FULL-LENGTH REPORT

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Correlates of frequent gambling and gambling-related chasing behaviors in individuals with schizophrenia-spectrum disorders

IGOR YAKOVENKO[1], REBECCA FORTGANG[2], JENNIFER PRENTICE[3], RANI A. HOFF[4,5] and MARC N. POTENZA[5,6,7,8,9]*

[1]School of Public Health, University of Alberta, Edmonton, AB, Canada
[2]Department of Psychology, Yale University, New Haven, CT, USA
[3]Department of Psychology, University of Calgary, Calgary, AB, Canada
[4]Veterans Administration Connecticut Healthcare System, West Haven, CT, USA
[5]Department of Psychiatry, Yale University School of Medicine, New Haven, CT, USA
[6]Department of Neuroscience, Yale University, New Haven, CT, USA
[7]Child Study Center, Yale University School of Medicine, New Haven, CT, USA
[8]Connecticut Mental Health Center, New Haven, CT, USA
[9]Connecticut Council on Problem Gambling, Wethersfield, CT, USA

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Background and aims: Published research on the relationship between disordered gambling and schizophrenia is limited. However, existing data suggest that individuals with schizophrenia/schizoaffective disorder may have a high prevalence of co-occurring disordered gambling. As such, effective strategies for screening and assessing gambling-related problems in individuals with psychosis are needed. The goal of this study was to explore the correlates of increased gambling frequency and chasing behavior, a hallmark feature of gambling disorder, in a sample of individuals with schizophrenia and schizoaffective disorders. *Methods:* Data from 336 participants who met DSM-IV criteria for schizophrenia or schizoaffective disorder were used to examine differences between non-gamblers, infrequent gamblers, frequent gamblers who do not report chasing, and frequent gamblers who report chasing on a variety of associated features and symptoms of schizophrenia and disordered gambling. *Results and discussion:* The results of the study support the conclusion that chasing behavior in individuals with schizophrenia/schizoaffective disorder lies on a continuum of severity, with more frequent gamblers endorsing greater chasing. Chasing was also associated with indicators of lower functioning across co-occurring disorders, such as greater problems with alcohol and drugs, greater gambling involvement, and a family history of gambling problems. The findings from the study suggest the utility of screening for chasing behavior as a brief and efficient strategy for assessing risk of gambling problems in individuals with psychotic-spectrum disorders.

Keywords: schizophrenia, disordered gambling, pathological gambling, comorbidity, chasing

INTRODUCTION

Approximately, 2% of individuals are diagnosed with a gambling disorder in their lifetime (Shaffer & Hall, 2001). Among individuals diagnosed with disordered gambling, a substantial proportion meets criteria for another co-occurring disorder (Yakovenko & Hodgins, 2018). For example, one study found that up to 75% of disordered gamblers may have a co-occurring Axis I disorder (Dowling et al., 2015) and another study found that 96% of individuals with pathological gambling had one or more co-occurring disorders (Kessler et al., 2008). The most commonly reported and studied co-occurring conditions are substance-use, mood, anxiety, personality, and attention-deficit hyperactivity disorders. By comparison, schizophrenia and other psychotic disorders have received less research attention in relation to gambling behaviours and disorder. Yet, published data suggest that up to one in five individuals with schizophrenia may experience problems related to gambling (Desai & Potenza, 2009).

To date, few studies have examined the relationship between disordered gambling and schizophrenia. The largest prevalence study was conducted by Haydock, Cowlishaw, Harvey, and Castle (2015) in Australia. They reported that among a sample of 442 adult individuals diagnosed with psychotic disorders, approximately 4% were classified as low-risk gamblers, 6% as moderate gamblers, and 6% as problem or disordered gamblers. Greater risk for gambling problems was associated with being male, lower education, and lower socioeconomic status. The authors also

* Corresponding author: Marc N. Potenza; Connecticut Mental Health Center, Room S-104, 34 Park St., New Haven, CT 06519, USA; Phone: +1 203 974 7356; Fax: +1 203 974 7366; E-mail: marc.potenza@yale.edu

reported a significant association between disordered gambling and substance use.

The results of the above study supported a similar conclusion to another large study of individuals with psychotic spectrum disorders. Desai and Potenza (2009) assessed 337 patients diagnosed with schizophrenia or schizoaffective disorder to evaluate the prevalence of gambling and associated characteristics. About 10% of participants met criteria for pathological gambling with approximately an additional 10% meeting cutoffs for lower severity, but impairing features of gambling-related problems. The authors highlighted the need of improved prevention and treatment efforts for disordered gambling in individuals with psychotic disorders.

Disordered gambling may be particularly common in individuals with psychotic-spectrum disorders even when compared with other co-occurring disorders. Aragay et al. (2012) compared the prevalence rates of co-occurring mental disorders in a sample of 100 psychiatric inpatients. Importantly, they found that patients with psychotic-spectrum disorders had a significantly higher prevalence of gambling-related problems than any other psychiatric disorder, including mood and anxiety disorders.

Emerging evidence also suggests that disordered gambling symptoms may not only commonly co-occur with psychosis, but may also exacerbate psychosis symptomatology, and present in unique ways that are not typically expressed in gamblers in the general population. Yakovenko, Clark, Hodgins, and Goghari (2016) explored the reciprocal associations between schizophrenia and disordered gambling by a qualitative in-depth interview with eight individuals diagnosed with both disorders. Their analysis revealed that this population endorsed motivations for engaging in excessive gambling and reasons for continuing to gamble in the face of extensive negative consequences that may be unique and not present in disordered gamblers without schizophrenia. In addition, participants described experiencing direct exacerbation of schizophrenia symptoms as a result of gambling involvement and vice versa. Altogether, the findings further support the need for more research on the co-occurrence of these two syndromes and its clinical implications.

The connection between disordered gambling and schizophrenia spectrum disorders may also be driven by shared neurobiological mechanisms, as mentioned in an early case report involving co-occurring gambling and psychotic disorders (Potenza & Chambers, 2001). Individuals with either schizophrenia or disordered gambling could potentially share abnormalities in specific neurotransmitter systems, such as those involving serotonin, dopamine, or glutamate (DeCaria, Begaz, & Hollander, 1998; Howes, McCutcheon, & Stone, 2015; Selvaraj, Arnone, Cappai, & Howes, 2014; Topf, Yip, & Potenza, 2009), and these may have clinical implications. Several lines of evidence argue against shared dopaminergic mechanisms including the efficacy of D2-like dopamine antagonists in the treatment of schizophrenia spectrum disorders and their worsening of features of gambling disorder in those with the disorder (Zack & Poulos, 2007). However, the glutamatergic nutraceutical n-acetyl cysteine has shown some efficacy in both populations with gambling disorder (Grant, Kim, & Odlaug, 2007; Grant et al., 2014) and schizophrenia spectrum disorder (Berk et al., 2008; Conus et al., 2018). As such, glutamatergic agents warrant study in the treatment of individuals with co-occurring gambling and schizophrenia spectrum disorders.

Other researchers have recognized the unique needs of this dual-diagnosis population and have attempted to tailor psychosocial treatment specifically for these individuals. Echeburúa, Gómez, and Freixa (2011) evaluated the effectiveness of a cognitive behavioural therapy (CBT) program designed for disordered gamblers with chronic schizophrenia. About 44 individuals meeting the criteria were randomly assigned to either standard drug therapy or a CBT treatment group, which included 20 sessions of treatment and relapse prevention. At 3-month follow-up and compared with a control group, the CBT group reported significantly greater rates of abstinence from gambling and an overall lower number of gambling episodes during the follow-up period. The results demonstrated the benefit of considering the uniqueness of dually diagnosed individuals with disordered gambling and schizophrenia when approaching treatment and prevention.

In summary, based on the review of the existing literature, it is likely that disordered gambling and psychotic-spectrum disorders co-occur frequently; one disorder may exacerbate the symptoms of the other; individuals with both disorders may have unique treatment and assessment considerations that are not applicable to either disorder alone; and tailoring interventions specifically for this dually diagnosed group may have a significant therapeutic benefit.

To advance this research, it is important to consider brief and effective ways of briefly screening for gambling problems in individuals with schizophrenia. One way to do this is to design screening around key diagnostic criteria that may signal increased risk for a gambling disorder. Chasing behavior, the tendency to continue gambling to recoup the money recently lost in gambling, has been frequently cited in the literature as a hallmark diagnostic feature of disordered gambling (American Psychiatric Association [APA], 2013). The behavior has been shown to be more frequent in disordered gamblers than social gamblers (Linnet, Rojskjaer, Nygaard, & Maher, 2006), and recent studies have found that it may be a behavior most likely to present initially in the absence of other symptoms of problem gambling. Kong et al. (2014) used a latent class analysis to identify subtypes of adolescent gamblers and identified that the largest class of at-risk gamblers was specifically characterized by increased chasing behavior without showing other signs of problematic gambling. James, O'Malley, and Tunney (2016) found a similar pattern in a sample of high-severity disordered gamblers, such that a moderate severity class was characterized specifically by chasing behaviors and preoccupation without a range of other symptoms. These findings suggest that chasing uniquely signals increases in risk and progression along the severity spectrum of gambling problems. With respect to a patient population with psychosis, the chasing criterion reflects objective behavior that might be particularly amenable to assess in this group.

Even though chasing appears to be a useful criterion for potentially identifying at-risk gamblers in need of assessment, no study has yet examined the expression and

correlates of chasing in individuals with psychotic-spectrum disorders. Given the prevalence and clinical relevance of problem gambling in this patient population, it is important to understand factors related to chasing in this group of individuals. The goal of this study was to explore the correlates of increased gambling frequency and chasing behavior on measures of mental health problems in a sample of individuals with schizophrenia and schizoaffective disorder. Consistent with findings in individuals without psychotic disorders, it was hypothesized that chasing behavior would be positively associated with severity of mental health problems in psychotic and non-psychotic (e.g., gambling and substance-use) domains.

METHODS

Participants

Data from a preexisting database of 337 outpatients diagnosed with either schizophrenia or schizoaffective disorder and treated at either the Veteran's Association Connecticut Healthcare System or the Connecticut Mental Health Center were described previously (Desai & Potenza, 2009) and used in this investigation. Participants' diagnoses were confirmed when study staff invited participants to participate in the parent study. Following informed consent, participants completed the study's measures and received $15.00 for their time and efforts. Recruitment and data collection were completed between June 2002 and November 2003. For a detailed review of the original study methodology, please refer the study of Desai and Potenza (2009).

Measures

Sociodemographic information. A demographic self-report questionnaire was administered that assessed the following characteristics: gender, date of birth, race, current marital status, current living situation, employment status, highest grade completed, enrollment status in day treatment program, annual income, financial situation (e.g., "does anyone currently handle your money for you?"), and daily activities or hobbies. In addition, the demographics questionnaire further assessed total number of days gambled in the last year, age at onset of gambling, most dollars ever gambled in 1 day, favorite type of gambling, number of types of gambling performed, reasons for gambling, and family history of disordered gambling.

Positive and Negative Syndrome Scale (PANSS; Kay, Fizbein, & Opler, 1987). The PANSS is a researcher-rated measure to assess the presence and severity of both positive and negative symptoms of schizophrenia. The PANSS was used to measure current psychosis-related symptoms severity in participants.

Addiction Severity Index (ASI; McLellan, Luborsky, Woody, & O'brien, 1980). To assess participants' potential for substance misuse, a semi-structured interview was used to examine seven potential problem areas related to substance use: medical status, employment and support needs, drug use, alcohol use, legal status, family and living situations, and mental health status. ASI alcohol and ASI drug subscores were calculated and used to determine potential risk/symptom severity for alcohol- and/or drug-use disorders, respectively.

National Opinion Research Centre DSM Screen for Gambling Problems (NODS; Wickwire, Burke, Brown, Parker, & May, 2008). The NODS assesses the fourth edition of *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV) criteria for pathological gambling and was developed using three independent data sets from a nation-wide US population-based study on gambling attitudes, behaviors, and problems.

Chasing. Chasing behavior was operationalized as a single self-report dichotomous question: "Have you often gone back to the place where you lost money to try to win it back?"

Statistical analysis

All data were examined for normality and outliers before conducting analyses. Missing data were not imputed as they constituted less than 5% of the data points. Bivariate correlations were calculated between scores on disordered gambling criteria, as assessed by the DSM-IV criterion A for pathological gambling and with the removal of the illegal acts criterion (APA, 2000, 2013). To test the study's main hypothesis, a between-subjects analysis of variance (ANOVA) was performed on the continuous data with gambling group entered as an independent variable with four levels: non-gamblers (did not gamble in the past year), infrequent gamblers (gambled <5 times in the past year), frequent gamblers who did not report chasing (gambled ≥5 times in the past year, but denied chasing behavior), and frequent gamblers who reported chasing (gambled ≥5 times in the past year and endorsed chasing). An alpha level of .05 was used for all analyses. For categorical outcome variables, a χ^2 analysis was performed.

Ethics

The study was approved by the Institutional Review Boards at they Yale University School of Medicine and the Veterans Administration Hospital in West Haven, CT. All subjects provided written informed consent and the research was conducted in accordance with the Declaration of Helsinki.

RESULTS

For the purpose of the analyses, the sample was not divided into groups by diagnosis. Although the authors recognize that there may be theoretical rationale for separately examining the individuals diagnosed with schizophrenia versus the individuals with schizoaffective disorder, a number of methodological reasons existed for pooling the analysis. First, the original study did not attempt to sample equally across diagnoses, resulting in considerably unequal group sizes ($n = 240$ for schizophrenia and 122 for schizoaffective disorder). Second, approximately 9% of the sample ($n = 30$) was diagnosed with both disorders in their charts, making it difficult to distinguish which disorder would have played an influence on their gambling behavior. Finally, a comparison

Table 1. Sociodemographic characteristics by gambling group

Variable	Non-gamblers ($n = 64$)[a]	Infrequent gamblers ($n = 136$)[a]	Frequent gamblers (no chasing) ($n = 74$)[a]	Frequent gamblers (chasing) ($n = 62$)[a]	χ^2 or F	p
Race/ethnicity					12.167	.204
White/Asian	31 (48.4)	85 (62.5)	42 (56.8)	32 (51.6)		
Black	27 (42.2)	43 (31.6)	29 (39.2)	26 (41.9)		
Hispanic	4 (6.3)	2 (1.5)	2 (2.7)	4 (6.5)		
Other	2 (3.1)	6 (4.4)	1 (1.4)	0 (0.0)		
Sex						
Female	20 (31.3)	40 (29.4)	20 (27.0)	16 (25.8)	0.591	.899
Age [mean (*SD*)]	47.22 (11.93)	47.01 (12.02)	47.54 (8.46)	45.42 (10.41)	0.479	.697
Single	32 (50.0)	70 (51.5)	39 (52.7)	40 (64.5)	3.569	.312
Living in own house or apartment	36 (56.3)	80 (58.8)	46 (62.2)	33 (53.2)	1.225	.747
No employment	54 (84.4)	104 (76.5)	64 (86.5)	48 (77.4)	4.056	.255
Education [mean (*SD*)]	12.55 (2.67)	12.52 (2.28)	12.42 (2.07)	11.74 (2.52)	1.784	.150
Monthly income [mean (*SD*)]	1,238.41 (815.52)	3,426.76 (14,866.96)	2,563.25 (11,715.61)	2,758.25 (12,794.25)	0.427	.734
Diagnosis						
Schizophrenia	52 (81.3)	96 (70.6)	52 (70.3)	39 (62.9)	5.281	.152
Schizoaffective	19 (29.7)	52 (38.2)	28 (37.8)	23 (37.1)	1.523	.677

Note. SD: standard deviation.
[a]All data are presented as *n* (%) unless otherwise noted.

between groups on diagnosis did not indicate a significant relationship between primary diagnosis and membership in gambling group (Table 1).

Across the total sample, the average age of the participants was 46.93 years ($SD = 11.02$); the majority were male (72%), Caucasian (57%), single (54%), housed (58%), and unemployed (80%). Participants had an average past-month income from all sources of \$1915.41 ($SD = 5,980.06$) and had gambled an average of 72 days in the past year ($SD = 125.20$). Participants were categorized into four gambling groups as follows: non-gamblers ($n = 64$), infrequent gamblers ($n = 136$), frequent gamblers who do not chase ($n = 74$), and frequent gamblers who chase ($n = 62$). Sociodemographic information by participant group, as well as bivariate associations between gambling group and each sociodemographic variable, is presented in Table 1. There were no significant differences between gambling groups across race, sex, age, marital status, employment status, home ownership, education, or mean monthly income. Table 2 presents bivariate correlations for DSM-5 criteria for gambling disorder. All disordered gambling criteria were significantly and positively correlated with criterion A6, which corresponds to the DSM-5-chasing criterion. Table 3 shows the mean scores and standard deviations of the outcome measures by gambling group as well as the results of the ANOVA and χ^2 models examining gambling group differences on various outcome measures.

Total days gambled

Total days gambled differed by gambling group, Welch's $F(2, 97.57) = 7.97$, $p < .001$, $\omega = 0.09$. There was a linear trend, $F(1, 161) = 18.59$, $p < .001$, $\omega = 0.10$, indicating that as the frequency and chasing of gambling increased across groups, total days gambled increased proportionately. Post-hoc contrasts revealed that frequent gamblers gambled more total days in the past year compared with infrequent gamblers, $t(130.99) = 3.95$, $p < .001$, $r = .33$. Similarly, those who endorsed frequent chasing behavior gambled more total days than those who did not endorse frequent chasing, $t(75.37) = 2.33$, $p = .023$, $r = .26$.

Age at onset of gambling

Age at onset of gambling differed as a function of gambling group, $F(2, 261) = 7.26$, $p < .001$, $\omega = 0.05$. There was a linear trend, $F(1, 261) = 14.30$, $p < .001$, $\omega = 0.05$, indicating that as the frequency and chasing of gambling increased across groups, the age at which participants first gambled decreased proportionately. Post-hoc contrasts revealed that frequent gamblers began gambling at an earlier age compared with infrequent gamblers, $t(261) = -3.31$, $p < .001$, $r = .20$. Similarly, those who endorsed frequent chasing behavior began gambling at an earlier age than those who did not endorse frequent chasing, $t(261) = 2.07$, $p = .039$, $r = .13$.

Most dollars ever gambled in 1 day

There was an association between gambling group and the largest amount of money that participants have ever spent in 1 day on gambling, $\chi^2(4) = 18.00$, $p < .001$, Cramer's $V = 0.19$. An examination of standardized residuals revealed that the association was mainly driven by the group of frequent gamblers who chase, who spent \$500 or more in 1 day, which was more frequently than expected.

Favorite type of gambling

There was an association between gambling group and favorite type of gambling, $\chi^2(8) = 23.50$, $p = .003$, Cramer's

Table 2. Correlation of disordered gambling criteria

	Needs to gamble with more money	Irritable when cutting down gambling	Unsuccessful attempts at stopping	Preoccupation with gambling	Gambles when feeling distressed	Chasing one's losses	Lies to conceal gambling	Loss of relationship or job due to gambling	Relies on others for money to gamble
A1	1								
A2	0.422**	1							
A3	0.354**	0.621**	1						
A4	0.391**	0.369**	0.379**	1					
A5	0.481**	0.225**	0.236**	0.326**	1				
A6	0.515**	0.244**	0.305**	0.416**	0.545**	1			
A7	0.398**	0.350**	0.419**	0.466**	0.369**	0.525**	1		
A8	0.101	0.060	0.239**	0.152	0.157	0.193*	0.510**	1	
A9	0.191*	0.245**	0.318**	0.204*	0.267**	0.249**	0.345**	0.473**	1

Note. Variable labels correspond to criterion A numbering in the DSM-5. A1 = gambles with more money; A2 = irritable when cutting down; A3 = unsuccessful attempts at stopping; A4 = preoccupation with gambling; A5 = gambles when feeling distressed; A6 = chasing one's losses; A7 = lies to conceal gambling; A8 = loss of relationship or job due to gambling; A9 = relies on others for money to gamble; *SD*: standard deviation.
*Correlation is significant at the 0.05 level (two-tailed).
**Correlation is significant at the 0.01 level (two-tailed).

$V = 0.22$. An examination of standardized residuals revealed that the association was mainly driven by the group of frequent gamblers who chase, who gambled on sports more frequently than expected.

Number of types of gambling

There was an association between gambling group and number of types of gambling, $\chi^2(2) = 13.18$, $p < .001$, Cramer's $V = 0.22$. An examination of standardized residuals revealed that the association was mainly driven by the group of frequent gamblers who chase, who gambled on only one type of gambling less frequently than expected.

Reasons for gambling

There was an association between gambling group and gambling to socialize with friends or family, $\chi^2(2) = 7.51$, $p < .001$, Cramer's $V = 0.02$. There was no association between gambling group and gambling to win money, $\chi^2(2) = 2.25$, $p = .325$.

There was no association between gambling group and gambling to receive personal service from staff, $\chi^2(2) = 2.98$, $p = .225$. There was an association between gambling group and gambling to be around other people, $\chi^2(2) = 6.28$, $p = .043$, Cramer's $V = 0.20$.

There was also an association between gambling group and gambling for excitement/challenge of gambling, $\chi^2(2) = 14.47, p < .001$, Cramer's $V = 0.30$. An examination of standardized residuals revealed that all three of the above associations were mainly driven by the group of frequent gamblers who chase, who endorsed gambling for excitement/challenge of gambling, to socialize with friends or family, and to be around other people significantly more frequently than expected.

Family history of problem gambling

There was an association between gambling group and family history of problem gambling, $\chi^2(3) = 22.34$, $p < .001$, Cramer's $V = 0.26$. An examination of standardized residuals revealed that the association was mainly driven by the group of frequent gamblers who chase, who reported a family history of problem gambling more frequently than expected.

PANSS score

Gambling group was not related to the PANSS score positive subscale, $F(3, 327) = 0.55$, $p = .65$, PANSS score negative subscale, $F(3, 323) = 0.11, p = .95$, or total PANSS score, $F(3, 319) = 0.50$, $p = .68$.

ASI alcohol score

ASI alcohol score was related to gambling group, Welch's $F(3, 156.17) = 3.03$, $p = .031$, $\omega = 0.02$. There was a linear trend, $F(1, 332) = 5.79$, $p = .017$, $\omega = 0.03$, indicating that as the frequency and chasing of gambling increased across groups, the ASI alcohol score increased proportionately. Games–Howell post-hoc analysis revealed that the mean

Table 3. Comparison of gambling groups on outcome measures

Characteristic	Non-gamblers ($n = 64$)[a,b,c]	Infrequent gamblers ($n = 136$)[a,b,c]	Frequent gamblers (no chasing) ($n = 74$)[a,b,c]	Frequent gamblers (chasing) ($n = 62$)[a,b,c]	χ^2 or F	p
Total days gambled last year [mean (*SD*)]		29.37 (84.05)	67.11 (96.76)	170.39 (24.10)	7.97	<.001
Age at onset of gambling [mean (*SD*)]		26.23 (10.38)	23.96 (10.20)	20.40 (8.54)	7.26	<.001
Most ever gambled in 1 day ($)					18.00	<.001
<100		99 (77.34)	54 (72.97)	31 (50.00)		
100–500		24 (18.75)	16 (21.62)	21 (33.87)		
>500		5 (3.91)	4 (5.41)	10 (16.13)		
Favorite type of gambling					23.50	.003
Lottery		54 (46.6)	41 (57.7)	25 (41.7)		
Sports		7 (6.0)	6 (8.5)	14 (23.3)		
Cards		12 (10.3)	10 (14.1)	11 (18.3)		
Machine		33 (28.4)	10 (14.1)	8 (13.3)		
Other		10 (8.6)	4 (5.6)	2 (3.3)		
Number of types of gambling					13.18	<.001
Only one type		45 (34.4)	19 (26.4)	6 (9.7)		
Multiple types of gambling		86 (65.6)	53 (73.6)	56 (90.3)		
Reason for gambling						
Socialize with friends/family		12 (20.7)	6 (10.5)	16 (32.0)	7.51	.023
Service from staff		8 (13.8)	4 (7.0)	9 (18.0)	2.98	.225
Be around people		10 (17.2)	9 (15.8)	17 (34.0)	6.28	.043
Excitement/challenge of gambling		24 (41.4)	27 (47.4)	38 (76.0)	14.47	<.001
Win money		46 (79.3)	44 (77.2)	44 (88.0)	2.25	.325
Family history of problem gambling	23 (35.9)	54 (39.7)	35 (47.3)	45 (72.6)	22.34	<.001
PANSS Score [mean (*SD*)]						
Positive	2.44 (0.72)	2.45 (0.64)	2.33 (0.65)	2.39 (0.66)	0.55	.652
Negative	2.62 (0.80)	2.58 (0.74)	2.55 (0.69)	2.58 (0.60)	0.11	.954
Total	2.45 (0.58)	2.47 (0.57)	2.39 (0.49)	2.40 (0.49)	0.50	.682
ASI alcohol score [mean (*SD*)]	0.06 (0.11)	0.08 (0.13)	0.06 (0.10)	0.12 (0.16)	3.03	.031
ASI drug score [mean (*SD*)]	0.02 (0.04)	0.02 (0.06)	0.03 (0.06)	0.05 (0.07)	2.81	.041
Social engagement [mean (*SD*)]	8.45 (4.68)	9.27 (4.35)	9.57 (4.56)	9.79 (4.03)	1.11	.347

Note. PANSS: Positive and Negative Syndrome Scale; ASI: Addiction Severity Index; *SD*: standard deviation.
[a]All data are presented as *n*(%) unless otherwise noted.
[b]Non-gamblers were not included in analyses of gambling-related outcome measures, since they did not gamble in the past year.
[c]Due to some missing data, percentages may not be calculated from baseline *n* in every category.

increase in ASI alcohol scores between non-gamblers and frequent gamblers with chasing (0.07, 95% CI [0.00, 0.13]) was significant ($p = .034$), as well as the increase between frequent gamblers without chasing and with chasing (0.06, 95% CI [0.00, 0.12], $p = .05$).

ASI score drugs

ASI drug score was related to gambling group, Welch's $F(3, 155.97) = 2.81$, $p = .041$, $\omega = 0.02$. There was a linear trend, $F(1, 332) = 8.32$, $p = .004$, $\omega = 0.02$, indicating that as the frequency and chasing of gambling increased across groups, the ASI drug score increased proportionately. Games–Howell post-hoc analysis revealed that the mean increase in ASI drug scores between non-gamblers and frequent gamblers with chasing (0.03, 95% CI [0.00, 0.05]) was significant ($p = .034$).

Social engagement

Social engagement was not related to gambling group, $F(3, 329) = 1.11$, $p = .347$.

DISCUSSION

The results of the study partially supported the primary hypothesis. Specifically, chasing was related to gambling and substance-use behaviors but not measures of psychosis severity. Both greater gambling frequency and endorsement of chasing behavior were associated with multiple proxy indicators of greater problem-gambling severity. On average, individuals who reported chasing spent more total days gambling per year reported starting gambling at an earlier age than the other groups, endorsed a higher reported

gambling expenditure in a single day, spent more time gambling on sports, reported engaging in more different gambling types, and gambled more for excitement, to be social, and to be around other people. Greater gambling frequency and expenditure and earlier age of gambling onset have been previously related to problem-gambling severity or risk (Black et al., 2015; Quilty, Avila Murati, & Bagby, 2014). Similarly, compared with social gamblers, disordered gamblers often report being more excited when gambling (Linnet, Rømer Thomsen, Møller, & Callesen, 2010). Social engagement and being around other people are also motivations for gambling that are consistent with recent qualitative research on gambling habits in individuals with schizophrenia (Yakovenko et al., 2016). The replication of the latter result gives credence to further explore the role of gambling in filling a social void in individuals with severe mental illness, such as psychotic-spectrum disorders. Finally, published data on disordered gamblers undergoing outpatient treatment show that sports gamblers typically having an intermediary level of gambling problems, second only to slot machine gamblers (Petry, 2003). In the same sample, sports gambling was also associated with high rates of current substance-use problems compared with other types of gambling, concurring with the findings in this study.

The demographic profile of the average participant in this study was representative of individuals with schizophrenia reported in other studies (e.g., Haydock et al., 2015). Participants had a mean income of only $1915/month but reported on average gambling 72 days in the past year, corresponding to 1–2 times/week. Depending on the duration of the gaming sessions and the type of game played, the relatively modest mean income combined with relatively frequent rate of play is troublesome, since it could signal that a significant proportion of participants' money went to gambling. Although total gambling expenditure was not collected as part of the assessment, researchers and clinicians working with individuals having schizophrenia should be aware of the potential financial burden related to gambling.

The overall picture appears to show that all other factors being equal, increased chasing behavior is related to greater gambling involvement, which could potentially generate problems relating to a significant frequency and expenditure of money spent on gambling activities. Importantly, simply gambling more frequently did not fully account for the increase in other gambling behaviors. Frequent gamblers who reported chasing were distinctly more involved in gambling than frequent gamblers who did not report chasing. Finally, gamblers reporting chasing also endorsed a greater likelihood of having a family history of disordered gambling, which is another factor linked to experiencing gambling-related problems (Blaszczynski & Nower, 2002).

Chasing behavior was also associated with drug and alcohol problems. Compared with frequent gamblers who did not endorse chasing, those acknowledging chasing had higher ASI alcohol scores. ASI drug scores were greater in chasers than non-gamblers, but were not significantly different from frequent gamblers. As such, while alcohol-use problems appear to be related to chasing, drug-use problems may accompany increased gambling frequency rather than chasing specifically, though the two often go hand in hand. The association between chasing and alcohol use is troublesome since alcohol is frequently served in casinos and other gambling venues. Furthermore, alcohol consumption while gambling has previously been shown to increase risky gambling practices within a session of play (Cronce & Corbin, 2010). Consequently, chasing may be a useful indicator of co-occurring mental health problems and a general increase in clinical severity.

There were no significant differences between gambling groups on PANSS sub-scores, suggesting that chasing and gambling frequency do not relate to severity of symptoms of schizophrenia. The result is consistent with prior reports from this sample not finding an association between problem-gambling severity and severity of positive and negative symptoms (Desai & Potenza, 2009) and is in seeming contrast to a separate study in a different jurisdiction (Yakovenko et al., 2016). Additional study is warranted to evaluate the extent to which different regulations regarding forms of gambling (e.g., the greater availability of video lottery terminals in Canada versus in Connecticut) or other factors may contribute to these seemingly different findings.

A clinical implication of the current findings is that chasing may be a useful indicator of emerging disordered gambling risk, as well as greater overall impairment in other co-occurring disorders. The finding appears to be consistent with chasing literature for disordered gamblers without schizophrenia in that chasing may represent a unique risk factor that signals movement toward more severe problem gambling (Kong et al., 2014; Linnet et al., 2006). Practically, this suggests that chasing may be used as a shorthand screening item for gambling problems in individuals with psychotic-spectrum disorders, and this speculation warrants direct examination. When pressed for time, asking patients who gamble about their tendency to go back to try to recover monetary losses may provide insight into whether a more comprehensive assessment and follow-up with regard to gambling disorder are needed. Endorsement of chasing could signal greater co-occurring problems, particularly with substance-use concerns, and may necessitate additional substance-use disorder screening and evaluation. The above clinical protocol would provide an effective way to query about gambling disorder in individuals with schizophrenia while minimizing time burden.

Limitations

This study has multiple methodological limitations, which may be addressed in future research. All data were cross-sectional and most were self-reported. Given the dynamic nature of mental health problems, often fluctuating between relapse and remission, a single point in time may not accurately represent the relationship between the evaluated constructs. Self-report data may also be subject to recall bias. Previous studies suggest that certain gambling-related variables such as expenditure may have significant inaccuracies when collected through self-report (Wood & Williams, 2007). Another limitation was that some gambling-related variables were categorical rather than continuous.

CONCLUSIONS

Despite the above limitations, this was the first study to examine chasing behavior in individuals with schizophrenia using a large clinical sample and rigorous methodology. Chasing was shown to be a statistical predictor of factors previously associated with gambling problems, as well as co-occurring problems with alcohol and drugs. The findings suggest the potential utility of a single-item screening assessment for chasing as a clinical tool for deciding whether to pursue more comprehensive assessment for disordered gambling in individuals with psychotic-spectrum disorders. Given the potentially prevalent problems associated with gambling in this population, there is a need for effective and efficient screening tools.

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