Problem gambling and substance use in patients attending community mental health services

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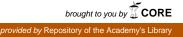[7]School of Public Health and Health Sciences, University of Massachusetts Amherst, Amherst, MA, USA

Background and aims: Relatively little is known about co-occurring gambling problems and their overlap with other addictive behaviors among individuals attending mental health services. We aimed to determine rates of gambling and substance use problems in patients accessing mental health services in Victoria, Australia. *Methods:* A total of 837 adult patients were surveyed about their gambling and administered standardized screening tools for problem gambling and harmful tobacco, alcohol, and drug use. Prevalence of gambling problems was estimated and regression models used to determine predictors of problem gambling. *Results:* The gambling participation rate was 41.6% [95% CI = 38.2–44.9]. The Problem Gambling Severity Index identified 19.7% [CI = 17.0–22.4] as "non-problem gamblers," 7.2% [CI = 5.4–8.9] as "low-risk" gamblers, 8.4% [CI = 6.5–10.2] as "moderate-risk" gamblers, and 6.3% [CI = 4.7–8.0] as "problem gamblers." One-fifth (21.9%) of the sample and 52.6% of all gamblers were identified as either low-risk, moderate-risk, or problem gamblers (PGs). Patients classified as problem and moderate-risk gamblers had significantly elevated rates of nicotine and illicit drug dependence ($p < .001$) according to short screening tools. Current diagnosis of drug use (OR = 4.31 [CI = 1.98–9.37]), borderline personality (OR = 2.59 [CI = 1.13–5.94]), bipolar affective (OR = 2.01 [CI = 1.07–3.80]), and psychotic (OR = 1.83 [CI = 1.03–3.25]) disorders were significant predictors of problem gambling. *Discussion and conclusions:* Patients were less likely to gamble, but eight times as likely to be classified as PG, relative to Victoria's adult general population. Elevated rates of harmful substance use among moderate-risk and PG suggest overlapping vulnerability to addictive behaviors. These findings suggest mental health services should embed routine screening into clinical practice, and train clinicians in the management of problem gambling.

Keywords: problem gambling, mental health, alcohol, nicotine, illicit drugs

INTRODUCTION

While gambling is a popular pastime for many individuals, it remains a significant public health issue in Australia, with adverse impacts on psychological, social, familial, and/or occupational functioning (Jauregui, Urbiola, & Estevez, 2016; Langham et al., 2016; Li, Browne, Rawat, Langham, & Rockloff, 2017). Although the latest edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) reclassified "pathological gambling" as "Gambling Disorder" under "addiction and related disorders," gambling problems are often conceptualized across a risk continuum. In Victoria, Australia, a recent household survey found that 70.1% of adults had gambled in the past year, with 0.8% identified as problem gamblers (PGs), 2.8% as moderate-risk gamblers, 8.9% as low-risk gamblers, and 57.6% as non-PGs (Hare, 2015).

Systematic reviews of epidemiological research, predominantly from the USA, have consistently revealed high rates of comorbidity between gambling and mental health disorders. These studies reveal a high prevalence of mental health conditions among problem and/or pathological gamblers in general population samples (57.5% comorbid substance use disorder and 57% comorbid mood or anxiety disorder) (Lorains, Cowlishaw, & Thomas, 2011). Similarly, among those who are seeking treatment for gambling problems up to three quarters have a comorbid DSM-IV Axis I disorder, most commonly mood disorder (23.1%) and/or any substance use disorder (22.2%) (Dowling et al.,

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2015b); and almost half have co-occurring personality disorders (Dowling et al., 2015a). There is also systematic review evidence that early alcohol use frequency, cannabis use, illicit drug use, tobacco use, and depressive symptoms, but not anxiety symptoms, are longitudinally associated with the development of gambling problems, with small but significant effect sizes (Dowling et al., 2017). Finally, there is also limited evidence from a growing number of studies that problem gambling is a risk factor for the subsequent occurrence of some mental health disorders, including mood disorders, anxiety disorders, and alcohol and other drug (AOD) use disorders (Chou & Afifi, 2011; Parhami, Mojtabai, Rosenthal, Afifi, & Fong, 2014; Pilver, Libby, Hoff, & Potenza, 2013).

The high prevalence of comorbid substance use disorders among mental health treatment seekers (with estimates of 25%–65%) (Croton, 2005; Hartz et al., 2014; Manning et al., 2008; Zimmermann, Lubman, & Cox, 2012) is well-established in the literature. However, few studies have examined the prevalence of gambling problems among this population, particularly in Australia. There is, however, systematic review and meta-analytic evidence from the international literature that gambling problems are overrepresented in AOD services (10.0%–43.4%) (Cowlishaw, Merkouris, Chapman, & Radermacher, 2014). A much more limited literature is also emerging internationally to suggest that problem gambling is also overrepresented in psychiatric outpatient services that treat patients with a range of psychiatric disorders (2.0%–4.4%) (Dowling et al., 2014; Henderson, 2004; Nehlin, Gronbladh, Fredriksson, & Jansson, 2013; Zimmerman, Chelminski, & Young, 2006a, 2006b).

In Australia, however, only three studies have examined the prevalence of problem gambling in mental health treatment populations using standardized screening tools. Two of these studies have explored the prevalence of PG in specific disorders. Haydock, Cowlishaw, Harvey, and Castle (2015) identified a PG prevalence of 5.8% in outpatients with psychotic disorders using the Problem Gambling Severity Index (PGSI), whereas Biddle, Hawthorne, Forbes, and Coman (2005) identified a pathological gambling prevalence of 29.1% in veterans with post-traumatic stress disorder using the South Oaks Gambling Screen. In the only study to explore the prevalence of problem gambling in Australian outpatient services that treat patients with a variety of psychiatric disorders, Dowling et al. (2014) found that 2% of the 51 individuals (i.e., one person) met criteria for PG using a very brief screening instrument (the Brief Bio-Social Gambling Screen).

To achieve a robust estimate of PG in Australian outpatient services, there is a clear need to examine PG prevalence across multiple service types and geographic locations (i.e., metropolitan and regional areas), among patients with a broad range of mental health disorders, and using gold standard measurement of PG. Moreover, the earlier Australian studies failed to examine patterns of gambling activities, nor interactions of PG with mental health and substance use characteristics. Understanding PG and related behaviors is critical for this clinical population, as they are often marginalized and stigmatized with high rates of unemployment and less disposable income to finance gambling activities (Haydock et al., 2015). Poor emotion/mood regulation and impulsivity are common features of many psychiatric disorders (Berking & Wupperman, 2012; Fox & Hammond,

2017) and may increase susceptibility to PG through extended or less-controlled gambling episodes.

Problem gambling comorbid with mental health disorders has been associated with increased psychiatric symptoms; substance use problem severity; interpersonal, physical, financial and social difficulties; impulsivity; and suicidality (Cowlishaw, Hakes, & Dowling, 2016; Di Nicola et al., 2010; Haydock et al., 2015; Jones et al., 2015; Kennedy et al., 2010), thereby complicating clinical presentations and compromising treatment engagement and effectiveness (Chou & Afifi, 2011). Determining the prevalence of PG in this population is thus a research priority. We therefore aimed to examine the prevalence of gambling problems across the risk continuum using a standardized screening tool of PG severity, as well as its relationship with harmful substance use and specific psychiatric diagnoses among patients attending a diverse range of mental health services in Victoria, Australia, including, for the first time, patients attending private mental health services.

METHODS

Participants

A total of 837 patients completed an anonymous online survey assessing gambling, psychiatric diagnoses, and substance use between June 2015 and January 2016. Participants were recruited from eight separate outpatient mental health services (across 12 individual sites, since some service organizations operated more than one site) in Victoria, Australia. To be representative of the Victorian outpatient mental health treatment-seeking population, the sample included patients from both public/state-funded and private services, adult and youth community mental health services, services in metropolitan and regional areas, and included a state-wide community support service (MHCSS) offering outreach, psychosocial rehabilitation, and support (see Table 1 for breakdown of service types). Patients were eligible to participate if they were receiving treatment from the mental health service and were aged over 18 years. Clients were excluded if they were too acutely unwell to participate or were unable to understand English. The sample included 55% of the 1,528 patients attending those services during the data collection periods. Of these, 165 patients were deemed by clinicians to be too unwell to participate in the study, 855 agreed to participate, 4 were excluded due to being aged under 18 years, and 14 withdrew participation prior to completion of the survey.

Measures

The survey was developed in collaboration with clinicians and consumers of mental health services who contributed to content and language. The survey was extensively piloted in multiple settings, underwent several revisions, with the final version taking around 15 min to complete. The survey was hosted by the online survey site Qualtrics, accessed on tablet computers using a link, with a paper copy available for participants who were unable or unwilling to use the online version. The survey assessed demographic information (e.g., gender, ethnicity, employment status, etc.) before proceeding to sections related to gambling, psychiatric diagnoses, and substance use.

Table 1. Characteristics of the sample

Characteristic	Descriptive statistics[a]
Gender (*n* = 837)	
Male	50.9 (426)
Female	48.3 (404)
Other	0.8 (7)
Age (*n* = 825)	38 (13), 18–95
Remoteness area according to postcode (*n* = 812)	
Major city	94.2 (765)
Inner regional	5.7 (46)
Outer regional	0.1 (1)
Remote or very remote	0 (0)
Born in Australia (*n* = 837)	77.8 (651)
Currently employed (*n* = 837)	29.0 (243)
Fortnightly income (*n* = 751)	
Less than $800	53.1 (399)
$800–$1,599	34.2 (257)
$1,600–$2,599	8.4 (63)
$2,600 or more	4.3 (32)
Highest level of education (*n* = 829)	
Less than year 12	25.9 (215)
Year 12 only	25.6 (212)
TAFE, diploma, or apprenticeship	21.6 (179)
University degree	26.9 (223)
Relationship status (*n* = 837)	
Single and never married	64.8 (542)
Married or de facto	19.8 (166)
Separated or divorced	14.3 (120)
Widowed	1.1 (9)
Mental health service type (*n* = 837)	
Public adult	46.5 (389)
Public adolescent/youth	10.8 (90)
Private	36.0 (301)
Community support service	6.8 (57)

Note. Total sample *n* = 837. Where statistics are based on smaller numbers, this is due to missing data for some participants for some variables.

[a]Statistics are % (*n*) for all variables except age, where mean (standard deviation) and range are presented.

Gambling. Participants were asked "Have you gambled at any point/time in the last 12 months? Gambling includes wagering on a race or event, buying a lottery ticket, playing keno or playing cards at home – as well as playing the pokies [electronic gaming machines (EGMs)] or betting on sports." Those who responded "yes" were asked to indicate the frequency (per month) for different gambling activities ("In the last 12 months, how many times per month have you spent any money playing or betting on: [gambling activity]", asked for both venue based gambling and gambling over the Internet) as well as past-month spending on gambling activities ("In the last month how much money in total did you spend on gambling?"). The severity of gambling problems was assessed using the 9-item PGSI (Ferris & Wynne, 2001), a standardized measure that identifies "non-PG" (a score of 0), "low-risk gambling" (a score of 1–2, indicating low-level problems with few or no identified negative consequences), "moderate-risk gambling" (score of 3–7, indicating moderate-level problems leading to some negative consequences), and "PG" (a score of 8–27, indicating PG with negative consequences and possible loss of

control), which was also used in the Victorian household survey (Hare, 2015). Participants indicating that they had not participated in any form of gambling in the past year (using the above definition) skipped the entire section on gambling behaviors. Participants were also asked if a mental health clinician had ever asked them about their gambling at that service.

Psychiatric diagnoses. Participants were presented with a list of diagnoses including "depression," "bipolar disorder or mania," "anxiety," "psychotic disorder, such as schizophrenia or schizoaffective disorder," "eating disorder, such as bulimia or anorexia," "borderline personality disorder (BPD)," "alcohol abuse or dependence," "drug abuse or dependence," "gambling disorder," and "other," and asked to indicate which disorders they had been diagnosed with during their lifetime. If participants selected "anxiety," they were presented with an additional list of specific anxiety disorders to select from. If participants selected "other," they were asked to type in additional diagnoses. Participants were also asked to indicate which of the lifetime diagnoses selected were current within the past year.

Substance use. The Alcohol Use Disorders Identification Test – Consumption (AUDIT-C) (Bush, Kivlahan, McDonell, Fihn, & Bradley, 1998) was used to assess hazardous drinking (with a cut-off score of 3 for females and 4 for males). Nicotine dependence was assessed using the 2-item Heavy Smoking Index (HSI; Heatherton, Kozlowski, Frecker, Rickert, & Robinson, 1989). Illicit drug use was assessed with the single-item Drug Use Screen (Smith, Schmidt, Allensworth-Davies, & Saitz, 2010). If participants indicated they had used illicit drugs or prescription medication for non-medical use in the past 12 months, they were asked if they had a primary drug of concern (PDOC). If so, level of dependence on their PDOC was assessed using the Severity of Dependence Scale (SDS; Gossop et al., 1995), where a score of 3+ indicated probable dependence.

Procedure

With the exception of one service, researchers (*n* = 10), all with undergraduate psychology degrees and trained by the project coordinator, were stationed in the waiting rooms during clinic hours throughout the data collection period. The time spent at each site was proportionate to the number of clinicians and frequency of patient visits, but was generally 1–2 weeks. Researchers directly approached patients, and explained that they were conducting a "survey about gambling among people attending mental health services," emphasizing that they did not have to gamble to participate, and that all responses were confidential and anonymous. Patients who consented to participate then completed the survey while waiting to see their clinician. The researcher was available to assist participants in survey completion if required (e.g., to clarify the meaning of questions). If a participant was unable to use the tablet, the researcher either entered the participant's verbal responses into the tablet, in a quiet secluded area/room away from the main waiting room to maintain the patient's confidentiality, or provided a paper copy of the survey for the participant to complete. Completed paper copies of the survey were later entered into Qualtrics by the researcher. In the MHCSS, support workers

were trained to administer the survey by members of the research team and took tablets to home visits so that patients could complete the survey in their home, with the support worker available to assist if necessary. All participants were offered a $10 supermarket gift card for their participation in the study.

Statistical analyses

Analyses were conducted using IBM® SPSS® version 22. All prevalence estimates for gambling participation, low risk, moderate risk, and PG are reported with exact binomial 95% confidence intervals. Using one-sample χ^2 tests, prevalence rates were compared with those in the general population (Hare, 2015), where in a randomly selected group of 837 Victorian adults, 6.78 PGs, 23.35 moderate-risk gamblers, and 74.58 low-risk gamblers were expected. Statistical significance of differences in proportions (e.g., across demographic variables) was examined using Pearson's χ^2 for categorical data. T-tests and analysis of variance (ANOVA) tests were used to examine differences in continuous data between PGSI categories, with Bonferroni pairwise post-hoc tests used to follow up significant ANOVA effects. Multinomial logistic regression was used to determine whether specific mental health diagnoses were predictors of PGSI category after controlling for gender, with adjusted odds ratios and 95% confidence intervals obtained. For the purpose of these analyses, non-gamblers and non-PGs were combined into a single reference group, against which the remaining PG categories were contrasted (preliminary logistic regression analyses, controlling for gender and restricted to non-gamblers and non-PGs, found that no psychiatric diagnoses significantly differentiated non-PGs from non-gamblers). Prevalence of substance use harm categories (i.e., hazardous drinking, according to the AUDIT; nicotine dependence according to the HSI; and illicit SDS score of 3+) was compared between PG categories using Pearson's χ^2 tests, with pairwise Bonferroni post-hoc comparisons examined in the case of statistically significant overall χ^2 test results.

Ethics

The study was approved by the Eastern Health Human Research Ethics committee (EHHREC; reference number: E02-2015). For sites not covered by the EHHREC, ethical review was undertaken and approval granted by the Alfred Hospital Ethics Committee (reference number: 245/15), the Albury Wodonga Human Research Ethics Committee (reference number: 411/15/6), and the Melbourne Health Office of Research (reference number: 2015.158). Participants were provided with information regarding the study on the tablet computer used to administer the questionnaires and asked to indicate agreement to participate before proceeding to the questionnaires.

RESULTS

Demographic characteristics

Sample characteristics are shown in Table 1. Approximately half (50.9%) of participants were male, 48.3% were female,

and 0.8% identified their gender as "other." The mean age was 38 ($SD = 13$) years, 77.8% were Australian-born, 10.5% identified as belonging to an ethnic minority, and 2.0% identified as Aboriginal or Torres Strait Islander. In addition, 64.8% were single or never married and 94.2% were residing in a major city. With respect to employment and income, 29.0% were in full-time- or part-time work, 43.7% received a disability support or other pension, and 53.1% had a personal fortnightly income of less than $800. Around half of the sample (52.3%) had been attending the mental health service from which they were recruited for more than 1 year.

Mental health

Most participants (92.7%) reported having been given at least one mental health diagnosis during their lifetime and 88.6% had a current mental health diagnosis in the past year (current diagnosis). The most common current diagnoses were major depression (54.7%), anxiety disorder (any; 48.3%), psychotic disorder (31.1%), and bipolar disorder (17.3%). Table 2 shows prevalence of all diagnoses.

Gambling participation

The gambling participation rate (any gambling in the past year, excluding raffles, which were not assessed) was 41.6% [95% CI = 38.2–44.9] and was significantly higher among male ($n = 198$, 46.5%) than female participants [$n = 148$, 36.6%; $\chi^2(1, n = 830) = 8.27, p < .01$]. As shown in Table 3, the most common gambling activities were EGMs, then lotteries, followed by horse/greyhound racing, and then scratch tickets. Most gambling took place in venues, although the most frequently played activity online was betting on sports, horse or greyhound racing, and EGMs, and betting on events exclusively took place online. Participants who had gambled in the past month reported

Table 2. Lifetime and current mental health conditions self-reported by participants

Psychiatric disorder	Lifetime		Current	
	%	n	%	n
Depression	64.3	538	54.7	458
Any anxiety disorder	53.8	450	48.3	404
Generalized anxiety disorder	41.3	346	36.6	306
Panic disorder, panic attacks, and agoraphobia	22.5	188	17.6	147
Social anxiety	21.0	176	16.6	139
Post-traumatic stress disorder	15.7	131	12.5	105
Obsessive–compulsive disorder	8.6	72	5.7	48
Phobia	3.1	26	2.4	20
Psychotic disorder	34.4	288	31.1	260
Bipolar disorder	21.7	182	17.3	145
Drug abuse or dependence	12.8	107	6.8	57
Borderline personality disorder	11.7	98	8.5	71
Alcohol abuse or dependence	9.1	76	5.0	42
Eating disorder	7.9	66	3.5	29
Gambling disorder	2.0	17	0.7	6
Other disorders	3.5	29	3.3	28

Table 3. Proportion of the sample participating in each form of gambling within the past year

Gambling type	% (n)
Electronic gaming machines (i.e., "pokies")	20.9 (175)
Lotteries, powerball, or pools	20.7 (173)
Horse or greyhound racing	10.9 (91)
Scratch tickets	10.5 (88)
Casino table games	5.7 (48)
Sports betting	5.0 (42)
Keno	3.0 (25)
Informal private betting	2.5 (21)
Bingo	1.4 (12)
Betting on other events	0.6 (5)

spending a mean of \$176.73 ($SD = 373.47), although this was skewed by a small minority with very high gambling expenditure – median past-month spent among past-month gamblers was \$50 (interquartile range = \$20–\$150).

PG severity

On the PGSI, the mean total score among the 348 participants who reported past-year gambling was 3.2 ($SD = 5.1$, range = 0–27). Of the total sample, 165 (19.7% [95% CI = 17.0–22.4]) had a PGSI score in the non-PG range, 60 (7.2% [CI = 5.4–8.9]) had a score in the low-risk range, 70 (8.4% [CI = 6.5–10.2]) had a score in the moderate-risk range, and 53 (6.3% [CI = 4.7–8.0]) were identified as PGs. The proportion of participants categorized as low risk, moderate risk, or PG significantly differed from estimated rates in the Victorian general population [$\chi^2(3) = 419.51$, $p < .001$]. Dichotomous contrasts comparing each category with all others indicated that PG [$\chi^2(1) = 317.66$, $p < .001$] and moderate-risk gambling [$\chi^2(1) = 95.87$, $p < .001$] were more prevalent among participants, whereas low-risk gambling was (non-significantly) *less* prevalent [$\chi^2(1) = 3.13$, $p = .077$] among participants than in the Victorian adult general population. One in five participants (21.9%; 52.6% of all gamblers) was identified as either low risk, moderate risk, or PGs. Despite this, less than half (42.7%; $n = 357$) reported that they had been asked about their gambling since attending the mental health service. ANOVA revealed significant differences in mean past-month gambling expenditure across PG category [$F(3, 338) = 27.2$, $p < .001$], with post-hoc tests indicating that PGs ($M = 439.79) spent significantly more than each other category [11 times more than non-PGs ($M = 39.12); eight times more than low-risk gamblers ($M = 50.32); and three times more than moderate-risk gamblers ($M = 123.84)], although non-problem, low-risk, and moderate-risk gamblers did not significantly differ from each other.

Mental health diagnosis by PG severity

Multinomial logistic regression analysis was conducted to examine associations between specific current psychiatric diagnoses and PG category. These analyses were conducted controlling for gender, since gambling prevalence significantly differed by gender, and rates of some psychiatric

diagnoses are also known to differ by gender. As shown in Table 4, psychotic disorder was the only diagnosis significantly associated with both moderate-risk gambling and PG: odds of moderate-risk gambling were more than doubled and odds of PG almost doubled relative to non-problem gambling in those with a current psychotic disorder. Participants with a current drug use disorder diagnosis had a more-than-fourfold increase in risk of being identified as a PG, relative to those without a current drug-use disorder. PG was also predicted by bipolar and BPD, both of which at least doubled the odds of PG.

Substance use

Approximately half of participants (49.3%) reported smoking tobacco in the past year, and these participants reported spending a median of \$60/week on tobacco. The mean HSI score among smokers was 3.0 ($SD = 1.9$), with 40.7% of participants (82.6% of past-year smokers) identified as nicotine-dependent, according to their HSI score. Two thirds of participants (67.9%) had consumed alcohol in the past year. Past-year drinkers reported spending a median of \$15/week on alcohol. More than one third (37.5%, or 55.3% of those who consumed alcohol) were drinking at hazardous levels according to the AUDIT-C. Just under a quarter (24.3%) reported using an illicit drug or a prescription medication for non-medical use in the past year, most commonly cannabis (20.7%), amphetamines (13.0%), and sedatives (9.1%). These participants reported spending a median of \$50/week on illicit drugs. Among the 113 participants who reported having a PDOC other than alcohol, the mean SDS score was 6.6 ($SD = 4.6$) with 76.8% (10.3% of all participants) indicating probable drug dependence.

Substance use by PG severity

Rates of nicotine dependence (according to HSI score) and illicit drug dependence (according to SDS score) significantly differed by PG category (Table 5). Post-hoc pairwise comparisons indicated that both moderate-risk and PGs had higher rates of nicotine and drug dependence than non-gamblers/non-PGs. For hazardous drinking (according to AUDIT-C score), there was a near-significant trend for differences across the PG categories, although in this instance, it was low-risk gamblers that had the highest proportion identified as hazardous drinkers.

DISCUSSION AND CONCLUSIONS

The study aimed to determine the prevalence of gambling participation and of PG across the risk continuum among patients attending a broad range of community-based mental health services in Victoria, Australia. The overall rate of gambling participation among the sample was 41.4%, substantially lower than the 61.6% [95% CI = 59.1%–64.0%] reported among the general adult population in Victoria when excluding gambling on raffles, as our study did (Hare, 2015). As expected, gambling participation was more common among male than female participants, and EGMs and

Table 4. Odds of meeting PGSI criteria for each problem gambling category (relative to non-problem gamblers) for each current psychiatric diagnosis, after controlling for gender[a]

	B	SE of B	Wald	p	Odds ratio	95% CI for odds ratio
Drug-use disorder						
Low-risk gambling	0.52	0.50	1.09	.30	1.69	0.63–4.50
Moderate-risk gambling	0.72	0.44	2.69	.10	2.06	0.87–4.87
Problem gambling	**1.46**	**0.40**	**13.62**	**<.001**	**4.31**	**1.98–9.37**
Borderline personality disorder						
Low-risk gambling	0.20	0.50	0.17	.68	1.23	0.46–3.25
Moderate-risk gambling	0.15	0.50	0.09	.77	1.16	0.44–3.06
Problem gambling	**0.95**	**0.42**	**5.05**	**.02**	**2.59**	**1.13–5.94**
Bipolar disorder						
Low-risk gambling	−0.25	0.39	0.41	.52	0.78	0.36–1.68
Moderate-risk gambling	0.06	0.34	0.04	.85	1.07	0.55–2.06
Problem gambling	**0.70**	**0.32**	**4.66**	**.03**	**2.01**	**1.07–3.80**
Psychotic disorder						
Low-risk gambling	0.26	0.29	0.85	.36	1.30	0.74–2.28
Moderate-risk gambling	**0.73**	**0.26**	**8.08**	**.004**	**2.08**	**1.25–3.44**
Problem gambling	**0.60**	**0.29**	**4.23**	**.04**	**1.83**	**1.03–3.25**
Alcohol use disorder						
Low-risk gambling	0.72	0.51	2.01	.16	2.06	0.76–5.60
Moderate-risk gambling	0.71	0.48	2.22	.14	2.03	0.80–5.16
Problem gambling	0.59	0.56	1.13	.29	1.81	0.60–5.43
Anxiety disorder (any)						
Low-risk gambling	0.16	0.27	0.35	.55	1.17	0.69–2.00
Moderate-risk gambling	−0.28	0.26	1.21	.27	0.75	0.45–1.25
Problem gambling	0.07	0.29	0.06	.81	1.07	0.61–1.88
Depression						
Low-risk gambling	−0.05	0.27	0.03	.86	0.95	0.56–1.62
Moderate-risk gambling	−0.05	0.25	0.03	.85	0.95	0.58–1.57
Problem gambling	−0.21	0.29	0.54	.46	0.81	0.46–1.42

Note. CI: confidence interval; *SE*: standard error; PGSI: Problem Gambling Severity Index.
[a]Seven participants who identified their gender as "other" were excluded from these analyses, as their inclusion led to perfect prediction errors. Thus, $n = 830$ for these statistics. The model testing whether eating disorders predicted problem gambling categories is excluded from this table, because there were insufficient participants with both an eating disorder and some levels of gambling problems to allow calculation of odds ratios and/or confidence intervals for all categories. Bold values reflect the statistically significant findings.

Table 5. Percentage of participants in each PGSI category meeting criteria for harmful substance use, according to substance use screening tools

	Non-gambler/ non-problematic gambler ($n = 654$)	Low-risk gambler ($n = 60$)	Moderate-risk gambler ($n = 70$)	Problem gambler ($n = 53^*$)	$\chi^2(3)$	p
Nicotine dependence	35.6[a,b]	43.3	65.7[c]	67.9[c]	41.56	<.001
Hazardous drinking	35.6[d]	53.3[c]	38.6	41.5	7.79	.0505
Drug dependence	8.4[a,b]	6.7[b]	20.0[c]	25.0[c,d]	22.70	<.001

Note. PGSI: Problem Gambling Severity Index.
Significant pairwise post-hoc results are indicated by: [a]Differs significantly from moderate-risk gamblers. [b]Differs significantly from problem gamblers. [c]Differs significantly from non-gamblers/non-problematic gamblers. [d]Differs significantly from low-risk gamblers.
*Data regarding illicit drug dependence were missing for one participant, who was classified as a problem gambler, so $n = 52$ for the bottom row.

lotteries were the most common activities, echoing the findings of earlier research on community samples (Bonnaire et al., 2016; Castrén et al., 2013).

Despite the lower rates of gambling participation, relative to the Victorian adult population, participants were more likely to be categorized within the PG risk categories, with one in five participants (half of those who gambled)

identified as either "low risk," "moderate risk," or "problem gamblers." The prevalence of PG was 6.3% and moderate-risk gambling was 8.3%, which is around eight and three times greater than in the general population, respectively. One-sample tests confirmed that problem and moderate-risk gamblers were overrepresented in our sample, relative to the general population. A further 7.1% were identified as

"low-risk" gamblers. These findings provide further evidence that individuals with mental health disorders have elevated rates of gambling problems. The rates of problem and moderate-risk gambling in this sample are slightly higher than those from other psychiatric outpatient services that treat patients with a range of psychiatric mental health disorders (Dowling et al., 2014; Henderson, 2004; Nehlin et al., 2013; Zimmerman et al., 2006a, 2006b). This may be because of the high prevalence of psychotic disorders in this sample. Indeed, the rates of problem gambling and moderate-risk gambling in this study closely align with the rates identified in patients with psychotic disorders in outpatient services in Victoria (5.8% and 6.4%, respectively) (Haydock et al., 2015).

One of the study strengths was the recruitment of patients with various mental health diagnoses, as well as the assessment of substance use. This permitted analysis of rates of PG category by current diagnosis as well as levels of harmful substance use, revealing a number of correlates of increased vulnerability. In support of the earlier literature, high rates of harmful substance use were reported among mental health patients (Croton, 2005; Hartz et al., 2014; Manning et al., 2008; Zimmermann et al., 2012). The motivations for substance use among this population may include the need for enhanced social participation (e.g., improving social confidence or connecting with peers), alleviating symptoms, or heightening positive affect (Kober & Bolling, 2014). Neurocognitive factors (e.g., altered brain reward systems or inhibitory control and decision-making) may also increase the likelihood of substance use (Gregg, Barrowclough, & Haddock, 2007).

This study revealed that patients with drug-use disorder had over four times the risk of PG, echoing a previous meta-analysis, which found that 10.0%–43.4% of alcohol and drug service attendees met criteria for PG (Cowlishaw et al., 2014). Aside from a self-reported diagnosis of drug-use disorder, PG also overlapped with other indicators of vulnerability to addictive behaviors: PGs exhibited significantly higher rates of nicotine and illicit drug dependence, based on standardized screening tools. Indeed high rates of comorbid substance use and gambling disorders are evident in the literature, with attention drawn to overlapping clinical, neurocognitive, and neurobiological features (Grant & Chamberlain, 2014, 2015). However, patients attending mental health services may be particularly vulnerable to both substance use and gambling behaviors more broadly, as a result of socioenvironmental, symptom-related, and neurobiological factors, such as impulsivity and reward dysregulation, which increase the likelihood of engaging in risky reward-seeking behaviors (Carey, Knodt, Conley, Hariri, & Bogdan, 2017; Dean & Keshavan, 2017; Polter & Kauer, 2014).

Participants diagnosed with a psychotic disorder, bipolar, or BPD had double the risk of PG, and psychotic disorder was the only significant predictor of moderate-risk gambling. While psychiatric symptoms may predict subsequent problem gambling (Dowling et al., 2017), and problem gambling may predict subsequent psychiatric disorders (Chou & Afifi, 2011; Parhami et al., 2014; Pilver et al., 2013), several factors, such as cognitive impairment, impulsivity, emotion dysregulation, and reward dysregulation,

could underpin these associations. For example, cognitive impairment, common to bipolar disorder and schizophrenia, could underpin the observed problem gambling comorbidity by compromising ability to self-monitor gambling behavior and losses, consider consequences, and make gambling-related decisions. Similarly, as with substance use disorders, impulsivity, and emotional dysregulation are hallmark and potentially transdiagnostic characteristics of BPD and bipolar disorder, which may drive risky reward-seeking behavior, such as excessive gambling. Indeed, impulsivity (Lorains, Stout, Bradshaw, Dowling, & Enticott, 2014; Suomi, Dowling, & Jackson, 2014) and emotional dysregulation (de Lisle, Dowling, & Allen, 2012; Jauregui et al., 2016) are elevated among individuals with gambling problems. Impulsivity also increases the likelihood of subsequent gambling becoming a problem (Dowling et al., 2017; Liu et al., 2013). Some mental illnesses also involve altered sensitivity to reward (e.g., hypersensitive in bipolar vs. hyposensitive in depression) (Alloy, Olino, Freed, & Nusslock, 2016), which likely influences motivation to engage in high-reward behaviors such as gambling. Experimental gambling paradigms have found that people with schizophrenia or BPD make riskier choices and are less likely to change their behavior in response to negative feedback (Pedersen, Goder, Tomczyk, & Ohrmann, 2017; Schuermann, Kathmann, Stiglmayr, Renneberg, & Endrass, 2011). The result of these potentially converging factors is that when engaging in an activity with high potential rewards, such as gambling, patients may make impulsive or poorly reasoned decisions and continue to gamble despite increasing losses (Grant & Chamberlain, 2014). However, further research is needed to disentangle the causal links between these risk factors, psychiatric disorders, and gambling problems.

The findings provide further evidence that individuals with mental health issues are particularly vulnerable to moderate risk gambling and PG. Isolation, poor social support, and stigma are common among individuals with mental health disorders (Angermeyer, Holzinger, & Matschinger, 2010; Linz & Sturm, 2013), and loneliness is a known predictor of PG (Botterill, Gill, McLaren, & Gomez, 2016). Mental health patients (80% of whom were single, divorced, or widowed), may gamble to counteract negative affect arising from these issues. The mean monthly spent among PGs ($440) is a potential concern given the low personal incomes (53% with a fortnightly personal income of less than $800 before tax) and the high proportion (44%) receiving disability support or other pensions in this sample. It is likely that among PGs high gambling expenditure could exacerbate financial difficulties, leading to personal loans and mounting debt, which could worsen the psychosocial problems driving patients to gamble in the first place.

Those experiencing PG should be a priority group in terms of regular monitoring, since high rates of self-harm and suicidal behaviors have been established among individuals with gambling disorders (Moghaddam, Yoon, Dickerson, Kim, & Westermeyer, 2015). However, given their high rates of moderate risk and PG, the finding that less than half (43%) of participants had ever experienced any clinician enquiry in relation to their gambling behavior at

their current mental health service was somewhat disconcerting and highlights the need for clinicians to engage in routine screening for gambling problems. This is particularly pertinent since over half of all gamblers were at risk of, or already experiencing gambling problems.

While these findings have important implications, there are a number of limitations worthy of consideration. While a large number of patients were surveyed ($n = 837$), this represented only 55% of the patients attending the services included in the study. Given the complex and vulnerable nature of the population being surveyed, high rates of exclusion or refusal to participate are to be expected, and clinicians asked researchers to avoid inviting the most acutely unwell patients to participate due to behavioral risk issues. Therefore, the estimated prevalence of PG may be conservative and not representative of those with more complex and acute conditions. While the use of a validated interviewer-administered diagnostic tool, such as the Structured Clinical Interview for DSM-5 Disorders (First, Williams, Karg, & Spitzer, 2015) to categorize participants' psychiatric diagnoses would have strengthened the reliability of the findings, this would have considerably increased the time taken to complete the survey and would not have allowed the questionnaire to be self-completed by participants. It is also possible that participants underreported their gambling behavior because of demand characteristics and social desirability effects. A further limitation is the reliance on participant self-report where the reporting of substance use and gambling behaviors could be affected by recall bias. Finally, despite our efforts to recruit from two regional sites and a state-wide outreach service, remote/rural clients were underrepresented in the sample – 82% of Victoria's population resides in the Melbourne metropolitan area, but 94% of our sample resided in the metropolitan area. Thus, our findings may not generalize to those residing outside metropolitan areas.

Despite these limitations, the findings provide important new insights into gambling problems among patients seeking treatment for mental health disorders. Despite lower rates of gambling participation, participants were eight times as likely to be PGs and three times as likely to be moderate-risk gamblers as adults in the general population, and half of all gamblers were experiencing some level of PG. The findings highlight important implications for mental health services including the need to raise awareness among both staff and consumers of the increased rates of PG (particularly for those diagnosed with psychotic, drug use, bipolar, and BPD). Finally, the findings also highlight the importance of embedding routine screening processes in clinical practice and ensuring clinical staff are adequately trained to recognize and respond to PG.

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