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Gender differences in the relationship between gambling problems and the incidence of substance-use disorders in a nationally representative population sample

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Abstract

Background—Cross-sectional studies have demonstrated gender-related differences in the associations between problem-gambling severity and substance-use disorders; however, these associations have not been examined longitudinally. We aimed to examine the prospective

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associations between problem-gambling severity and incident substance-use disorders in women versus men.

Methods—Analyses were conducted using Wave-1 and Wave-2 NESARC data focusing on psychiatric diagnoses from 34,006 non-institutionalized US adults. Inclusionary criteria for pathological gambling were used to categorize Wave-1 participants as at-risk/problem gambling (ARPG) and non-ARPG (i.e. non-gambling/low-frequency gambling/low-risk gambling). Dependent variables included the three-year incidence of any substance-use disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, prescription drug-use disorders, and illicit drug-use disorders.

Results—Significant gender-by-ARPG status interactions were observed with respect to the three-year incidence of nicotine dependence and prescription drug-use disorders, and approached significance with respect to incident alcohol-use disorders. ARPG (relative to non-ARPG) was positively associated with nicotine dependence among women (OR=2.00; 95% CI=1.24-3.00). ARPG was negatively associated with incident prescription drug-use disorders among men (OR=0.30; 95% CI=0.10-0.88). Finally, ARPG was positively associated with incident alcohol-use disorders among men (OR=2.20; 95% CI=1.39-3.48).

Conclusions—Gambling problems were associated with an increased 3-year incidence of nicotine dependence in women and alcohol dependence in men. These findings highlight the importance of considering gender in prevention and treatment initiatives for adults who are experiencing gambling problems. Moreover, the specific factors underlying the differential progressions of specific substance-use disorders in women and men with ARPG warrant identification.

Keywords

Problem/pathological gambling; gender differences; substance use disorders; incidence

1. INTRODUCTION

Research has illuminated gender-related differences in gambling and its correlates. For instance, motivations for gambling and gambling preferences vary by gender (Potenza et al., 2006), and women progress more quickly than men from the initiation of gambling to experiencing gambling problems, a process called “telescoping” (Grant and Kim, 2002; Potenza et al., 2001; Tavares et al., 2001). Gender-related differences extend to pathological gambling (PG), with stronger links to substance-use disorders observed in women and women more likely to report negative reinforcement motivations for gambling (American Psychiatric Association, 2000; Blanco et al., 2006; Grant and Kim, 2002). Subclinical levels of PG are also differentially associated with psychopathology and poor health/functioning among boys/men and girls/women (Blanco et al., 2006; Desai and Potenza, 2008; Morasco et al., 2006; Yip et al., 2011).

Significant gender-related differences in the co-occurrence of substance-use disorders and PG and subsyndromal gambling have also been observed. Wave-1 data from the nationally representative National Epidemiologic Study Survey on Alcohol and Related Disorders (NESARC) indicate stronger associations between PG and alcohol dependence, any drug-use disorder, drug abuse, and nicotine dependence, among women compared to men (Petry et al., 2005). Past-year problem-gambling severity was associated more strongly with nicotine dependence in women compared to men (Desai and Potenza, 2008), and similar (non-significant) patterns for alcohol abuse/dependence and drug abuse/dependence were observed.

To our knowledge, the gender-related differences observed in cross-sectional data have not been explored longitudinally. From a public health perspective, understanding the prospective relationships between problem gambling and substance-use disorders is important, as problem gambling may influence the onset, course, and treatment of substance-use disorders. Characterization of gender-related differences in these relationships would help optimize prevention and treatment strategies.

Two studies indicate that problem gambling may be associated with the incidence of substance-use disorders, although neither study examined gender as a possible moderator of this relationship. In the NESARC, past-year problem gamblers were more likely than non-disordered gamblers to develop incident alcohol-use disorders (Chou and Afifi, 2011). Among older adults in the NESARC sample, at-risk/problem/pathological gambling (ARPG) was associated with elevated odds for incident substance-use disorders, relative to non-gambling/low-frequency gambling (Pilver et al., 2013). In retrospective age-of-onset analysis of the cross-sectional National Comorbidity Survey-Replication, PG was associated with the onset of substance-use disorders (Kessler et al., 2008).

In order to address existing gaps in knowledge, we investigated whether the prospective association between ARPG status and incident substance-use disorders differed in women compared to men among a general population sample of US adults. Given cross-sectional evidence for stronger associations between PG and substance-use disorders in women versus men (Desai and Potenza, 2008; Petry et al., 2005), we hypothesized that ARPG status would be more strongly associated with incident substance-use disorders in women as compared to men.

2. METHODS

2.1 NESARC Methods

The NESARC was conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) and the US Census Bureau; prior publications provide a detailed methodology (Grant and Kaplan, 2005; Grant et al., 2003b). Ethical review and approval was conducted by the U.S. Census Bureau and the U.S. Office of Management and Budget. Data are de-identified and publicly available, exempting analyses from further Institutional Review Board (IRB) review (as confirmed by the Yale University IRB for these analyses).

Participants were non-institutionalized adults living in the United States, and were assessed at Wave-1 (2001-2002) and at Wave-2 (2004-2005). Of the 43,093 Wave-1 participants (81% response rate), 34,653 participants completed Wave-2 (87% response rate; 70% cumulative response rate; Ruan et al., 2008). Weighting variables accounted for minority and youth oversampling, the sampling strategy, and the probability of non-response.

2.2 Survey Instrument

The Alcohol Use Disorder and Associated Disabilities Interview Schedule—Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition (AUDADIS-IV) is a structured diagnostic instrument assessing Axis-I and Axis-II disorders based on DSM-IV criteria, and has demonstrated reliability in a general population sample (Grant et al., 2003a). Non-clinicians administered the AUDADIS-IV in face-to-face interviews at Wave-1 and Wave-2.

2.3 Sample

Participants without valid data for Wave-1 gambling were excluded (n=647), yielding a sample of 34,006. Following methodological strategies described previously (Chou and Afifi, 2011; Chou et al., 2011; Grant et al., 2012; Martins et al., 2012; Pilver et al., 2013;

Schepis and Hakes, 2011), individuals with a lifetime history of the disorder of interest (at Wave-1) were excluded for examining *incidence* of that disorder.

2.4 Measures

2.4.1 Dependent variables—Binary dependent variables indicated disorders which were incident during the 36.6 month (on average) period between Wave-1 and Wave-2 assessments (Grant and Kaplan, 2005; Grant et al., 2003b). Dependent variables were the combined category of any substance-use disorder and the individual disorders: alcohol abuse/dependence (alcohol-use disorders), nicotine dependence, and drug abuse/dependence (drug-use disorders). Drug-use disorders were sub-divided into prescription drug abuse/dependence (sedatives, tranquilizers, and opiates [other than heroin or methadone], and illicit drug abuse/dependence (hallucinogens, cannabis, crack/cocaine, inhalants/solvents, heroin), taking into account the legal status of drugs at the times of the NESARC assessments. Although the drug classes of “stimulants” and “other drugs” were included in the broader category of drug-use disorders, these drug classes could not be categorized as either prescription or illicit drugs because they encompass both prescription and illicit substances.

2.4.2 Independent variable—ARPG status was assessed at Wave 1. Participants indicated whether they had gambled at least five times in any year; those who responded affirmatively were administered fifteen questions corresponding to the ten inclusionary criteria for PG in the DSM-IV (American Psychiatric Association, 1994). As in previous studies, participants who acknowledged one or more features of PG were categorized as ARPG (Pilver et al., 2013). Participants who indicated they were lifetime non-gamblers/low frequency gamblers, or had gambled more than five times in any year but did not acknowledge any past-year symptoms of PG (low-risk gambling), were categorized as non-ARPG. As in previous work (Pilver et al., 2013), we focused on past-year rather than lifetime features of PG because their presence or absence would be most relevant for examining the three-year incidence of psychopathology.

2.4.3 Covariates—Wave-1 demographic covariates included age, gender, race, education, employment, household income, and marital status. Past-year Wave-1 psychiatric comorbidity was assessed with binary measures of any mood disorder (includes major depressive disorder, dysthymia, mania, hypomania), any anxiety disorder (includes panic disorder with or without agoraphobia, agoraphobia, social phobia, specific phobia, and generalized anxiety disorder), alcohol-use disorders, nicotine dependence, and drug-use disorders. A binary measure for any Wave-1 Axis-II disorder (includes lifetime avoidant, dependent, obsessive-compulsive, paranoid, schizoid, and histrionic personality disorders) was also included. The selection and operationalization of these covariates are consistent with prior NESARC analyses (Desai and Potenza, 2008; Martins et al., 2012; Petry et al., 2005; Pilver et al., 2013).

2.5 Analytic approach

Analyses were performed using SUDAAN 10.1 to account for survey design characteristics and weighting. The three-year incidence of each disorder by gender, by ARPG status, and by ARPG status according to gender was calculated by dividing the number of new cases by the baseline population at risk and multiplying this value by 100 (presented as weighted %). Logistic regression modeling was adapted from, and is very similar to, techniques used in prior examinations of longitudinal NESARC data for incident outcomes (Chou and Afifi, 2011; Chou et al., 2011; Dakwar et al., 2012; Lazareck et al., 2012; Martins et al., 2012). Specifically, individuals with a lifetime history of the disorder at Wave 1 were excluded from the analytical sample so that outcomes represented incident rather than chronic or

recurrent episodes. Adjustment for socio-demographic covariates and relevant Wave-1 psychiatric comorbidity is widely practiced and arguably considered a standard approach (Chou et al., 2011; Lazareck et al., 2012; Martins et al., 2012; Pilver et al., 2013).

Models 1 and 2 included the main effects of gender and ARPG status, and the gender-by-ARPG status interaction (gender*ARPG status). Model two was further adjusted for demographic covariates, baseline Axis-II, mood, and anxiety disorders, and relevant baseline substance-use disorders. Unadjusted (model 1) and multivariate-adjusted (model 2) gender-specific odds ratios (ORs), as well as the interaction OR, are presented. Gender-specific ORs quantify the magnitude and direction of the association between ARPG status and the incident disorder of interest, separately for women and men. The interaction odds ratio (OR) is the ratio of the gender-specific ORs (i.e., OR_{women}/OR_{men}). A statistically significant interaction OR indicates that the association between ARPG status and the incident disorder of interest varies between men and women. Statistical significance was determined with the Wald F-test, and considered to be $p < .05$ for the category of incident substance-use disorders. Given that significant findings were observed in women and men for this category, follow-up analyses examined individual disorders.

3. RESULTS

3.1 Sample characteristics, by ARPG status and gender (Table 1)

Among women, ARPG status was associated with race, education, any mood disorder, any anxiety disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, and any Axis-II disorder (all $p < 0.01$). The prevalence of ARPG appeared highest among women who were black, divorced/separated/widowed, had not graduated college, and had any mood disorder, any anxiety disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, or any Axis-II disorder. Among men, ARPG status was associated with marital status, any mood disorder, any anxiety disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, any Axis-II disorder, and age (all $p < 0.05$). The prevalence of ARPG was highest amongst men who were black or of “other” race, had never married, and had any mood disorder, any anxiety disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, and any Axis-II disorder. On average, ARPG men were younger than non-ARPG men.

3.2 Bivariate analyses: ARPG status, gender, and incidence of substance-use disorders (Table 2)

ARPG status was associated with gender; the prevalence of ARPG was lower among women as compared to men (2.0% vs. 3.9%; $p < .0001$). The three-year incidences of any substance-use disorder and alcohol-use disorders were significantly higher among ARPG participants compared to non-ARPG participants (all $p < .005$). The three-year incidences of any substance-use disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, and illicit drug-use disorders were lower among women compared to men (all $p < .0001$).

3.3 ARPG status and the incidence of substance-use disorders, according to gender (Table 2)

ARPG status was positively associated with the incidence of any substance-use disorder among women ($p = .033$) and men ($p = .001$). Incident nicotine dependence ($p = .012$) was elevated among women, and incident alcohol-use disorders ($p = .003$) were elevated among men. Specifically, the three-year incidences of these disorders were approximately twice as high among ARPG women as compared to non-ARPG women (any substance-use disorder: 14.97% vs. 7.73%; nicotine dependence: 11.53% vs. 5.40%). A similar pattern was observed among men, for whom the three-year incidences of any substance-use disorder and alcohol-

use disorders were also almost twice as high among ARPG men as compared to non-ARPG men (any substance-use disorder: 26.74% vs. 14.7%; alcohol-use disorders: 19.65% vs. 9.21%). No other gender-specific bivariate associations between ARPG status and incident disorders were observed.

3.4 Logistic regression modeling with interaction analysis: Gender specific effects of ARPG status (Table 3)

In Model 1, ARPG status was significantly associated with the three-year incidence of any substance-use disorder among women (OR=2.10; $p=.0073$) and among men (OR=2.11; $p=.001$). Specifically, ARPG status was associated with the three-year incidences of nicotine dependence (OR=2.28; $p=.001$), drug-use disorders (OR=2.32; $p=.0448$), and prescription drug-use disorders (OR=3.01; $p=.0175$) among women, and alcohol-use disorders (OR=2.41; $p=.0001$) among men. The significant gender-by-ARPG status interaction for incident alcohol-use disorders (OR=0.41; $p=.036$), nicotine dependence (OR=2.12; $p=.020$), and prescription drug-use disorders (OR=5.23; $p=.020$) indicate that ARPG status was differentially associated with the incidences of these disorders in women and men. Specifically, ARPG status was strongly associated with incident nicotine dependence and prescription drug-use disorders among women, whereas no association was observed among men (nicotine dependence: OR=1.08, $p=.75$; prescription drug-use disorders: OR=0.58, $p=.29$). The pattern was reversed with respect to incident alcohol-use disorders, as ARPG was strongly associated the incidence of alcohol-use disorders among men but not women (OR=0.99; $p=.99$). Non-significant gender-by-ARPG status interactions for the incidence of any substance-use disorder, drug-use disorders, and illicit drug-use disorders suggest that the associations between ARPG status and the incidences of these disorders were similar in women and men.

Adjustment for Wave-1 socio-demographic characteristics and relevant Axis-I and Axis-II comorbidity (Model 2) somewhat altered these associations, suggesting that these factors may influence or account for some of the association between ARPG status and incident substance-use disorders among women and men. Although the gender-specific associations between ARPG status and any substance-use disorder (among women [OR=2.16; $p=.0058$] and men [OR=1.97; $p=.0026$]), nicotine dependence (among women [OR=2.00; $p=.0051$]), and alcohol-use disorders (among men [OR=2.20; $p=.0011$]) observed in Model 1 remained statistically significant in Model 2, the associations between ARPG status and incident drug-use disorders (among women [OR=1.82; $p=.16$]) and prescription drug-use disorders (among women [OR=1.79; $p=.24$]) were no longer statistically significant. Furthermore, while the gender-by-ARPG status interactions remained statistically significant for incident nicotine dependence (OR=2.11; $p=.024$) and prescription drug-use disorders (OR=5.94; $p=.018$) in Model 2, the gender-by-ARPG status interaction for alcohol-use disorders (OR=0.46; $p=.072$) was not. Finally, a negative association between ARPG status and incident prescription drug-use disorders (among men [OR=0.30; $p=.029$]) reached statistical significance in Model 2.

3.5 Bivariate analysis (Supplemental Table 1¹) and logistic regression modeling (Supplemental Table 2): ARPG status and gender

Given the reciprocity of interactions, it was of interest to present the associations between gender and incident substance-use disorders according to ARPG status, in bivariate analysis and in multivariate-adjusted logistic regression modeling. In bivariate analysis, the incidences of any substance-use disorder and alcohol-use disorders are significantly higher among ARPG men compared to ARPG women ($p<.05$). The incidences of any substance-

¹Supplementary material can be found by accessing the online version of this paper at <http://dx.doi.org> and by entering doi:...

use disorder, alcohol-use disorders, nicotine dependence, drug-use disorders, and illicit drug-use were higher among non-ARPG men as compared to non-ARPG women ($p<.05$). In logistic regression modeling (Model 2; adjusted for Wave-1 socio-demographic characteristics and relevant Axis-I and Axis-II comorbidity), non-ARPG men were more likely than non-ARPG women to develop any incident substance-use disorder ($OR=1.97$; $p=.0058$), alcohol-use disorders ($OR=2.59$; $p<.0001$), nicotine dependence ($OR=$; $p<.0001$), drug-use disorders ($OR=1.88$; $p<.0001$), and illicit drug-use disorders ($OR=2.33$; $p<.0001$). ARPG men were more likely than ARPG women to develop incident alcohol-use disorders ($OR=5.61$; $p=.0001$); ARPG men were less likely than ARPG women to develop incident prescription drug-use disorders ($OR=0.23$; $p=.0392$).

4. DISCUSSION

This is the first study to examine whether ARPG status is differentially associated with incident substance-use disorders among women and men; based on findings from cross-sectional research, we hypothesized that ARPG status would be more strongly associated with the incident substance-use disorders in women as compared to men. Results indicated that ARPG status was differentially associated with the incidence of some substance-use disorders among women and men. Specifically, Significant gender-by-ARPG-status interactions were observed in relation to nicotine dependence and prescription drug-use disorders in fully adjusted models, where ARPG status was positively associated with nicotine dependence among women (no association was found among men) and was negatively associated with prescription drug-use disorders among men (no association was found among women). Although the gender-by-ARPG status interaction was not significant (approaching but not reaching $p<0.05$) in relation to incident alcohol-use disorders, we observed a strong association between ARPG status and incident alcohol-use disorders among men and but not among women. Overall, our results suggest important gender-related differences in the risk for specific substance-use disorders in association with ARPG. These relationships and their clinical implications are discussed below.

Results suggest that over the course of three years, ARPG women may be more vulnerable to the development of nicotine dependence than non-ARPG women, and ARPG men may be more vulnerable to the development of alcohol-use disorders than non-ARPG men. Due to limitations of the NESARC data, we were not able to examine the mechanisms that may contribute to such possible differences in vulnerabilities. One possible explanation for this finding is that stress associated with gambling may contribute to the development and maintenance of nicotine dependence in women and alcohol-use disorders in men. Psychosocial stress may trigger and worsen substance-use disorders (Koob, 2008) and gambling (Elman et al., 2010; Tschibelu and Elman, 2011). Furthermore, women are more likely than men to smoke for stress relief (Fidler and West, 2009), and men are more likely than women to consume alcohol in response to stress (Dawson et al., 2005). Additionally, emotional arousal following a stressful cue has been associated with alcohol craving in men but not in women (Chaplin et al., 2008). Given that gambling-related stress responses appear greater at higher levels of problem-gambling severity (Meyer et al., 2004), the incidence of substance-use disorders (specifically, nicotine dependence in women and alcohol-use disorders in men) would be expected to be higher among persons with ARPG, relative to non-ARPG. The extent to which stress responsiveness and/or other specific mechanisms (e.g., gender-related differences in brain reward/stress pathways or differences in physiological responses to nicotine and alcohol) and/or factors (e.g., tendencies to act impulsively) may mediate the relationships between ARPG status and incident nicotine dependence among women and incident alcohol-use disorders among men warrants closer examination.

It is possible that negative mood states linked to ARPG may also contribute to gender-related differences in the association between ARPG and incident nicotine dependence. First, negative mood, depression, and anxiety are more prevalent among women versus men with gambling problems (Desai and Potenza, 2008; Potenza et al., 2001). Second, women more often than men report gambling to escape negative affective states (Blanco et al., 2006). Third, an experimental study (Weinberger and McKee, 2012) found that female tobacco smokers had a briefer smoking latency, compared to male smokers, following a negative mood induction.

Men may have different motivations for both gambling and smoking. For example, data show that men with PG prefer action-oriented, strategic forms of gambling such as blackjack and poker, whereas women with PG prefer non-strategic forms of gambling such as bingo or slot machines (Grant and Kim, 2002; Potenza et al., 2001). These preferences may reflect greater arousal and sensation-seeking among men (Blaszczynski et al., 1997; Odlaug et al., 2011), both of which are positively associated with greater alcohol use and alcohol abuse/dependence (Pantalon et al., 2008). Additionally, men are both more likely than women to report gambling as a means to deal with preoccupations (Blanco et al., 2006) and to consume alcohol while gambling (Welte et al., 2004). Finally, men appear to be at greater risk than women for both alcohol-use disorders and PG (Blanco et al., 2006), which suggests that the observed relationship between ARPG and incident alcohol-use disorders may be driven by a third factor (e.g., relating to impulsive tendencies) that may render men, but not women, more vulnerable to both gambling problems and alcohol-use disorders. These and other possibilities warrant direct examination.

The findings from this longitudinal study did not follow precisely the gender-related patterns observed in cross-sectional studies (Desai and Potenza, 2008; Petry et al., 2005). In these studies, the cross-sectional associations between measures of ARPG status and substance-use disorders were consistently positive ($OR > 1.0$) and statistically significant for both women and men. In contrast, the longitudinal data indicated that ARPG status was not consistently associated with the incidences of all substance-use disorders for both women and men; furthermore, one association was negative ($OR < 1.0$). These differences highlight the importance of examining *incidence* rather than only *prevalence*, to more fully inform our understanding of how ARPG status may be associated with the development and maintenance of certain substance-use disorders among women and men. Specifically, these findings suggest important developmental considerations may underlie gender-related differences in prevalent and incident disorders as related to ARPG, with some factors promoting stronger associations in women/girls relative to men/boys earlier in life (contributing to prevalence findings) and other factors promoting stronger associations in women relative to men later in life (contributing to incidence findings).

Limitations of this study exist. First, we characterized ‘ARPG status’ to reflect both the content of the Wave-1 gambling module and to provide a sample large enough for gender-specific analyses. Thus, the categories of “non-ARPG” and “ARPG” do not reflect clinical definitions (American Psychiatric Association, 2000). They are, however, based on approaches adopted in prior work with this dataset (Desai and Potenza, 2008; Pilver et al., 2013) and others (Kessler et al., 2008; Rahman et al., 2012; Potenza et al., 2011). A public-health approach to the study of gambling indicates that attention to sub-threshold manifestations of PG, which are correlated with negative health measures (Desai et al., 2007, 2004, 2005; Potenza et al., 2006), is warranted. Nevertheless, future analyses would ideally distinguish among non-gamblers and low-frequency gamblers (which are grouped together by the structure of the NESARC gambling questions), low-risk gamblers, at-risk gamblers (acknowledging 1 to 2 DSM-IV PG inclusionary criteria), problem gamblers (acknowledging 3 to 4 criteria), and pathological gamblers (acknowledging 5 or more

criteria). Second, gambling was not assessed at Wave-2, which precludes the examination of the prospective association between substance-use disorders and problem-gambling severity, which would have been a valuable contribution to existing research. Furthermore, lacking Wave-2 gambling data, we could not evaluate the course of ARPG status relative to substance-use disorders. For example, an incident substance-use disorder might represent the substitution of one addictive behavior (substance use) for another (gambling). A final limitation relates to factors that were not examined in the study, such as degree of impulsivity, family history of PG, genetic factors, and age-of-onset measures that may vary by gender and influence the findings. Future studies should investigate these variables in relation to gender, PG, and incident substance-use disorders to more fully understand these relationships.

Despite these limitations, this study has numerous strengths. First, a large, nationally representative sample was used to examine gender-related differences in incident substance-use disorders relating to problem-gambling severity. Therefore, these results are more generalizable to community-dwelling adults compared to findings from treatment-seeking samples. Second, the NESARC employed valid and reliable measures for psychiatric diagnoses (Ruan et al., 2008). Third, we controlled for potential demographic confounders and psychiatric comorbidity (both Axis-I and Axis-II) in multivariate modeling.

In conclusion, we found that ARPG appears differentially associated with incident nicotine dependence, prescription drug-use disorders, and alcohol-use disorders in women and men. For men and women, ARPG may represent a vulnerability factor in the development of particular substance-use disorders; the mechanisms that underlie the observed relationships should be examined in future studies. Finally, these findings suggest that gender-informed approaches to understanding relationships between ARPG and incident substance-use disorders, with an aim towards improving prevention strategies, are warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1
Baseline socio-demographic characteristics/psychiatric comorbidity and at-risk/problem gambling status, by gender

Study characteristics	Women				Men			
	Non-ARPG		ARPG		Non-ARPG		ARPG	
	N	%	N	%	N	%	N	%
Race								
White	10900	98.0	231	2.0	8373	96.2	326	3.8
Black	4029	97.0	125	3.0	2158	95.3	104	4.7
Other	835	97.5	28	2.5	620	95.2	30	4.8
Hispanic	3538	99.0	52	1.0	2569	96.8	88	3.2
Marital status								
Married ¹	9640	98.2	185	1.8	8061	96.6	276	3.4
Formerly married ²	5755	97.5	151	2.4	2360	95.7	95	4.3
Never married	3907	97.8	100	2.2	3299	94.9	177	5.1
Education								
Less than high school	3231	97.7	85	2.3	2196	95.7	99	4.3
High school	5644	97.8	134	2.2	3815	95.5	170	4.5
Some college	5927	97.5	164	2.5	4040	96.1	167	3.9
College +	4500	98.9	53	1.1	3689	97.0	112	3.0
Employment								
Full time	8702	97.8	212	2.2	8847	96.2	350	3.8
Part time	2478	97.8	58	2.2	935	95.3	46	4.7
Other	8122	98.1	166	1.9	3938	96.1	152	3.9
Income								
\$0-19,999	5928	97.8	143	2.2	2545	96.1	103	3.9
\$20,000-34,999	4075	97.5	100	2.5	2925	96.7	100	3.3
\$35,000-69,999	5781	98.0	129	2.0	4846	96.2	191	3.8
\$70,000	3518	98.4	64	1.6	3404	95.7	154	4.3
Any Mood Disorder								

Study characteristics	Women						Men					
	Non-ARPG N=19302; 98.0%			ARPG N=436; 2.0%			Non-ARPG N=13720; 96.1%			ARPG N=548; 3.9%		
	N	%		N	%		N	%		N	%	P
Yes	2152	94.8		114	5.2		985	93.5		81	6.5	
No	17150	98.3		322	1.7		12735	96.3		467	3.7	
Any Anxiety Disorder												.0001
Yes	2714	95.8		117	4.2		1094	92.4		87	7.6	
No	16588	98.3		319	1.7		12626	96.4		461	3.6	
Alcohol-use Disorders												<.0001
Yes	861	93.5		62	6.5		1548	90.8		159	9.2	
No	18441	98.2		374	1.8		12172	96.9		389	3.1	
Nicotine Dependence												<.0001
Yes	1965	93.9		134	6.1		1696	91.8		154	8.2	
No	17337	98.5		302	1.5		12024	96.8		394	3.2	
Drug-use Disorders												.0083
Yes	212	92.8		19	7.2		340	90.6		34	9.4	
No	19090	98.0		417	2.0		13380	96.3		514	3.7	
Any Axis-II Disorders												<.0001
Yes	2758	95.2		145	4.8		2091	91.4		198	8.6	
No	16544	98.4		291	1.6		11629	97.1		350	2.9	
Current Age	M	SE		M	SE		M	SE		M	SE	
	45.9	0.2		46.3	1.0		44.3	0.2		41.8	1.0	.0111

Notes:

ARPG, at-risk/problem gambling

M, Mean; SE, standard Error

N are unweighted; % are weighted row percentages

p is for Wald Chi-Square test; bivariate associations between ARPG and each covariate are presented, separately by gender.

¹Category includes living as married

²Category includes separated, widowed, and divorced participants

Table 2
Incidence of substance-use disorders overall, by at-risk/problem gambling status, by gender, and by at-risk/problem gambling status and gender

	Any Substance-use Disorder		Alcohol-use Disorders		Nicotine Dependence		Drug-use Disorders		Prescription Drug-use Disorders		Illicit Drug-use Disorders	
	At risk (n)	Incidence (%)	At risk (n)	Incidence (%)	At risk (n)	Incidence (%)	At risk (n)	Incidence (%)	At risk (n)	Incidence (%)	At risk (n)	Incidence (%)
Total Sample	21,534	10.65	24,272	5.86	28,397	6.75	30,642	1.72	33,116	0.84	30,920	1.24
ARPG Status												
Non-ARPG	21,204	10.48	23,820	5.74	27,784	6.68	29,867	1.68	32,434	0.83	30,128	1.22
ARPG	330	21.45	452	11.94	613	9.73	775	3.06	936	1.15	792	2.25
<i>P</i>	.0008		.0029		.0525		.0878		.4159		.1575	
Gender												
Women	14,220	7.81	16,027	3.48	16,809	5.48	18,343	1.25	19,487	0.75	18,499	0.74
Men	7,314	14.97	8,245	9.46	11,588	8.19	12,299	2.27	13,883	0.94	12,421	1.83
<i>P</i>	<.0001		<.0001		<.0001		<.0001		.1673		<.0001	
Women only												
Non-ARPG	14,040	7.73	15,771	3.48	16,543	5.40	17,974	1.22	19,065	0.72	18,124	0.72
ARPG	180	14.97	256	3.46	266	11.53	369	2.78	422	2.14	375	1.64
<i>P</i>	.0325		.9887		.0120		.1524		.1234		.2945	
Men only												
Non-ARPG	7,164	14.71	8,049	9.21	11,241	8.18	11,893	2.24	13,369	0.95	12,004	1.81
ARPG	150	26.74	196	19.65	347	8.75	406	3.24	514	0.55	417	2.64
<i>P</i>	.0095		.0028		.7581		.3760		.2046		.4244	

Notes:
 ARPG, at-risk/problem gambling
 n are unweighted (population at risk); % are weighted row percentages (Incidence)
p is for Wald Chi-Square test; bivariate associations between ARPG and each substance-use disorder outcome (overall and by gender) are presented

Table 3
Gender differences in the multivariate association between at-risk/problem gambling status and incident substance-use disorders

Incident Substance-use Disorders	Women		Men		Interaction OR=OR _{women} /OR _{men}	
	ARPG vs. Non-ARPG		ARPG vs. Non-ARPG		ARPG vs. Non-ARPG	
	OR	95% CI	OR	95% CI	Interaction OR	95% CI
Model 1 ^a						
Any Substance-use Disorder	2.10 ^{**}	1.23-3.60	2.11 ^{**}	1.37-3.26	0.99	0.52-1.89
Alcohol-use Disorders	0.99	0.45-2.18	2.41 ^{***}	1.58-3.58	0.41 [*]	0.18-0.94
Nicotine Dependence	2.28 ^{**}	1.41-3.69	1.08	0.68-1.72	2.12 [*]	1.13-3.97
Drug-use Disorders	2.32 [*]	1.02-5.27	1.46	0.72-2.99	1.59	0.52-4.80
Prescription Drug-use Disorders	3.01 [*]	1.22-7.43	0.58	0.20-1.63	5.23 [*]	1.30-20.96
Illicit Drug-use Disorders	2.30	0.76-6.94	1.47	0.66-3.28	1.56	0.41-6.01
Model 2 ^b						
Any Substance-use Disorder ^c	2.16 ^{**}	1.26-3.69	1.97 ^{**}	1.28-3.04	1.09	0.57-2.10
Alcohol-use Disorders	1.02	0.47-2.19	2.20 ^{**}	1.39-3.48	0.46	0.20-1.07
Nicotine Dependence	2.00 ^{**}	1.24-3.22	0.95	0.58-1.53	2.11 [*]	1.11-4.03
Drug-use Disorders	1.82	0.78-4.21	1.01	0.47-2.19	1.79	0.56-5.73
Prescription Drug-use Disorders	1.79	0.67-4.78	0.30 [*]	0.10-0.88	5.94 [*]	1.38-25.65
Illicit Drug-use Disorders	1.83	0.57-5.89	0.91	0.37-2.26	2.00	0.47-8.49

For Wald F-test:

Notes:

ARPG, at-risk/problem gambling

OR, Odds Ratio; CI, Confidence Interval

* $p < .05$

** For Wald F-test: $p < .01$

*** For Wald F-test: $p < .001$;

^aModel includes only the main effects of gender, at-risk/problem gambling, and the interaction of gender and at-risk/problem gambling.

^bModel covariates include age, race/ethnicity, marital status, education, employment, household income, lifetime history of any Axis-II disorder, history of any past-year mood disorder, history of any past-year anxiety disorder, history of past-year alcohol-use disorders (for incident nicotine dependence and incident drug-use disorders), history of past-year nicotine dependence (for incident alcohol-use disorders and incident drug-use disorders), and history of past-year drug-use disorders (for incident alcohol-use disorders and incident nicotine dependence).

^cFor the combined outcome of any incident substance-use disorder, adjustment for baseline history of alcohol-use disorders, nicotine dependence, and drug-use disorders would be inappropriate because by definition, individuals with any of these disorders at baseline are excluded from the analysis. Thus, model covariates include age, race/ethnicity, marital status, education, employment, household income, lifetime history of any Axis-II disorder, history of any past-year mood disorder, and history of any past-year anxiety disorder.