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Recreational gamblers with and without parental addiction

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Abstract

Research has found that children who have parents with an addiction may be more vulnerable to developing psychopathology compared to children without parental addiction. We compared young adult, recreational gamblers with and without parental addiction on measures of gambling behavior and impulsivity. A total of 286 recreational gamblers (defined as having gambled at least five times in the past 12 months) between the ages of 18 and 29 participated in an initial intake of a longitudinal study assessing susceptibility to pathological gambling. Trained staff interviewed subjects and subjects completed cognitive testing and self-report measures. Fifty-three subjects (18.53%) reported at least one parent with an addiction (including alcohol and substance dependence and pathological gambling). Subjects with at least one addicted parent were significantly more likely to report problems resulting from gambling, have significantly greater rates of psychiatric comorbidity, and report significantly more current marijuana and tobacco use. Subjects with an addicted parent were not significantly different on measures of impulsivity. These findings suggest that even at a stage of low-risk gambling, before what has been considered a psychopathology arises, those with a possible environmental and/or genetic risk of addiction exhibit a range of problematic behaviors.

Keywords

Pathological Gambling; Psychopathology; Addiction; Family History; Young Adults

1. Introduction

Addictive disorders (a term used to encompass both substance use disorders and behavioral addictions such as pathological gambling) are common and complex illnesses involving behaviors with enormous social and health consequences. Family, adoption, and twin studies suggest that addictive disorders are among the most heritable psychiatric disorders (Goldman et al., 2005). Addictive disorders are also under strong environmental influences, such as being exposed to the drug or behavior in question, and usually begin in adolescence, indicating that the environment during childhood and adolescence may be of importance. Severe childhood stressors, such as family separation, divorce, child abuse, and death in the family, have been associated with an increased risk for addictive disorders (Kessler et al.,

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1997; Kendler et al., 2003). As such, addictive disorders likely reflect a complex interaction between individual vulnerabilities, genes, and environment (Schuckit et al., 1996; Kendler et al., 2003; Agrawal and Lynskey, 2008).

Studies have demonstrated the familial aggregation of addictive disorders (Kendler et al., 1997; Merikangas et al., 1998). Children of addicts are at a high risk for developing emotional and behavioral problems (Hill & Shen, 2002; Keller et al., 2008; Marmorstein, Iacono, & McGue, 2009). Marmorstein and colleagues (2009) found that those with parental substance use disorders were significantly more likely to have conduct disorder, adult antisocial behavior, and nicotine, alcohol, and drug dependence. Children of alcoholics also have significantly higher rates of alcoholism and drug abuse than offspring of healthy controls (Jacob et al., 1999).

Family history and genetic studies have demonstrated a link between addictive disorders, such as pathological gambling and substance use disorders (Slutske et al., 2000; Eisen et al., 2001; Black et al., 2006; Lobo and Kennedy, 2009). Arguably the same general brain structures and cellular pathways are involved in both substance use disorders and behavioral addictions (e.g., the role of the dopaminergic mesolimbic and mesocortical systems in reward and reinforcement) (Grant et al., 2006). A study of 844 high school students found that those with at least one parent with pathological gambling were at a higher risk of dysfunctional adjustment and substance addiction (Jacobs et al 1989).

Previous studies have not examined the possible familial link between addictive disorders and recreational gambling (i.e., a potentially addictive behavior that has not risen to the level of psychopathology). Although family history studies cannot separate genetics from environmental components, they provide important information about possible genetic links that can then be furthered examined using twin studies. Studies of twins have found that genetics plays a role in gambling symptomatology (Eisen et al., 2001) and between 49% to 66% of the variance in pathological gambling is due to genetics (Potenza et al., 2005; Xian et al., 2007). The family history study presented here has utility for several reasons. First, the sample is comprised of recreational gamblers (defined as individuals meeting fewer than 3 DSM-IV criteria for Pathological Gambling), excluding subjects who meet criteria for problem or pathological gambling. This allows for an understanding of familial links in those who have not yet developed a psychopathology and could offer a greater understanding of early intervention and prevention. Second, previous family studies have typically focused on rates of pathology in the family, whereas this study examines the construct of impulsivity, allowing for the investigation of the familiarity of addictive disorders on a cognitive phenotypic level. We sought to identify differences between those reporting having at least one parent with an addictive disorder and those reporting no parental addictive disorder. We hypothesized that subjects who report having at least one parent with an addictive disorder would score higher on measures of impulsivity, have more psychiatric problems, and report greater gambling severity.

2. Methods

Men and women between the age of 18 and 29 who gambled (defined as any type of betting with real money) at least 5 times in the past 12-months were recruited through poster advertisements within the community, mass mailings, and online classified advertisements. Those meeting criteria for problem or pathological gambling (defined as meeting 3 or more of the DSM-IV criteria for Pathological Gambling) as well as those unable to understand the study or informed consent were excluded from this analysis. Subjects were recruited from October 2009 to October 2010. Trained research staff asked all subjects about demographics, gambling behaviors and thoughts, family history (see below for further

details on family history), and medical and psychiatric history. After being interviewed by research staff, cognitive testing was administered (see below for further description and ordering of cognitive testing) by research staff in a room with limited cognitive stimulation. Subjects subsequently completed self-report questionnaires measuring personality, impulsivity, gambling behavior, self-esteem, and emotional regulation.

The institutional review board for the University of Minnesota approved the study and the informed consent. After complete description of the study, subjects provided written informed consent. This study was carried out in accordance with the Declaration of Helsinki.

2.1 Psychiatric Evaluation

2.1.1. Mini International Neurological Interview (MINI) (Sheehan et al., 1997)—

The MINI is a well-validated, clinician-administered, diagnostic interview evaluating past and current psychiatric diagnoses.

2.1.2. Structured Clinical Interview for Pathological Gambling (SCI-PG) (Grant et al., 2004)—

This clinician-administered scale based on the DSM-IV includes 10 diagnostic items about pathological gambling. Endorsement of 3 or more criteria indicates the presence of problem gambling (3 or 4 criteria) or pathological gambling (5 or more criteria).

2.2. Parental Addiction Assessment

Trained research staff asked study participants if either their mother or father had a diagnosis of alcohol and/or substance dependence/abuse, or pathological gambling. If subjects were uncertain, the subjects were further asked if either parent had received treatment or psychotherapy, gone to support group meetings, or taken medication for alcohol and/or substance dependence or pathological gambling. If subjects answered yes to any of the previous questions, the parent would be classified as having an addictive disorder. Parents were not contacted to confirm or deny the accuracy of this report. This assessment was used to reflect the real-world experience of subjects and has clinical utility in that clinicians typically rely on the young adults' reports for family history information.

2.3 Cognitive Assessments

Subjects completed cognitive paradigms from the Cambridge Neuropsychological Test Automated Battery (CANTABeclipse, version 3, Cambridge Cognition Ltd, UK) quantifying aspects of decision-making, motor impulse control and cognitive flexibility. Subjects completed the cognitive battery in the following order:

2.3.1. Stop Signal Task (SST)—The SST measures an individual's ability to stop a prepotent response (Logan et al., 1984; Aron et al., 2004). In this task, subjects are given a press pad with two buttons and press the right hand button and the left hand button when then they see a right encircled arrow and a left encircled arrow, respectively. After completing 16 trials of this, subjects are told to continue pressing the buttons, but to refrain from pressing the buttons if they hear a beep.

2.3.2. Intra-Extra Dimensional Set Shift Task (IED)—This task was derived from the Wisconsin Card Sorting Task (Lezak et al., 2004). In this task, subjects view a series of on-screen stimuli, which are presented two at a time. Subjects can learn an underlying rule about which stimuli is 'correct.' On-screen feedback (either the word 'correct' or 'incorrect') is presented after a stimuli is selected. After the subject has selected six consecutive 'correct' choices, the underlying rule is changed by the computer and the subject must demonstrate learning and flexibility to ascertain the new rule and correctly

respond. In this task, there are a total of nine stages. The total number of errors made throughout the task (corrected for stages not attempted) is the primary outcome measure. When the 'total errors' significantly differs between groups, other measures explored include: total number of errors at the intra-dimensional (ID) shift stage, total errors at the extra-dimensional (ED) shift stage, and total reversal stage errors. While the ID shifting involves attending to the previously correct stimulus dimension, the ED shifting requires cognitive flexibility, in which attention needs to be shifted away from the previously correct stimulus dimension to the previously incorrect stimulus dimension.

2.3.3. Cambridge Gambling Task (CGT)—The CGT, which has been previously validated in a variety of clinical settings, including brain lesions (Manes et al., 2002; Clark et al., 2008) and pathological gambling (Lawrence et al., 2009), assesses decision-making and risk-taking behavior. On each trial, ten boxes are presented to the subject at the top of the screen. Some of these boxes are blue, others are red. Underneath one of the boxes, a yellow token is hidden. The subject selects a rectangle with the word red or blue on the bottom of the screen to indicate underneath which color box he or she thinks the yellow token is hidden. During the gambling portion of this task, the subjects continue the previously described task, but now, they select a point amount (presented in first in increasing order and then in decreasing order) to bet on the correctness of their choice. Subjects start with 100 points to bet. Subjects are told to accumulate as many points as possible.

2.4 Gambling Assessments

2.4.1. Yale-Brown Obsessive Compulsive Scale modified for Pathological Gambling (PG-YBOCS) (Pallanti et al., 2005)—This 10-item, clinician-administered scale includes items about thoughts/urges and behaviors relating to gambling in the past week.

2.4.2—A semi-structured interview was used to collect information about frequency of gambling, time spent gambling, and money lost. Subjects were asked about any problems they recognized as being due to their gambling behavior and whether friends or family had raised concerns about their gambling.

2.5 Impulsivity and Personality Questionnaires

2.5.1. Barratt Impulsivity Scale, Version 11 (BIS-11) (Barratt, 1959; Patton et al., 1995)—This valid, reliable, 30-item, self-report measure assesses general impulsivity. Subscales of the BIS-11 include attentional impulsivity (inability to concentrate attention), motor impulsivity (acting without thinking), and nonplanning impulsivity (being in the present moment, lack of future thinking).

2.5.2. Eysenck Impulsivity Questionnaire (EIQ) (Eysenck & Eysenck, 1978)—This valid, reliable, 54-item, self-report measure assesses 3 facets of impulsivity, including impulsivity (failure to evaluate risk), venturesomeness (consciousness and acceptance of risk), and empathy (added for variety in scale). Higher scores indicate higher levels of impulsivity.

2.5.3. Tridimensional Personality Inventory (TPQ) (Cloninger, 1987)—This valid, reliable, self-report, 100-item scale assesses different dimensions of personality. This multi-faceted measurement includes subscales of novelty-seeking (higher scores indicate a tendency to experience intense excitement in response to novel stimuli), harm avoidance (higher scores indicate a tendency to react strongly towards aversive stimuli), and reward dependence (higher scores indicate a tendency to have an intense response towards rewards).

Each subscale has four dimensions. Impulsivity is included as one of the dimensions of novelty seeking. Higher scores indicate higher levels of each subscale.

2.5. Statistical Analysis

The percentages of recreational gamblers (defined as meeting 2 or fewer criteria on the SCI-PG) reporting parents with an addictive disorder and those reporting no parental addictive disorder were determined. Subjects in these two groups were then analyzed using Pearson χ^2 and a MANOVA (to account for multiple comparisons) for differences in demographic and clinical variables, as well as clinician and self-report scales. A Poisson regression was run on the number of SCI-PG criteria met, which was represented by counts. The distribution of such data resembles a Poisson distribution in which the majority of individuals have responses of zero. All comparisons were two-tailed, and an α level of 0.05 was used to determine statistical significance.

Follow-up analysis included running a logistic regression on problems resulting from gambling using age, past year marijuana use and smoking, and presence of a psychiatric disorder as covariates. Parental addiction was entered in the analyses as a main group effect.

3. Results

A total of 286 recreational gamblers (mean age = 21.33 ± 3.32 ; 30.5% female; 66.1% with some college education; 85.4% Caucasian) were enrolled. Fifty-three subjects (18.5%) reported at least one parent with an addictive disorder (defined as a substance use disorder or pathological gambling). Of those reporting a parental addictive disorder, 39 (73.6%) had a parent with alcohol use disorder, 12 (22.6%) had a parent with a drug use disorder, 9 (17.0%) had a parent with pathological gambling, and 6 (11.3%) reported having at least one parent with more than one addictive disorder. Five (9.4%) reported having a parent with alcohol and drug use disorders, 1 (1.8%) reported alcohol use disorder and pathological gambling, and 1 (1.8%) reported drug use disorder and pathological gambling.

Subjects reported mean age of starting to gamble at $14.68 (\pm 3.68)$ years old and currently, gamble on average of $1.20 (\pm 1.36)$ times per week. The entire sample spent a mean of $132.95 (\pm 115.50)$ minutes and $\$52.61 (\pm \$102.76)$ each time they gambled. Subjects with an addicted parent were more likely to have problems with gambling (see Table 1). Significantly more subjects with an addicted parent met criteria for a lifetime comorbid psychiatry disorder than without a parental addictive disorder (see Table 1) and more specifically, significantly more met criteria for a lifetime major depressive episode and had a lifetime anxiety disorder compared to those without an addicted parent (major depressive episode: 40.7% vs. 20.4%, respectively, F -statistic = 9.558; $p=0.002$; anxiety disorder: 14.8% vs. 6.7%, respectively, F -statistic=3.904; $df=1$; $p=0.048$). Similar rates of psychotic, eating, and antisocial personality disorders were found each group. In addition, a significantly greater number of those with an addicted parent reported marijuana and tobacco use compared to those without parental addiction (see Table 1), however no between group differences were found on alcohol use, or alcohol and drug use disorders.

In terms of impulsivity, a parental addictive disorder was not associated with greater impulsivity scores on self-report measures or computerized cognitive tasks. However, we did find that delay aversion on the Cambridge Gambling Task showed a trend toward significance (F -statistic = 2.89; $df=1$; $p=0.090$; see Table 2).

In the initial analysis, we found that those in the parental addiction group reported more problems secondary to gambling (see Table 1). In follow-up analysis we used age, psychiatric comorbidity, past year smoking and marijuana use as covariates in a logistic

regression to assess differences in problems resulting from gambling between groups, and found that the groups still significantly differed (Wald Chi-squared statistic=3.83; $df=1$; $p=0.050$).

4. Discussion

In this study, we compared the characteristics of recreational gamblers reporting at least one parent with an addictive disorder to those reporting no parental addictive disorders, hypothesizing that greater gambling severity and impulsivity would be found in those reporting parental addictive disorders. Overall, compared to those without parental addictive disorder, we found that recreational gamblers reporting parental addiction do not report more severe gambling symptoms and are not more impulsive on self-report or cognitive measures. However, in partial support of our hypothesis, we found that young adults reporting parental addictive disorders reported more problems secondary to gambling (such as financial and social problems), despite spending similar amounts of time and money on gambling. King and colleagues (2010) reported similar results in a sample of 581 college students, finding that parental gambling problems predicted student gambling problems. Schreiber et al. (2009) found that pathological gamblers with at least one problem gambling parent have significantly more financial and relational problems due to gambling. Other measures of gambling severity, however, did not differ between groups (for example, time spent and money lost gambling and SCI-PG and PG-YBOCS scores). One explanation for this disparity in findings could be that differences in recreational gamblers may not be adequately captured by items generally used to measure problem or pathological gamblers. Past research has found that in offspring who view themselves as similar to their parent, perceptions of parental drinking was positively correlated with the offsprings' drinking behavior (Fromme & Ruela, 1994), suggesting the possibility that the subjects' perception of parental addictive behaviors and similarity with the parent may impact how they perceive problems resulting from similar behaviors and perhaps, they may also view these problems more intensely than those without parents with addictive disorders.

Strong evidence exists that impulsivity is a robust and reliable predictor of addictive problems (Verdejo-Garcia et al., 2008). A review of several studies suggested that offspring of parents with addictive behaviors score higher on various impulsivity measures prior to exposure to addictive substances (Verdejo-Garcia et al., 2008). Other research, however, has failed to demonstrate a link between impulsivity in children and alcohol use in parents (Schuckit et al., 1990). Overall, in the present study, standard self-report measures of impulsivity (Eysenck, BIS, the novelty seeking subscale of the TPQ) do not, however, support the link between impulsivity and parental addictive behaviors.

Past research has linked pathological gambling with cognitive deficits across various domains (van Holst et al., 2010), but has produced inconclusive results concerning family history's impact on cognitive impulsivity. Some studies found little or no significant differences in impulsivity measures of receiving immediate and delayed hypothetical monetary rewards (Petry et al., 2002; Herting et al., 2010), while other studies observed increased impulsivity in those with positive family addiction histories (Reynolds, 2006; de Wit, 2009). We found no significant cognitive differences between groups, but found a trend towards a greater delay aversion (in which a smaller immediate reward is chosen over a larger delayed reward) in those with a parent with an addiction, suggesting possible deficiencies in executive functioning and increased impulsivity in this group.

Even though recreational gamblers with parental addictive disorders did not self-report or cognitively display greater impulsivity, they reported greater use of both marijuana and nicotine, two behaviors that may reflect impulsivity. These findings may suggest greater

risk-taking and greater impulsivity among those subjects. One interpretation might be that the positive family history of addictive disorders results in greater impulsivity in offspring in the form of impulsive reckless behaviors such as using substances. This form of impulsivity may not be a cognitive impulsivity domain that is adequately covered by the measures used in this study. Another possibility is that the use of marijuana and nicotine may be more likely due to modeling behaviors by offspring of their parents and that it is not necessarily a result of greater cognitive impulsivity. In a sample of 422 adult adoptees of alcoholic and nonalcoholic adoptive parents, Newlin et al. (2000) found that being reared by an alcoholic adoptive mother increased the risk of alcohol abuse and being reared by an alcoholic adoptive father increased the risk of illicit drug use and drug dependence in the adoptee, suggesting the role of the environment in the development of addictive behavior.

Consistent with past research (Mathew et al., 1993; Johnson & Leff, 1999), we found that those reporting parental addictive disorders met significantly more lifetime psychiatric diagnoses. Mathew and colleagues (1993) found that adult children of alcoholics have significantly higher current (6-month) prevalence rates of psychiatric disorders, including alcohol and drug abuse. Similarly, children of substance abusers report higher rates of psychiatric disorders and drug use (Johnson and Leff, 1999). Previous research has also found a significant association between a positive family history and increased severity of depression, anxiety disorders, alcoholism, and substance dependence (Milne et al., 2009), which is consistent with our finding of significantly higher rates of a lifetime major depressive disorder and anxiety disorder in the parental addictive disorder group. This suggests that parental addiction may be a familial risk factor in the development of psychopathology.

It is possible that our results may underestimate the difference between the two groups because the more severe gamblers (who would most likely to have disproportionately been included in the parental addictive disorder group) were excluded from this analysis. It is possible that including the problem and pathological gamblers in the sample may have resulted in greater differences between the two groups. Another explanation for why few significant differences emerged for impulsivity measures could be that our sample consisted mainly of young adult males of similar age. Past research has established that both males and older adolescents have high levels of impulsivity (Chambers, Taylor, & Potenza, 2003; Romer & Hennessy, 2007) and that risk-taking behavior decreases as individuals age (Deakin et al., 2004). In this study, both the parental addiction and nonaddiction groups scored higher on all subscales of novelty seeking on the TPQ when compared to United States normative data ($n=326$ white males; mean age of 43.6 ± 16.4 years old) (Cloninger, Przybeck, & Svrakic, 1990). Therefore, it is possible that our sample exhibits such high novel seeking, that differences between groups on cognitive impulsivity could not be detected and perhaps differences in impulsivity would have emerged in sample of recreational gamblers with a larger age range and gender balanced.

4.1 Limitations and Future Directions

Several limitations exist in this study. First, parental addictive disorders were reported by participants without a direct interview of the parent. Mixed results have been found in regards to the accuracy of family history reports of psychopathology by first-degree relatives (Cotton, 1979). Reports of parental alcoholism by offspring have been found to be moderately accurate (O'Malley, Carey, & Maisto, 1986; Smith et al., 1994; Slutske et al., 1996) but may underestimate the real percentage of family members with psychopathology (Cotton, 1979; Thompson et al., 1982; O'Malley, Carey, & Maisto, 1986). Future studies should use more rigorous methods of collecting family history, such as the Family History-Research Diagnostic Criteria (Andreasen, Endicott, Spitzer, Winokur, 1977). Second, this sample is mainly Caucasian and male, and therefore may not generalize to the overall

population of young adults with a parent with an addictive disorder. Furthermore, there are more recreational gamblers without parental addictive disorders compared to those with addictive disorders. Future studies may want to have a matched control sample to compare individuals reporting parental addictive disorders to further investigate the differences between each group.

These data reflect baseline findings of a longitudinal study assessing risk factors for the development of pathological gambling. Future analysis will assess which factors, including environmental, cognitive, and genetic variables, correlate with the development of pathological gambling. Results of this study need to be confirmed by additional longitudinal studies in which first-degree relatives are clinically evaluated, providing a greater knowledge about the etiology of impulsivity. It would also be interesting to assess the clinical and cognitive differences between recreational gamblers and pathological gamblers after following each group for several years. This could inform clinicians about behaviors and thinking patterns that may lead to an addiction and may be helpful in developing a targeted intervention for these individuals displaying these high-risk cognitions and behaviors to prevent the further progression of addictive behaviors and cognitive processes.

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References

- Agrawal A, Lynskey MT. Are there genetic influences on addiction: evidence from family, adoption, and twin studies. *Addiction*. 2008; 103(7):1069–1081. [PubMed: 18494843]
- Andreasen NC, Endicott J, Spitzer RL, Winokur G. The family history method using diagnostic criteria: reliability and validity. *Archives of General Psychiatry*. 1977; 34(10):1229–1235. [PubMed: 911222]
- Aron AR, Robbins TW, Poldrack RA. Inhibition and the right inferior frontal cortex. *Trends in Cognitive Science*. 2004; 8:170–177.
- Barratt ES. Anxiety and impulsiveness related to psychomotor efficiency. *Perceptual and Motor Skills*. 1959; 9:191–198.
- Black DW, Monahan PO, Temkit M, Shaw M. A family study of pathological gambling. *Psychiatry Research*. 2006; 141(3):295–303. [PubMed: 16499975]
- Cambridge Cognition Limited: CANTABeclipse, version 3. Cambridge, United Kingdom: Cambridge Cognition Limited; 2006.
- Chambers RA, Taylor JR, Potenza MN. Developmental neurocircuitry of motivation in adolescence: a critical period of addiction vulnerability. *American Journal of Psychiatry*. 2003; 160:1041–1052. [PubMed: 12777258]
- Clark L, Bechara A, Damasio H, Aitken MR, Sahakian BJ, Robbins TW. Differential effects of insular and ventromedial prefrontal cortex lesions on risky decision-making. *Brain*. 2008; 131:1311–1322. [PubMed: 18390562]
- Cloninger, CR. The tridimensional personality questionnaire, version IV. St. Louis MO: Department of Psychiatry, Washington University School of Medicine; 1987.
- Cloninger CR, Przybeck TR, Svrakic DM. The tridimensional personality questionnaire: US normative data. *Psychological Reports*. 1991; 69:1047–1057. [PubMed: 1784653]
- Cotton NS. The familial incidence of alcoholism: a review. *Journal of Studies on Alcohol*. 1979; 40(10):89–116. [PubMed: 376949]

- Deakin J, Aitken M, Robbins T, Sahakian BJ. Risk taking during decision-making in normal volunteers changes with age. *The Journal of International Neuropsychological Society*. 2004; 10(4):590–598.
- deWit H. Impulsivity as a determinant and consequence of drug use: a review of underlying processes. *Addiction Biology*. 2009; 14(1):22–31. [PubMed: 18855805]
- Eisen SA, Slutske WS, Lyons MJ, Lassman J, Xian H, Toomey R, Chantarujikapong S, Tsuang MT. The genetics of pathological gambling. *Seminars in Clinical Psychiatry*. 2001; 6(3):195–204.
- Eysenck SB, Eysenck HJ. Impulsiveness and venturesomeness: their position in a dimensional system of personality description. *Psychological Reports*. 1978; 43(3 Pt 2):1247–1255. [PubMed: 746091]
- Fromme K, Ruela A. Mediators and moderators of young adults' drinking. *Addiction*. 1994; 89:63–71. [PubMed: 8148746]
- Goldman D, Oroszi G, Ducci F. The genetics of addictions: uncovering the genes. *Nature Reviews Genetics*. 2005; 6(7):521–532.
- Grant JE, Brewer JA, Potenza MN. The neurobiology of substance and behavioral addictions. *CNS Spectrums*. 2006; 11(12):924–930. [PubMed: 17146406]
- Grant JE, Steinberg MA, Kim SW, Rounsaville BJ, Potenza MN. Preliminary validity and reliability testing of a structured clinical interview for pathological gambling. *Psychiatry Research*. 2004; 128(1):79–88. [PubMed: 15450917]
- Jacob T, Windle M, Seilhamer RA, Bost J. Adult children of alcoholics: drinking, psychiatric, and psychosocial status. *Psychology of Addictive Behaviors*. 1999; 13(1):3–21.
- Johnson JL, Leff M. Children of substance abusers: overview of research findings. *Pediatrics*. 1999; 103(Supplement 5):1085–1099. [PubMed: 10224196]
- Herting MM, Schwartz D, Mitchell SH, Nagel BJ. Delay discounting and white matter microstructure abnormalities in youth with a family history of alcoholism. *Alcoholism: Clinical and Experimental Research*. 2010; 34(9):1590–1602.
- Hill SY, Shen S. Neurodevelopmental patterns of visual P3b in association with familial risk for alcohol dependence and childhood diagnosis. *Biological Psychiatry*. 2002; 51(8):621–631. [PubMed: 11955462]
- Keller PS, Cummings EM, Davies PT, Mitchell PM. Longitudinal relations between parental drinking problems, family functioning, and child adjustment. *Development and Psychopathology*. 2008; 20:195–212. [PubMed: 18211734]
- Kendler KS, Davis CG, Kessler RC. The familial aggregation of common psychiatric and substance use disorders in the National Comorbidity Survey: a family history study. *The British Journal of Psychiatry*. 1997; 170:541–548. [PubMed: 9330021]
- Kendler KS, Prescott CA, Myers J, Neale MC. The structure of genetic and environmental risk factors for common psychiatric and substance use disorders in men and women. *Archives of General Psychiatry*. 2003; 60(9):929–937. [PubMed: 12963675]
- Kessler RC, Berglund PA, Foster CL, Saunders WB, Stang PE, Walters EE. Social consequences of psychiatric disorder, II: teenage parenthood. *American Journal of Psychiatry*. 1997; 154(10):1405–1411. [PubMed: 9326823]
- King SM, Abrams K, Wilkinson T. Personality, gender, and family history in the prediction of college gambling. *Journal of Gambling Studies*. 2010; 26(3):347–359. [PubMed: 20052607]
- Lawrence AJ, Luty J, Bogdan NA, Sahakian BJ, Clark L. Problem gamblers share deficits in impulsive decision-making with alcohol-dependent individuals. *Addiction*. 2009; 104:1006–1015. [PubMed: 19466924]
- Lezak, MD.; Howieson, DB.; Loring, DW.; Hannay, HJ.; Fischer, JS. *Neuropsychological Assessment*. New York: Oxford University Press; 2004.
- Lobo DS, Kennedy JL. Genetic aspects of pathological gambling: a complex disorder with shared genetic vulnerabilities. *Addiction*. 2009; 104(9):1454–1465. [PubMed: 19686516]
- Logan GD, Cowan WB, Davis KA. On the ability to inhibit simple and choice reaction time responses: a model and a method. *Journal of Experimental Psychology: Human Perception and Performance*. 1984; 10:276–291. [PubMed: 6232345]

- Manes F, Sahakian B, Clark L, Rogers R, Antoun N, Aitken M, Robbins T. Decision-making processes following damage to the prefrontal cortex. *Brain*. 2002; 125:624–639. [PubMed: 11872618]
- Marmorstein NR, Iacono WG, McGue M. Alcohol and illicit drug dependence among patients: associations with offspring externalizing disorders. *Psychological Medicine: A Journal of Research in Psychiatry and the Allied Sciences*. 2009; 39(1):149–155.
- Mathew RJ, Wilson WH, Blazer DG, George LK. Psychiatric disorders in adult children of alcoholics: data from the epidemiologic catchment area project. *The American Journal of Psychiatry*. 1993; 150:793–800. [PubMed: 8480827]
- Merikangas KR, Stolar M, Stevens DE, Goulet J, Preisig MA, Renton B, Zhang H, O'Malley SS, Roundsaville BJ. Familial transmission of substance use disorders. *Archives of General Psychiatry*. 1998; 55(11):973–979. [PubMed: 9819065]
- Milne BJ, Caspi A, Harrington H, Poulton R, Rutter M, Moffitt TE. Predictive value of family history on severity of illness: the case for depression, anxiety, alcohol dependence, and drug dependence. *Archives of General Psychiatry*. 2009; 66(7):738–747. [PubMed: 19581565]
- Newlin DB, Miles DR, van den Bree MBM, Gupman AE, Pickens RW. Environmental transmission of DSM-IV substance use disorders in adoptive and step families. *Alcoholism: Clinical and Experimental Research*. 2000; 24(12):1785–1794.
- O'Malley SS, Carey KB, Maisto SA. Validity of young adults' reports of parental drinking practices. *Journal of Studies on Alcohol*. 1986; 47(5):433–435. [PubMed: 3762165]
- Pallanti S, DeCaria CM, Grant JE, Urpe M, Hollander E. Reliability and validity of the pathological gambling adaption of the Yale-Brown Obsessive-Compulsive Scale (PG-YBOCS). *Journal of Gambling Studies*. 2005; 21(4):431–443. [PubMed: 16311876]
- Patton JH, Stanford MS, Barratt ES. Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*. 1995; 51:768–774. [PubMed: 8778124]
- Petry NM, Kirby KN, Kranzler HR. Effects of gender and family history of alcohol dependence on a behavioral task of impulsivity in healthy subjects. *Journal of Studies on Alcohol*. 2002; 63(1):83–90. [PubMed: 11925063]
- Potenza MN, Xian H, Shah K, Scherrer JF, Eisen SA. Shared genetic contributions to pathological gambling and major depression in men. *Archives of General Psychiatry*. 2005; 62(9):1015–1021. [PubMed: 16143733]
- Romer D, Hennessy M. A biosocial-affect model of adolescent sensation seeking: the role of affect evaluation and peer-group influence in adolescent drug use. *Prevention Science*. 2007; 8:89–101. [PubMed: 17286212]
- Schreiber LRN, Odlaug BL, Kim SW, Grant JE. Characteristics of pathological gamblers with a problem gambling parent. *The American Journal on Addiction*. 2009; 18:462–469.
- Schlutske WS, Heath AC, Madden PAF, Bucholz KK, Dinwiddie SH, Dunne MP, Statham DJ, Martin NG. Reliability and reporting biases for perceived parental history of alcohol-related problems: agreement between twins and differences between discordant pairs. *Journal of Studies on Alcohol*. 1997; 57(4):387–395.
- Schuckit MA, Irwin M, Mahler HIM. Tridimensional personality questionnaire scores of sons of alcoholic and nonalcoholic fathers. *American Journal of Psychiatry*. 1990; 147:481–487. [PubMed: 2316736]
- Schuckit MA, Tsuang JW, Anthenelli RM, Tipp JE, Nurnberger JI. Alcohol challenges in young men from alcoholic pedigrees and control families: a report from the COGA Project. *Journal of Studies on Alcohol*. 1996; 57(4):368–377. [PubMed: 8776678]
- Sheehan DV, Lecrubier Y, Sheehan KH, Janavs J, Weiller E, Keskiner A, Schinka J, Knapp E, Sheehan MF, Dunbar GC. The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability. *European Psychiatry*. 1997; 12:232–241.
- Slutske WS, Eisen S, True WR, Lyons MJ, Goldberg J, Tsuang M. Common genetic vulnerability for pathological gambling and alcohol dependence in men. *Archives of General Psychiatry*. 2000; 57(7):666–673. [PubMed: 10891037]

- Smith EM, Pryzbeck TR, Bradford SE, Gogineni A, Spitznager EL. Adult offspring of alcoholic women as family history informants. *Alcoholism: Clinical and Experimental Research*. 1994; 18(6):1354–1360.
- Thompson WD, Orvaschel H, Prusoff BA, Kidd KK. An evaluation of the family history methodology for ascertaining psychiatric disorders. *Archives of General Psychiatry*. 1982; 39:53–58. [PubMed: 7055408]
- van Holst RJ, van den Brink W, Veltman DJ, Goudriaan AE. Why gamblers fail to win: a review of cognitive and neuroimaging findings in pathological gambling. *Neuroscience and Biobehavioral Reviews*. 2010; 34:87–107. [PubMed: 19632269]
- Verdejo-Garcia A, Lawrence AJ, Clark L. Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers, and genetic association studies. *Neuroscience and Biobehavioral Review*. 2008; 32:777–810.
- Xian H, Scherrer JF, Slutske WS, Shah KR, Volberg R, Eisen SA. Genetic and environmental contributions to pathological gambling symptoms in a 10-year follow-up. *Twin Research and Human Genetics*. 2007; 10(1):174–179. [PubMed: 17539377]

Table 1

Demographic and Clinical Characteristics of 286 Recreational Gamblers

	Recreational gamblers with parental addiction (N=53)	Recreational gamblers without parental addiction (N=233)	Test Statistic	df	P-value
Age, years, Mean $\pm$ SD	22.53 $\pm$ 3.82	21.06 $\pm$ 3.15	8.596 F	1	0.004
Gender, <i>n</i> (%)					
Female	19 (35.2)	71 (29.5)	0.382 χ^2	1	
Education, <i>n</i> (%)					
H.S. grad or less	8 (14.8)	23 (9.5)			
Some college	34 (63.0)	161 (66.8)	1.304 χ^2	2	0.521
College graduate or more	12 (22.2)	57 (23.7)			
Race, <i>n</i> (%) Caucasian	48 (88.9)	204 (84.6)	0.637 χ^2	1	0.425
Marital Status, <i>n</i> (%)					
Single	48 (88.9)	224 (92.9)			
Other	6 (11.1)	17 (7.1)	1.01 χ^2	1	0.315
Any lifetime psychiatric comorbidity, <i>n</i> (%)	24 (44.4)	58 (24.1)	9.128 χ^2	1	0.003
Any Alcohol Use (current), <i>n</i> (%)	43 (79.6)	171 (71.0)	1.667 χ^2	1	0.197
Alcohol abuse or dependence (current), <i>n</i> (%)	6 (11.1)	44 (18.3)	1.600 χ^2	1	0.206
Any Marijuana use (current), <i>n</i> (%)	21 (38.9)	52 (21.6)	7.100 χ^2	1	0.008
Drug abuse or dependence (current), <i>n</i> (%)	5 (9.3)	8 (3.3)	f	1	0.068
Any tobacco use (current), <i>n</i> (%)	22 (40.7)	38 (15.8)	16.981 χ^2	1	<0.001
Age of 1st gambling, Mean $\pm$ SD	14.51 $\pm$ 3.40	14.66 $\pm$ 3.55	0.076 F	1	0.784
Type of gambling Strategic, <i>n</i> (%)	33 (61.1)	170 (70.5)	1.827 χ^2	1	0.176

	Recreational gamblers with parental addiction (N=53)	Recreational gamblers without parental addiction (N=233)	Test Statistic	df	P-value
Any problems due to gambling^a, n (%)	14 (25.9)	26 (10.8)	8.625 χ^2	1	0.003
Any Objections to subject's gambling, n (%)					
None	37 (68.5)	186 (77.2)			
Family/Friends	17 (31.5)	55 (22.8)	1.793 χ^2	1	0.181
Gambling Frequency, per week, Mean $\pm$ SD	1.32 $\pm$ 1.54	1.17 $\pm$ 1.31	0.529 F	1	0.468
Minutes spent in a typical gambling episode, Mean $\pm$ SD	142.89 $\pm$ 145.14	128.55 $\pm$ 106.72	0.674 F	1	0.412
Reported money lost due to gambling in past 3 months, Mean $\pm$ SD	\$168.74 $\pm$ 335.27	\$124.58 $\pm$ 334.63	0.751 F	1	0.387
SCI-PG Criteria met, n (%)					
0	27 (50.0)	145 (60.2)			
1	19 (35.2)	70 (29.0)	1.661 ^w	1	0.197
2	8 (14.8)	26 (10.8)			
PG-YBOCS					
Urge/Thoughts	1.62 $\pm$ 1.57	1.42 $\pm$ 1.75	0.574 F	1	0.449
Behaviors	1.62 $\pm$ 1.67	1.51 $\pm$ 1.84	0.178 F		0.674
Total Score	3.25 $\pm$ 2.78	2.93 $\pm$ 3.29	0.414 F		0.520

^aProblems included legal, social, financial, and relational problems as a result from gambling

F F -Test Statistic

χ^2 Chi-Squared statistic

^wWald Chi-Squared statistic

^fFischer's Exact Test was used

Abbreviations Used: H.S.: High School; SCI-PG: Structured Clinical Interview for Pathological Gambling; YBOCS: Yale-Brown Obsessions and Compulsions Scale

Table 2

Impulsivity Measures and Cognitive Tasks from 286 Recreational Gamblers

	Recreational gamblers with parental addiction (N=53)	Recreational gamblers without parental addiction (N=233)	F-Statistic	df	P-value
ETQ, Mean ± SD					
Impulsivity	6.91 ± 3.96	7.15 ± 4.16	0.146		0.702
Venturesomeness	10.70 ± 3.45	10.91 ± 3.45	0.169	1	0.681
Empathy	12.21 ± 3.60	11.96 ± 3.62	0.201		0.654
BIS -11, Mean ± SD					
Atten. Impulsivity	16.51 ± 4.02	16.51 ± 3.80	0.000		0.996
Motor Impulsivity	23.17 ± 4.39	22.77 ± 4.51	0.345	1	0.557
Non-planning Impulsivity	24.66 ± 6.06	23.48 ± 5.09	2.169		0.142
TPQ, Mean ± SD					
Novelty Seeking Total	18.43 ± 6.21	17.55 ± 5.79	0.972		0.325
Harm Avoidance Total	9.79 ± 6.64	9.45 ± 7.05	0.106	1	0.745
Reward Dependence Total	16.85 ± 5.29	17.53 ± 4.95	0.793		0.374
IED, Mean ± SD					
Total Errors (adjusted)	25.30 ± 19.96	21.09 ± 23.65	1.445		0.230
Total Errors Stage 6	0.45 ± 0.70	0.40 ± 0.62	0.307	1	0.580
Total Errors Stage 8	10.87 ± 9.85	8.56 ± 9.36	2.569		0.110
SST, Mean ± SD					
Median Reaction Time, msec	446.65 ± 135.30	433.83 ± 121.59	0.460	1	0.498
SSRT, msec	173.70 ± 53.87	173.83 ± 47.35	0.000		0.986
CGT, Mean ± SD					
Delay aversion	0.326 ± 0.22	0.271 ± 0.21	2.890		0.090
Deliberation time	1674.14 ± 462.62	1652.93 ± 475.73	0.087		0.769
Quality of decision making	0.955 ± 0.08	0.962 ± 0.08	0.293	1	0.589
Risk Adjustment	1.78 ± 1.04	1.89 ± 1.18	0.382		0.537
Overall proportion of points gambled	0.511 ± 0.14	0.521 ± 0.14	0.251		0.617

Abbreviations Used: EIQ: Eysenck Impulsivity Questionnaire; BIS: Barratt Impulsivity Scale; TPQ: Tridimensional Personality Questionnaire; IED: Intra-Extra Dimensional Shift Set Task; SST: Stop Signal Task; SSRT: Stop Signal Reaction Time; CGT: Cambridge Gambling Task