latent class analysis of pathological-gambling criteria among high school students: associations with gambling, risk and health/functioning characteristics. J Addict Med. 2014;8(6):421–30. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=01271255-201411000-00006

16. Ledgerwood DM, Petry NM. Subtyping pathological gamblers based on impulsivity, depression, and anxiety. Psychol Addict Behav. 2010;24(4):680–8. Available from: http://doi.apa.org/getdoi.cfm?doi=10.1037/a0019906

17. McBride O, Adamson G, Shevlin M. A latent class analysis of DSM-IV pathological gambling criteria in a nationally representative British sample. Psychiatry Res. 2010;178(2):401–7. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0165178109004260

18. Milosevic A, Ledgerwood DM. The subtyping of pathological gambling: a comprehensive review. Clin Psychol Rev. 2010;30(8):988–98. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0272735810001078

19. Moon M, Lister JJ, Milosevic A, Ledgerwood DM. Subtyping Non-treatment-seeking Problem Gamblers Using the Pathways Model. J Gambl Stud. 2017;33(3):841–53. Available from: http://link.springer.com/10.1007/s10899-016-9658-y

(**)20. Odlaug BL, Marsh PJ, Kim SW, Grant JE. Strategic vs nonstrategic gambling: characteristics of pathological gamblers based on gambling preference. Ann Clin Psychiatry. 2011;23(2):105–12. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21547270

21. Moore SM, Thomas AC, Kyrios M, Bates G, Meredyth D. Gambling accessibility: a scale to measure gambler preferences. J Gambl Stud. 2011;27(1):129–43. Available from: http://link.springer.com/10.1007/s10899-010-9203-3

22. Welte JW, Barnes GM, Tidwell M-CO, Hoffman JH. Legal gambling availability and problem gambling among adolescents and young adults. Int Gambl Stud. 2009;9:89–99.

(*)23. Rigoli F, Rutledge RB, Dayan P, Dolan RJ. The influence of contextual reward statistics on risk preference. Neuroimage. 2016;128:74–84. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1053811915011295

24. Venkatraman V, Payne JW, Bettman JR, Luce MF, Huettel SA. Separate neural mechanisms underlie choices and strategic preferences in risky decision making. Neuron. 2009;62(4):593–602. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0896627309002888

(*)25. Quintero G. A biopsychological review of gambling disorder. Neuropsychiatr Dis Treat. 2016;Volume 13:51–60. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28096672

26. Grant JE, Chamberlain SR, Schreiber LRN, Odlaug BL. Gender-related clinical and neurocognitive differences in individuals seeking treatment for pathological gambling. J Psychiatr

Res. 2012;46(9):1206–11. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0022395612001665

27. Kastirke N, Rumpf H-J, John U, Bischof A, Meyer C. Demographic Risk Factors and Gambling Preference May Not Explain the High Prevalence of Gambling Problems Among the Population with Migration Background: Results from a German Nationwide Survey. J Gambl Stud. 2015;31(3):741–57. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24722950

28. Okuda M, Liu W, Cisewski JA, Segura L, Storr CL, Martins SS. Gambling Disorder and Minority Populations: Prevalence and Risk Factors. Curr Addict Reports. 2016;3(3):280–92. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28824833

29. Assanangkornchai S, McNeil EB, Tantirangsee N, Kittirattanapaiboon P, Thai National Mental Health Survey Team. Gambling disorders, gambling type preferences, and psychiatric comorbidity among the Thai general population: Results of the 2013 National Mental Health Survey. J Behav Addict. 2016;5(3):410–8. Available from: http://www.akademiai.com/doi/abs/10.1556/2006.5.2016.066

30. McCarrey AC, Henry JD, von Hippel W, Weidemann G, Sachdev PS, Wohl MJA, et al. Age differences in neural activity during slot machine gambling: an fMRI study. Sensi SL, editor. PLoS One. 2012;7(11):e49787. Available from: https://dx.plos.org/10.1371/journal.pone.0049787

31. Nower L, Blaszczynski A. Characteristics of problem gamblers 56 years of age or older: A statewide study of casino self-excluders. Psychol Aging. 2008;23(3):577–84. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18808247

32. Potenza MN. Non-substance addictive behaviors in the context of DSM-5. Addict Behav. 2014;39(1):1–2. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460313002633

33. Shin Y-C, Choi S-W, Ha J, Mok JY, Lim S-W, Choi J-S, et al. Age of Pathological Gambling Onset. J Addict Med. 2014;8(3):205–10. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24695020

(*)34. Lorains FK, Dowling NA, Enticott PG, Bradshaw JL, Trueblood JS, Stout JC. Strategic and non-strategic problem gamblers differ on decision-making under risk and ambiguity. Addiction. 2014;109(7):1128–37. Available from: http://doi.wiley.com/10.1111/add.12494

35. Boggio PS, Campanhã C, Valasek CA, Fecteau S, Pascual-Leone A, Fregni F. Modulation of decision-making in a gambling task in older adults with transcranial direct current stimulation. Eur J Neurosci. 2010;31(3):593–7. Available from: http://www.ncbi.nlm.nih.gov/pubmed/20105234

36. Di Rosa E, Mapelli D, Arcara G, Amodio P, Tamburin S, Schiff S. Aging and risky decision-making: New ERP evidence from the Iowa Gambling Task. Neurosci Lett. 2017;640:93–8. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0304394017300319

(*)37. Schiebener J, Brand M. Age-related variance in decisions under ambiguity is explained by changes in reasoning, executive functions, and decision-making under risk. Cogn Emot. 2017;31(4):816–24. Available from: https://www.tandfonline.com/doi/full/10.1080/02699931.2016.1159944

38. Bonnaire C, Kovess-Masfety V, Guignard R, Richard JB, du Roscoät E, Beck F. Gambling Type, Substance Abuse, Health and Psychosocial Correlates of Male and Female Problem Gamblers in a Nationally Representative French Sample. J Gambl Stud. 2017;33(2):343–69. Available from: http://link.springer.com/10.1007/s10899-016-9628-4

(*)39. Khanbhai Y, Smith D, Battersby M. Gender by Preferred Gambling Activity in Treatment Seeking Problem Gamblers: A Comparison of Subgroup Characteristics and Treatment Outcomes. J Gambl Stud. 2017;33(1):99–113. Available from: http://link.springer.com/10.1007/s10899-016-9614-x

40. Potenza MN, Steinberg MA, McLaughlin SD, Wu R, Rounsaville BJ, O'Malley SS. Gender-related differences in the characteristics of problem gamblers using a gambling helpline. Am J Psychiatry. 2001;158(9):1500–5. Available from: http://psychiatryonline.org/doi/abs/10.1176/appi.ajp.158.9.1500

(*)41. Subramaniam M, Abdin E, Vaingankar JA, Shahwan S, Picco L, Chong SA. Strategic Versus Nonstrategic Gambling: Results From a Community Survey. J Addict Med. 2016;10(3):174–81. Available from: http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=01271255-201606000-00007

42. Lightsey OR, Hulsey CD. Impulsivity, coping, stress, and problem gambling among university students. J Couns Psychol. 2002;49:202-211

43. Ledgerwood DM, Petry NM. Psychological experience of gambling and subtypes of pathological gamblers. Psychiatry Res. 2006;144(1):17–27. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16919760

(*)44. Mouneyrac A, Lemercier C, Le Floch V, Challet-Bouju G, Moreau A, Jacques C, et al. Cognitive Characteristics of Strategic and Non-strategic Gamblers. J Gambl Stud. 2018;34(1):199–208. Available from: http://link.springer.com/10.1007/s10899-017-9710-6

45. Ladd GT, Petry NM. Gender differences among pathological gamblers seeking treatment. Exp Cinical Psychopharmacol. 2002;10(3):302–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12233991

46. Tavares H, Zilberman ML, Beites FJ, Gentil V. Gender differences in gambling progression. J Gambl Stud. 2001;17(2):151–9. Available from: http://www.ncbi.nlm.nih.gov/pubmed/11705209

47. Svensson J, Romild U. Problem Gambling Features and Gendered Gambling Domains Amongst Regular Gamblers in a Swedish Population-Based Study. Sex Roles. 2014;70(5–6):240–54. Available from: http://link.springer.com/10.1007/s11199-014-0354-z

48. Ji L-J, McGeorge K, Li Y, Lee A, Zhang Z. Culture and gambling fallacies. Springerplus. 2015;4(1):510. Available from: http://www.springerplus.com/content/4/1/510

49. Raylu N, Oei TP. Role of culture in gambling and problem gambling. Clin Psychol Rev. 2004;23(8):1087–114. Available from: http://www.ncbi.nlm.nih.gov/pubmed/14729424

50. Bonnaire C, Bungener C, Varescon I. Subtypes of French pathological gamblers: comparison of sensation seeking, alexithymia and depression scores. J Gambl Stud. 2009;25(4):455–71.

Available from: http://link.springer.com/10.1007/s10899-009-9142-z

51. Dufour M, Brunelle N, Roy É. Are poker players all the same? Latent class analysis. J Gambl Stud. 2015;31(2):441–54. Available from: http://link.springer.com/10.1007/s10899-013-9429-y

52. Lorains FK, Stout JC, Bradshaw JL, Dowling NA, Enticott PG. Self-reported impulsivity and inhibitory control in problem gamblers. J Clin Exp Neuropsychol. 2014;36(2):144–57. Available from: http://www.ncbi.nlm.nih.gov/pubmed/24479640

(**)53. Navas JF, Billieux J, Perandrés-Gómez A, López-Torrecillas F, Cándido A, Perales JC. Impulsivity traits and gambling cognitions associated with gambling preferences and clinical status. Int Gambl Stud. 2017;17:102-124

54. Breen RB, Zimmerman M. Rapid onset of pathological gambling in machine gamblers. J Gambl Stud. 2002;18(1):31–43. Available from: http://www.ncbi.nlm.nih.gov/pubmed/12050846

55. Ronzitti S, Soldini E, Lutri V, Smith N, Clerici M, Bowden-Jones H. Types of gambling and levels of harm: A UK study to assess severity of presentation in a treatment-seeking population. J Behav Addict. 2016;5(3):439–47. Available from: http://www.akademiai.com/doi/abs/10.1556/2006.5.2016.068

(*)56. Rodda SN, Bagot KL, Manning V, Lubman DI. "It was terrible. I didn't set a limit": Proximal and Distal Prevention Strategies for Reducing the Risk of a Bust in Gambling Venues. J Gambl Stud. 2019;in press. Available from: http://link.springer.com/10.1007/s10899-019-09829-0

57. LaPlante DA, Nelson SE, LaBrie RA, Shaffer HJ. Disordered gambling, type of gambling and gambling involvement in the British Gambling Prevalence Survey 2007. Eur J Public Health. 2011;21(4):532–7. Available from: https://academic.oup.com/eurpub/article-lookup/doi/10.1093/eurpub/ckp177

58. Karlsson A, Håkansson A. Gambling disorder, increased mortality, suicidality, and associated comorbidity: A longitudinal nationwide register study. J Behav Addict. 2018;7(4):1091–9. Available from: https://www.akademiai.com/doi/10.1556/2006.7.2018.112

59. Kim HS, von Ranson KM, Hodgins DC, McGrath DS, Tavares H. Demographic, psychiatric, and personality correlates of adults seeking treatment for disordered gambling with a comorbid binge/purge type eating disorder. Eur Eat Disord Rev. 2018;26(5):508–18. Available from: http://doi.wiley.com/10.1002/erv.2606

60. Nicholson R, Mackenzie C, Afifi TO, Keough M, Sareen J. An Examination of Comorbid Psychiatric Disorders in Disordered Gamblers Versus Other Substance-Related Disorders. J Gambl Stud. 2019;in press. Available from: http://link.springer.com/10.1007/s10899-019-09839-y

61. Bonnaire C, Barrault S, Aïte A, Cassotti M, Moutier S, Varescon I. Relationship between pathological gambling, alexithymia, and gambling type. Am J Addict. 2017;26(2):152–60. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28211964

62. Suomi A, Dowling NA, Jackson AC. Problem gambling subtypes based on psychological distress, alcohol abuse and impulsivity. Addict Behav. 2014;39(12):1741–5. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460314002548

63. Desai RA, Potenza MN. Gender differences in the associations between past-year gambling problems and psychiatric disorders. Soc Psychiatry Psychiatr Epidemiol. 2008;43(3):173–83. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18080792

64. Granero R, Penelo E, Martínez-Giménez R, Álvarez-Moya E, Gómez-Peña M, Aymamí MN, et al. Sex differences among treatment-seeking adult pathologic gamblers. Compr Psychiatry. 2009;50(2):173–80. Available from: http://www.ncbi.nlm.nih.gov/pubmed/19216895

65. Valero-Solís S, Granero R, Fernández-Aranda F, Steward T, Mestre-Bach G, Mallorquí-Bagué N, et al. The Contribution of Sex, Personality Traits, Age of Onset and Disorder Duration to Behavioral Addictions. Front Psychiatry. 2018;9:497. Available from: https://www.frontiersin.org/article/10.3389/fpsyt.2018.00497/full

66. Gainsbury SM, Russell A, Blaszczynski A, Hing N. The interaction between gambling activities and modes of access: a comparison of Internet-only, land-based only, and mixed-mode gamblers. Addict Behav. 2015;41:34–40. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460314003141

67. Gainsbury S, Wood R, Russell A, Hing N, Blaszczynski A. A digital revolution: Comparison of demographic profiles, attitudes and gambling behavior of Internet and non-Internet gamblers. Comput Human Behav. 2012;28:1388-1398

68. Mallorquí-Bagué N, Fernández-Aranda F, Lozano-Madrid M, Granero R, Mestre-Bach G, Baño M, et al. Internet gaming disorder and online gambling disorder: Clinical and personality correlates. J Behav Addict. 2017;6(4):669–77. Available from: http://www.akademiai.com/doi/10.1556/2006.6.2017.078

69. Wood RT, Williams RJ. A comparative profile of the internet gambler: Demographic characteristics, game-play patterns, and problem gambling status. New Media Soc. 2011;13: 1123–1141

(*)70. David D, Cristea I, Hofmann SG. Why Cognitive Behavioral Therapy Is the Current Gold Standard of Psychotherapy. Front Psychiatry. 2018;9:4. Available from: http://www.ncbi.nlm.nih.gov/pubmed/29434552

71. Cowlishaw S, Merkouris S, Dowling N, Anderson C, Jackson A, Thomas S. Psychological therapies for pathological and problem gambling. Cochrane Database Syst Rev. 2012;11:CD008937. Available from: http://www.ncbi.nlm.nih.gov/pubmed/23152266

(*)72. Dowling NA, Merkouris SS, Lorains FK. Interventions for comorbid problem gambling and psychiatric disorders: Advancing a developing field of research. Addict Behav. 2016;58:21–30. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0306460316300375

(*)73. Petry NM, Ginley MK, Rash CJ. A systematic review of treatments for problem gambling. Psychol Addict Behav. 2017;31(8):951–61. Available from: http://www.ncbi.nlm.nih.gov/pubmed/28639817

(**)74. Merkouris SS, Thomas SA, Browning CJ, Dowling NA. Predictors of outcomes of psychological treatments for disordered gambling: A systematic review. Clin Psychol Rev. 2016;48:7–31.

Available from: https://linkinghub.elsevier.com/retrieve/pii/S0272735815301513

75. Mallorquí-Bagué N, Vintró-Alcaraz N, Verdejo-García A, Granero R, Fernández-Aranda F, Magaña P, Mena-Moreno T, Aymamí N, Gómez-Peña M, del Pino-Gutiérrez A, Mestre-Bach G, Menchón JM, Jiménez-Murcia S. Impulsivity and cognitive distortions in different clinical phenotypes of gambling disorder: profiles and longitudinal prediction of treatment outocomes. European Psychiatry, 2019; 61:9-16. Available from: https://www.ncbi.nlm.nih.gov/pubmed/31255958

Figure 1

Correlates of the preferred forms of gambling