

Relationships Between Problem-Gambling Severity and Psychopathology as Moderated by Income

RACHEL L. SANACORA^{1,2}, SETH W. WHITING^{3,4}, COREY E. PILVER⁵, RANI A. HOFF^{3,4} and MARC N. POTENZA^{1,4,6,7*}

¹Yale Child Study Center, Yale University School of Medicine, New Haven, CT, USA

²University of Connecticut, Storrs, CT, USA

³Department of Veterans Affairs, VISN 1 Mental Illness Research Education and Clinical Center, West Haven, CT, USA

⁴Department of Psychiatry, Yale University School of Medicine, New Haven, CT, USA

⁵Department of Biostatistics, Yale School of Public Health, New Haven, CT, USA

⁶Department of Neuroscience and the National Center on Addiction and Substance Abuse (CASAColumbia), Yale University School of Medicine, New Haven, CT, USA

⁷Connecticut Mental Health Center, Yale University School of Medicine, New Haven, CT, USA

(Received: December 1, 2015; revised manuscript received: May 12, 2016; accepted: May 15, 2016)

Background and aims: Problem and pathological gambling have been associated with elevated rates of both Axis-I and Axis-II psychiatric disorders. Although both problem gambling and psychiatric disorders have been reported as being more prevalent among lower income vs. middle/higher income groups, how income might moderate the relationship between problem-gambling severity and psychopathology is incompletely understood. To examine the associations between problem-gambling severity and psychopathology in lower income and middle/higher income groups. *Methods:* Data from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) ($n = 43,093$) were analyzed in adjusted logistic regression models to investigate the relationships between problem-gambling severity and psychiatric disorders within and across income groups. *Results:* Greater problem-gambling severity was associated with increased odds of multiple psychiatric disorders for both lower income and middle/higher income groups. Income moderated the association between problem/pathological gambling and alcohol abuse/dependence, with a stronger association seen among middle/higher income respondents than among lower income respondents. *Discussion and conclusions:* The findings that problem-gambling severity is related to psychopathology across income groups suggest a need for public health initiatives across social strata to reduce the impact that problem/pathological gambling may have in relation to psychopathology. Middle/higher income populations, perhaps owing to the availability of more “disposable income,” may be at greater risk for co-occurring gambling and alcohol-use psychopathology and may benefit preferentially from interventions targeting both gambling and alcohol use.

Keywords: income, problem gambling, psychiatric disorders, psychopathology, NESARC

INTRODUCTION

Problem/pathological gambling (PPG) is a significant public health concern. In addition to financial and relationship problems associated with PPG, high rates of comorbidity exist between PPG and many psychiatric disorders, suggesting complex contributions to negative outcomes associated with PPG. Multiple levels of problem-gambling severity (including low-risk, at-risk, and PPG) are associated with elevated rates of both Axis-I and Axis-II DSM-IV psychiatric disorders, with the strongest relationships typically observed with more severe gambling pathology (Barry, Stefanovics, Desai, & Potenza, 2011; Crockford & El-Guebaly, 1998; Cunningham-Williams, Cottler, Compton, & Spitznagel, 1998; Desai & Potenza, 2008). Nationally representative studies have shown that PPG is associated with a broad range of other negative health correlates including incarceration and poorer general health (Afifi, Cox, Martens, Sareen, & Enns, 2010b; Desai, Maciejewski,

Dausey, Daldarone, & Potenza, 2004; Welte, Barnes, Weiczorek, Tidwell, & Parker, 2002). In addition to health concerns, PPG has been correlated with socioeconomic status as indexed by annual family income. Data suggest that lower income as well as living in disadvantaged neighborhoods (a correlate of low income) correspond to the increased odds of PPG (Afifi, Cox, Martens, Sareen, & Enns, 2010a; Faregh & Derevensky, 2013). Gambling may represent a form of regressive taxation as people with lower incomes may spend higher proportions of their annual income on gambling as compared to those with middle/higher incomes (Schissel, 2001). This aspect warrants consideration, as people with gambling-related and other psychopathology are more likely to have lower incomes

* Corresponding author: Marc N. Potenza, MD, PhD; Yale University School of Medicine, Room 726, 1 Church St., New Haven, CT 06510, USA; Phone: +1 203 974 7356; Fax: +1 203 974 7366; E-mail: marc.potenza@yale.edu

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium for non-commercial purposes, provided the original author and source are credited.

(Greenberg & Bimbaum, 2005; Sareen, Afifi, McMillan, & Asmundson, 2011). For example, an increased likelihood of past-year personal mental health difficulty was observed in individuals with a household income lower than \$59,082 when compared to those with a household income above \$59,083 (Ennis & Bunting, 2013; Kessler et al., 2008). As both PPG and psychiatric disorders are more prevalent among lower income groups, situations may arise regarding difficulties in individuals' abilities to afford treatment for their illnesses and maintain stable jobs. Understanding the relationship between PPG and psychiatric disorders and how these may be moderated by income is thus important with respect to considering public health interventions. In particular, data suggest that income may moderate PPG and alcohol-use disorders. In a community-based survey of 2,638 adults in the United States, an odds ratio of 23.1 was observed between current pathological gambling and alcohol dependence; however, the odds ratio was even higher (odds ratio = 66) among individuals in the top third of the group based on socioeconomic status (Welte, Barnes, Wiczorek, Tidwell, & Parker, 2001).

This study was undertaken to explore how psychiatric disorders relate to problem-gambling severity in lower and middle/higher income groups and how these relationships may differ across income groups. Data from the first wave of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a nationally representative sample ($n = 43,093$), were used to examine these relationships, using reported annual family income to generate the lower income and middle/higher income groups. Based on the previous data displaying the relationships between problem-gambling severity and psychiatric disorders, it was hypothesized that in both lower income and middle/higher income groups, greater problem-gambling severity would be positively associated with Axis-I and Axis-II disorders. In addition, we hypothesized that income would moderate the associations between problem-gambling severity and psychiatric disorders such that the strengths of many of these relationships would be greater in lower income group vs. middle/higher income groups. However, we hypothesized that the relationship between problem-gambling severity and alcohol abuse/dependence would be stronger in the middle/higher income groups as compared to the lower income group, consistent with the previous findings (Welte et al., 2001).

METHODS

Sample

The NESARC study methodology has been described elsewhere (Desai & Potenza, 2008; Grant, Dawson, et al., 2003; Grant et al., 2004; Grant, Desai, & Potenza, 2009). Conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) and U.S. Census Bureau, the NESARC sampled U.S. residents (citizens and non-citizens) aged 18 years old and over living in non-institutionalized settings. Respondents were identified using multi-stage cluster sampling, where census sampling units, households, and then members of households were sampled in sequence. The sample was enhanced with members of group-living environments such as dormitories, group homes, shelters,

and facilities for housing workers. Jails, prisons, and hospitals were not included. The study oversampled black and Hispanic households and respondents aged 18–24 years old to have sufficient statistical power to examine the minority populations and young people, who may have otherwise been under-represented in a simple random sample. The final sample consisted of 43,093 respondents, representing an 81% response rate.

Measures

The Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM IV version (AUDADIS-IV; Grant, Dawson, et al., 2003; Ruan et al., 2008), a structured diagnostic assessment administered by trained lay interviewers, was used to make diagnoses regarding psychiatric disorders. The instrument has been repeatedly tested for reliability and validity and found to be a good measure for detecting psychiatric disorders in clinical and general population samples (Chatterji et al., 1997; Grant, Dawson, et al., 2003; Grant et al., 2004; Hasin, Carpenter, McCloud, Smith, & Grant, 1997).

The publicly accessible data from the NESARC contains variables that have synthesized self-report data from the AUDADIS-IV into diagnostic categories based upon DSM-IV criteria. The data contain diagnostic variables for major depression, dysthymia, mania and hypomania, panic disorder with and without agoraphobia, social phobia, simple phobia, generalized anxiety disorder, alcohol abuse, alcohol dependence, drug abuse, drug dependence, nicotine dependence, and pathological gambling (Grant, Kaplan, Shepard, & Moore, 2003). The instrument provides the ability to distinguish past-year diagnoses, prior to past-year diagnoses, and lifetime diagnoses, and includes exclusions for illness and substance-induced symptoms where appropriate. We utilized the past-year diagnoses with illness and substance exclusions, thereby making the diagnoses “primary” or independent diagnoses as defined by the DSM (Desai & Potenza, 2008). Past-year diagnoses are less susceptible to recall bias and allow for a more precise examination of psychiatric disorder temporal co-occurrence, because features of disorders will have been present within one year of each other.

The NESARC at wave 1 also assessed seven Axis-II personality disorders: antisocial, avoidant, dependent, histrionic, obsessive/compulsive, paranoid, and schizoid. Not every DSM-IV personality disorder was assessed due to subject burden and time constraints (Grant et al., 2004). Because the Axis-II disorders were assumed to be temporally stable constructs, no time periods were applied. Respondents were asked about how they felt or acted most of the time throughout their lives regardless of situation. The assessments followed DSM-IV diagnostic criteria. To meet the criteria, respondents had to endorse the required number of symptoms as well as report that at least one of the symptoms had caused significant social dysfunction (Grant et al., 2004).

Problem-gambling-severity groupings were based on the 10 diagnostic inclusionary criteria for pathological gambling. Five or more inclusionary symptoms are required for a DSM-IV diagnosis of pathological gambling (Desai & Potenza, 2008). Given data suggest that problem-gambling severity as defined by DSM criteria lies along a spectrum (Slutske et al., 2000, 2001; Toce-Gerstein,

Gerstein, & Volberg, 2003), we divided the sample into four groups as previously done (Desai & Potenza, 2008; Grant et al., 2009): non-gambling and low-frequency gambling (non-/LF gambling; individuals who reported that they had never gambled more than five times in a single year in their lifetime); low-risk gambling (individuals who reported gambling more than five times in a year but with no inclusionary criteria for pathological gambling in the previous year); at-risk gambling (individuals who reported one or two inclusionary criteria for pathological gambling in the previous year); and problem/pathological gambling (PPG; those who reported three or more inclusionary criteria for pathological gambling in the previous year). The divisions of low-risk, at-risk, and PPG are identical to those recently used in population-based samples of gamblers (Desai & Potenza, 2008; Grant et al., 2009), with the low frequency of pathological gambling (five or more inclusionary criteria, less than 1% of the sample) necessitating the combination of individuals with problem or pathological gambling, as done in prior studies (Cunningham-Williams et al., 1998; Slutske et al., 2000, 2001).

Annual family income was used to stratify respondents into two groups: lower income and middle/higher income. The lower income group was defined as having an annual family income of less than \$24,000, while middle/higher income was \$24,000 or more. This threshold is similar to that used previously to examine the factors relating to income differences and recreational gambling (Barry, Maciejewski, Desai, & Potenza, 2007). Other variables utilized in the analyses include self-reported gender, age in years, race/ethnicity (black, Hispanic, and white), education, current employment, and marital status. Race/ethnicity categories were non-mutually exclusive because respondents could endorse more than one category.

Data analyses

The primary research questions concerned the associations between past-year problem-gambling severity and psychiatric disorders among lower income and middle/higher income

groups. To investigate, we first examined the association between problem-gambling severity and other sociodemographic variables among lower income (Figure 1a) and middle/higher income groups (Figure 1b) to identify sociodemographic variables potentially influencing the relationship between income, problem-gambling severity, and psychiatric disorders. Finally, we fit a series of logistic regression models where psychiatric variables were the dependent variables of interest and the four-level problem-gambling-severity variable, income, and an interaction between income and problem-gambling severity were the independent variables of interest, adjusting for previously identified sociodemographic variables.

Ethics

All respondents gave written consent to participate in the NESARC. This study used de-identified data and thus was exempted from further IRB review.

RESULTS

Sociodemographics by income and problem-gambling severity

Of the 43,093 respondents from the NESARC survey, 16,016 people were classified as lower income (37.17%). Compared to the middle/higher income groups, the lower income group was significantly more likely to be female, older, unemployed, single, black, or Hispanic, and have a lower education level (Table 1). Lower income and middle/higher income respondents differed on problem-gambling severity with the lower income vs. middle/higher income groups showing the largest disparities mainly on non-/LF and low-risk levels of problem-gambling severity: non-/LF gambling (77.17% vs. 71.32%), low-risk gambling (20.14% vs. 25.81%), at-risk gambling (2.12% vs. 2.32%), and PPG (0.57% vs. 0.55%; Table 2).

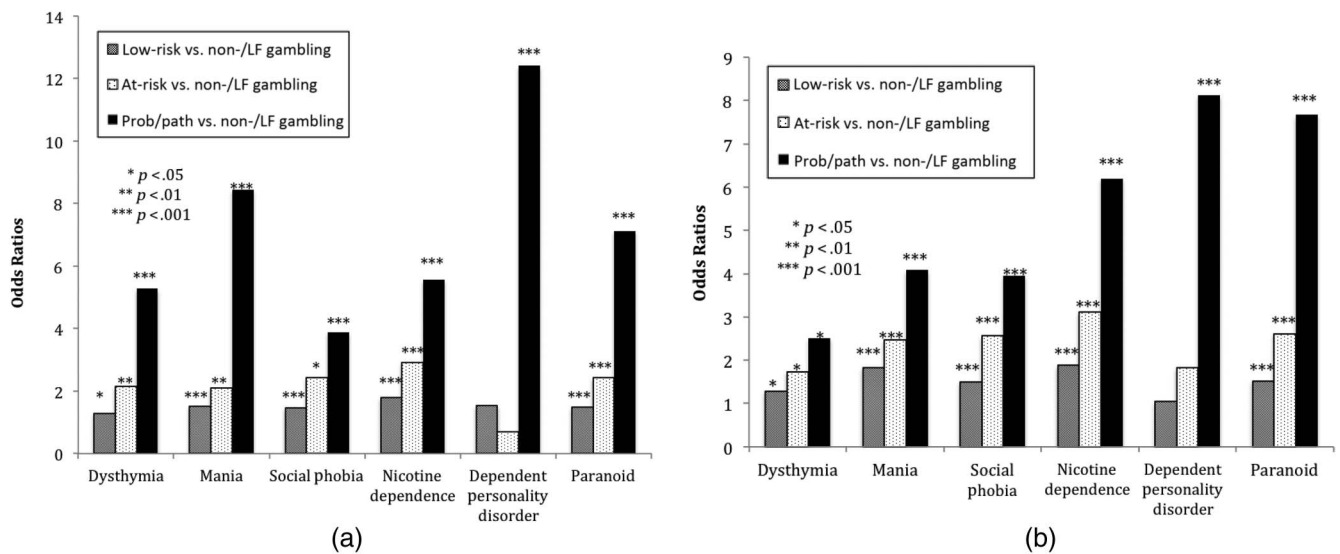


Figure 1. (a) Association between problem-gambling severity and selected psychiatric disorders in the lower income group. (b) Association between problem-gambling severity and selected psychiatric disorders in the middle/higher income groups

Table 1. Sociodemographic characteristics of the NESARC sample by income

Characteristic	Lower income (<i>n</i> = 16,016) <i>n</i> (%)	Middle/higher income (<i>n</i> = 27,077) <i>n</i> (%)	χ^2	<i>p</i>
Gender				
Male	5,672 (35.41)	12,846 (47.44)	594.09	<.0001
Female	10,344 (64.59)	14,231 (52.56)		
Education				
Less than high school	5,293 (33.05)	2,556 (9.44)	5,694.03	<.0001
High school graduate	5,349 (33.40)	7,198 (26.58)		
Some college	3,945 (24.63)	8,718 (32.20)		
College or higher	1,429 (8.92)	8,605 (31.78)		
Employment				
Full time	4,702 (29.36)	17,565 (64.87)	5,334.51	<.0001
Part time	1,869 (11.67)	2,394 (8.84)		
Not working	9,445 (58.97)	7,118 (26.29)		
Marital status				
Married	5,038 (31.46)	17,043 (62.94)	4,183.91	<.0001
Previously married	6,291 (39.28)	4,826 (17.82)		
Never married	4,687 (29.26)	5,208 (19.23)		
White race	11,223 (70.07)	21,566 (79.65)	506.93	<.0001
Black race	4,138 (25.84)	4,462 (16.48)	551.66	<.0001
Hispanic ethnicity	3,623 (22.62)	4,685 (17.30)	182.92	<.0001
	<i>n</i> (mean)	<i>n</i> (mean)	<i>t</i>	<i>p</i>
Age in years	16,016 (49.73)	27,077 (44.43)	874.17	<.0001

Note. *n* represents the actual number of respondents in each category; % indicates the weighted percentages.

In Table 2, the sociodemographic characteristics of the groups are presented by problem-gambling severity among lower income and middle/higher income groups. For both lower income and middle/higher income respondents, problem-gambling severity was significantly related to gender, education, marital status, race/ethnicity, and age. In both the income groups, males and individuals with lower education levels were found more frequently in the higher problem-gambling-severity groups. There was also a significant relationship with marital status, with a relatively fewer married individuals reporting higher problem-gambling severity. For both income groups, there was a relationship between race/ethnicity and problem-gambling severity with higher proportions of black individuals and lower proportions of white and Hispanic individuals reporting higher problem-gambling severity (particularly, PPG). Age was also associated with problem-gambling severity in both income groups, with the PPG group being youngest within each income group.

Psychiatric disorders, income level, and severity of gambling pathology

Consistent with the previous NESARC studies (Affi et al., 2010a; Barry et al., 2011), rates of psychiatric disorders were highest among respondents with lower incomes (Supplementary Table S1) and greater problem-gambling severity (Table 3 and Supplementary Table S2). The average numbers of Axis-I diagnoses increased with increasing problem-gambling severity in both the lower income and

middle/higher income groups (Supplementary Table S3). Logistic regression models examined the relationships between problem-gambling severity and psychopathology among lower income and middle/higher income respondents, and how income might moderate the relationships (Table 4). In both the income groups and in comparison with their respective low-frequency/non-gambling groups, elevated odds in both income groups between low-risk gambling, at-risk gambling, and PPG; and most Axis-I and Axis-II disorders were observed with odds typically higher with increasing problem-gambling severity (Table 4). An interaction between income group and PPG significant at $p < .01$ was observed for alcohol abuse/dependence, indicating a stronger relationship between PPG and alcohol abuse/dependence in the middle/higher income group as compared to the lower income group (Figure 2).

DISCUSSION AND CONCLUSIONS

This is the first study to the author's knowledge to examine the association between income, problem-gambling severity, and a broad range of Axis-I and Axis-II psychopathology in a national sample. The significant relationships between problem-gambling severity and psychopathology for both lower income and middle/higher income respondents, as hypothesized, suggest a need for public health interventions across social strata to reduce the impact that greater problem-gambling severity may have with respect to psychopathology.

Table 2. Sociodemographic characteristics of the NESARC sample by income and problem-gambling severity

Characteristic	Lower income				Middle/higher income				χ^2	<i>p</i>
	Non-/LF gambling ^a (n = 12,002, 77.17%)	Low-risk gambling (n = 3,132, 20.14%)	At-risk gambling (n = 330, 2.12%)	Problem/pathological gambling (n = 88, 0.57%)	Non-/LF gambling ^a (n = 18,883, 71.32%)	Low-risk gambling (n = 6,832, 25.81%)	At-risk gambling (n = 615, 2.32%)	Problem/pathological gambling (n = 145, 0.55%)		
Gender										
Male	32.36	44.86	46.36	46.59	42.99	57.46	62.28	63.45	494.36	<.0001
Female	67.64	55.14	53.64	53.41	57.01	42.54	37.72	36.55		
Education										
Less than high school	33.99	29.41	32.42	34.09	9.73	8.14	12.03	12.41	112.56	<.0001
High school graduate	32.78	36.05	31.82	37.5	25.83	27.96	31.06	32.41		
Some college	24.11	26.09	29.70	22.73	31.16	34.95	34.47	35.17		
College or higher	9.12	8.46	6.06	5.68	33.28	27.98	22.44	20.00		
Employment										
Full time	29.28	28.77	33.33	35.23	64.24	65.68	68.13	68.97	13.36	.0376
Part time	11.89	10.41	13.64	9.09	9.12	8.37	7.8	11.72		
Not working	58.83	60.82	53.03	55.68	26.64	25.95	24.07	19.31		
Marital status										
Married	32.21	30.04	26.67	30.68	62.81	65.44	56.59	44.83	82.75	<.0001
Previously married	37.87	44.99	36.97	30.68	17.4	18.46	19.19	22.76		
Never married	29.92	24.97	36.36	38.64	19.78	16.1	24.23	32.41		
White race ^b	70.36	71.04	63.03	51.14	79.57	80.43	78.54	65.52	20.97	.0001
Black race	25.36	25.54	33.03	44.32	16.21	16.69	18.21	27.59	15.58	.0014
Hispanic ethnicity	24.99	15.74	14.24	11.36	18.79	13.36	15.77	14.48	105.29	<.0001
Age in years ^c	49.09	53.03	45.55	40.99	43.62	46.71	43.47	41.25	68.29	<.0001

Note. Non-/LF gambling = non- or low-frequency gambling.

^aNumbers represent the weighted percentages, stratified by income. ^bRace and ethnicity categories are not mutually exclusive. ^cNumbers represent the weighted mean values, stratified by income.

Table 3. Rates of psychiatric disorders in the NESARC data by income and problem-gambling severity

Diagnosis	Lower income					Middle/higher income				
	Non-/LF gambling	Low-risk gambling (OR)	At-risk gambling (OR)	Problem/pathological gambling (OR)	χ^2 p	Non-/LF gambling	Low-risk gambling (OR)	At-risk gambling (OR)	Problem/pathological gambling (OR)	χ^2 p
Major depression	8.43	9.45 (1.13)	16.36 (2.13)	17.05 (2.23)	34.41 <.0001	6.44	6.03 (0.93)	9.27 (1.48)	20.00 (3.63)	54.00 <.0001
Dysthymia	2.74	3.26 (1.19)	4.55 (1.69)	6.82 (2.60)	10.44 .0152	1.31	1.48 (1.13)	2.60 (2.02)	6.21 (4.99)	31.95 <.0001
Mania	2.02	3.13 (1.57)	5.15 (2.64)	9.09 (4.86)	42.87 <.0001	1.17	1.54 (1.32)	2.44 (2.11)	9.66 (9.02)	87.51 <.0001
Hypomania	1.17	1.21 (1.04)	4.85 (4.32)	2.27 (1.97)	35.77 <.0001	0.85	1.32 (1.55)	3.90 (4.72)	3.45 (4.15)	67.47 <.0001
Panic disorder ^a	2.57	3.00 (1.17)	7.88 (3.24)	6.82 (2.77)	39.24 <.0001	1.62	1.96 (1.22)	3.90 (2.47)	5.52 (3.55)	31.41 <.0001
Social phobia	2.71	3.74 (1.39)	6.67 (2.57)	10.23 (4.10)	39.76 <.0001	2.29	2.88 (1.27)	3.74 (1.66)	10.34 (4.93)	47.70 <.0001
Simple phobia	6.89	9.87 (1.48)	14.55 (2.30)	20.45 (3.48)	73.37 <.0001	6.43	8.06 (1.28)	12.52 (2.08)	18.62 (3.33)	79.23 <.0001
Generalized anxiety	2.52	3.13 (1.25)	5.15 (2.10)	10.23 (4.42)	29.75 <.0001	1.68	1.90 (1.13)	1.95 (1.16)	5.52 (3.41)	13.34 .004
Alcohol ab/dep	5.67	9.32 (1.71)	19.09 (3.93)	37.55 (9.99)	262.83 <.0001	6.43	11.39 (1.87)	21.79 (4.06)	25.52 (4.99)	380.75 <.0001
Nicotine dep	11.06	18.71 (1.85)	30.61 (3.55)	47.73 (7.35)	309.54 <.0001	8.65	14.37 (1.77)	23.25 (3.20)	37.24 (6.27)	389.83 <.0001
Drug ab/dep	1.88	3.19 (1.72)	7.58 (4.27)	4.55 (2.48)	63.70 <.0001	1.23	2.06 (1.69)	4.07 (3.41)	8.28 (7.25)	93.16 <.0001
Personality disorders										
Avoidant	3.21	2.81 (0.87)	6.06 (1.95)	12.5 (4.31)	34.33 <.0001	1.79	1.70 (0.95)	3.41 (1.94)	9.66 (5.87)	58.28 <.0001
Dependent	0.84	0.77 (0.91)	1.52 (1.81)	6.82 (8.62)	38.00 <.0001	0.24	0.31 (1.26)	0.16 (0.67)	2.76 (11.62)	34.21 <.0001
Antisocial	2.99	5.33 (1.83)	13.64 (5.12)	25.00 (10.81)	236.34 <.0001	2.21	4.93 (2.30)	7.48 (3.58)	16.55 (8.78)	252.00 <.0001
Obsessive-compulsive	6.33	8.21 (1.32)	16.97 (3.02)	25.00 (4.93)	108.77 <.0001	7.19	9.70 (1.39)	15.61 (2.39)	31.72 (6.00)	198.13 <.0001
Paranoid	6.11	7.73 (1.29)	15.15 (2.75)	36.36 (8.79)	171.09 <.0001	3.50	4.39 (1.27)	8.13 (2.44)	22.07 (7.82)	168.16 <.0001
Schizoid	3.73	4.47 (1.21)	7.58 (2.11)	22.73 (7.59)	93.62 <.0001	2.68	3.41 (1.28)	5.85 (2.26)	10.34 (4.19)	54.97 <.0001
Histrionic	2.00	2.30 (1.15)	7.27 (3.84)	14.77 (8.50)	104.32 <.0001	1.42	2.02 (1.43)	5.20 (3.80)	13.10 (10.43)	167.71 <.0001

Note. ab/dep = abuse or dependence; Non-/LF gambling = non- or low-frequency gambling; OR = odds ratio.

^aWith or without agoraphobia.

Table 4. Adjusted odds ratios for psychiatric disorders in the NESARC data

Diagnosis	Lower income			Middle/higher income			Lower vs. middle/higher income		
	OR for low-risk vs. non-/LF gambling	OR for at-risk vs. non-/LF gambling	OR for problem/pathological vs. non-/LF gambling	OR for low-risk vs. non-/LF gambling	OR for at-risk vs. non-/LF gambling	OR for problem/pathological vs. non-/LF gambling	Low-risk gambling	At-risk gambling	Problem/pathological gambling
Any Axis-I disorder	1.722***	3.185***	7.73***	1.815***	3.302***	10.308***	0.949	0.965	0.750
Any mood disorder	1.248***	2.162***	5.226***	1.336***	2.627***	3.079***	0.935	0.823	1.697
Major depression	1.105	1.639***	3.951***	1.294***	2.177***	2.174***	0.854	0.753	1.817
Dysthymia	1.294*	2.154**	5.280***	1.291*	1.737*	2.517*	1.002	1.240	2.098
Mania	1.515***	2.092***	8.445***	1.837***	2.468***	4.080***	0.825	0.848	2.070
Hypomania	1.817***	4.631***	3.460***	1.268	3.932	1.594	1.432	1.178	2.171
Any anxiety disorder	1.448	2.131***	3.603***	1.536***	2.431***	3.755***	0.943	0.877	0.960
Panic disorder	1.416**	2.858***	4.186***	1.311*	3.387***	2.766*	1.081	0.844	1.514
Social phobia	1.383***	1.727*	5.269***	1.499***	2.560***	3.955***	0.922	0.675	1.332
Simple phobia	1.465***	2.434***	3.893***	1.669***	2.421***	3.521***	0.878	1.005	1.106
Generalized anxiety	1.322**	1.318	3.839***	1.376**	2.194**	4.523***	0.961	0.601	0.849
Any substance-use disorder	1.907***	3.455***	5.904***	1.973***	3.614***	8.994***	0.967	0.956	0.656**
Alcohol ab/dep	1.952***	3.579***	3.892***	1.845***	3.508***	9.898***	1.051	1.020	0.393**
Nicotine dep	1.787***	2.909***	5.567***	1.877***	3.110***	6.201***	0.952	0.935	0.898
Drug ab/dep	1.892***	2.689***	4.779***	1.995***	3.512***	1.764	0.948	0.766	2.709
Any Axis-II disorder	1.56***	2.725***	7.208***	1.54***	2.901***	7.361***	1.013	0.939	0.979
Any cluster A disorder	1.433***	2.237***	4.946***	1.422***	2.356***	6.918***	1.008	0.949	0.715
Paranoid	1.479***	2.432***	7.124***	1.523***	2.611***	7.676***	0.971	0.931	0.928
Schizoid	1.369***	2.165***	3.681***	1.301**	1.954**	6.419***	1.052	1.108	0.574
Any cluster B disorder	2.062***	3.118***	8.285***	1.768***	4.125***	9.026***	1.167	0.756	0.918
Antisocial	2.264***	3.126***	6.820***	1.922***	4.312***	8.445***	1.203	0.665	0.789
Histrionic	1.589***	3.590***	8.638***	1.290	3.427***	6.957***	1.232	1.047	1.242
Any cluster C disorder	1.381***	2.332***	5.537***	1.281***	2.559***	4.441***	1.078	0.911	1.247
Avoidant	1.080	1.971**	5.862***	0.975	1.892**	3.946***	1.107	1.042	1.486
Dependent	1.526***	0.692	12.401***	1.056	1.820	8.132***	1.444	0.380	1.526
Obsessive-compulsive	1.422***	2.452***	6.112***	1.339***	2.874***	4.562***	1.062	0.853	1.340

Note. OR are adjusted for age, race/ethnicity, marital status, education, employment, and gender. ab/dep = abuse or dependence; Non-/LF gambling = non- or low-frequency gambling. * $p < .05$; ** $p < .01$; *** $p < .001$.

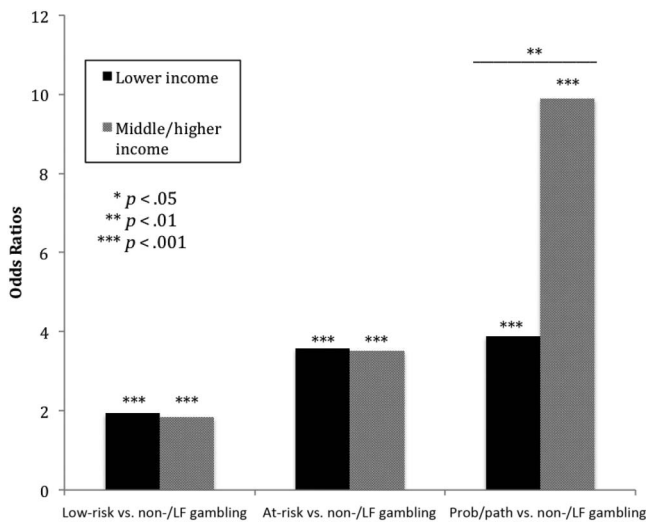


Figure 2. Income moderates the association between problem-gambling severity and alcohol abuse/dependence

In contrast to the anticipated greater strength between problem-gambling severity and psychopathology in the lower income vs. middle/higher income group, largely similar patterns were observed across income groups. The most robust statistical difference indicated a stronger relationship between alcohol abuse/dependence and PPG in the middle/higher income groups as compared to the lower income group. This finding resonates with that from a prior study in the United States using an independent sample that similarly indicated a stronger relationship between alcohol-use problems and gambling problems in higher vs. lower income groups. Specifically in that study, the relationship between pathological gambling and alcohol dependence was approximately three-fold higher in middle vs. lower income groups and ninefold higher in higher vs. lower income groups (Welte et al., 2001). Findings from these studies raise the possibility that availability of “disposable income” may influence the relationship between problems with gambling and alcohol. As alcohol consumption has been shown to increase gambling (Kyngdon & Dickerson, 1999; Potenza, Steinberg, & Wu, 2005), it suggests that alcohol’s impact on gambling problems may be particularly relevant to middle/higher income groups, although this possibility warrants further investigation. Additional research is needed to investigate whether this relationship may be linked to specific forms of gambling or gambling venues (e.g., to casinos or bars, environments in which alcohol may be readily available and sometimes provided for free to individuals who are gambling). Other factors that have been linked to gambling problems also warrant further investigation; for example, neighborhood disadvantage has been linked to gambling problems in different ways than to alcohol-use problems despite their co-occurrence (Barnes, Welte, Tidwell, & Hoffman, 2013). Future studies might also consider the addition of genetic assessments given that gambling and alcohol-use disorders are linked by both shared environmental and genetic factors (Slutske et al., 2000).

This study has multiple limitations including the cross-sectional nature, which precludes causal inferences, self-report information which may be subject to recall bias, and the relatively small proportion of individuals with pathological gambling that prompted the PPG grouping. Nonetheless, strengths of the study include the large, representative sample and the assessment of formal DSM-based diagnoses, albeit based on DSM-IV rather than DSM-5 criteria.

In conclusion, these analyses of the NESARC data suggest that problem-gambling severity is associated with psychopathology across income groups. As such, public health considerations with respect to lessening the relationship between problem-gambling severity and psychopathology should include those targeting both lower income and higher income groups. The finding of a stronger relationship between PPG and alcohol abuse/dependence among middle/higher income respondents as compared to lower income respondents suggests the need for further investigation into this relationship, with prevention and policy interventions warranting consideration based on the findings.

Funding sources: This work was supported in part by the Veterans Administration, the National Center for Responsible Gaming, the National Center on Addiction and Substance Abuse (CASAColumbia), the Connecticut Department of Mental Health and Addiction Services, and the NIH under Grant T32 MH014235. The funding agencies did not provide input into the content of the manuscript beyond the grant funding.

Authors’ contribution: RLS was responsible for writing the first draft of this manuscript. She also contributed to the interpretation of the data. SWW was responsible for the interpretation of the data. CEP and RAH were responsible for statistical analysis and the interpretation of the data. MNP was responsible for the conception of the research questions and the interpretation of the data. All authors provided input into the text of the manuscript and approved the submitted version.

Conflict of interest: The authors report no conflict of interests with respect to the content of this manuscript. Dr. M. N. Potenza has received the financial support or compensation for the following: He has consulted for Ironwood, Lundbeck, Shire, INSYS, RiverMend Health, and Opiant/Lakelight Therapeutics; has received the research support from Mohegan Sun Casino, the National Center for Responsible Gaming, and Pfizer pharmaceuticals; has participated in surveys, mailings, or telephone consultations related to drug addiction, impulse control disorders, or other health topics; has consulted for law offices and gambling entities on issues related to impulse control disorders; provides clinical care in the Connecticut Department of Mental Health and Addiction Services Problem Gambling Services Program; has performed grant reviews for the National Institutes of Health and other agencies; has guest-edited journal sections; has given academic lectures in

grand rounds, CME events, and other clinical or scientific venues; and has generated books or book chapters for publishers of mental health texts.

REFERENCES

- Affi, T. O., Cox, B. J., Martens, P. J., Sareen, J., & Enns, M. W. (2010a). Demographic and social variables associated with problem gambling among men and women in Canada. *Psychiatry Research, 178*, 395–400. doi:10.1016/j.psychres.2009.10.003
- Affi, T. O., Cox, B. J., Martens, P. J., Sareen, J., & Enns, M. W. (2010b). The relationship between problem gambling and mental and physical health correlates among a nationally representative sample of Canadian women. *Canadian Journal of Public Health, 101*, 171–175.
- Barnes, G., Welte, J., Tidwell, M., & Hoffman, J. (2013). Effects of neighborhood disadvantage on problem gambling and alcohol abuse. *Journal of Behavioral Addictions, 2*, 82–89. doi:10.1556/JBA.2.2013.004
- Barry, D. T., Maciejewski, P., Desai, R., & Potenza, M. (2007). Income differences and recreational gambling. *Journal of Addiction Medicine, 1*, 145–153. doi:10.1097/ADM.0b013e318125088f
- Barry, D. T., Stefanovics, E. A., Desai, R. A., & Potenza, M. N. (2011). Gambling problem severity and psychiatric disorders among Hispanic and white adults: Findings from a nationally representative sample. *Journal of Psychiatric Research, 45*, 404–411. doi:10.1016/j.jpsychires.2010.07.010
- Chatterji, S., Saunders, J. B., Vrsti, R., Grant, B. F., Hasin, D. S., & Mager, D. (1997). The reliability of the Alcohol Use Disorders and Associated Disabilities Interview Schedule-Alcohol/Drug-Revised (AUDADIS-ADR) in India, Romania, and Australia. *Drug and Alcohol Dependence, 47*, 171–185. doi:10.1016/S0376-8716(97)00088-4
- Crockford, D. N., & El-Guebaly, N. (1998). Psychiatric comorbidity in pathological gambling: A critical review. *Canadian Journal of Psychiatry, 43*, 43–50. doi: 10.1177/070674379804300104
- Cunningham-Williams, R. M., Cottler, L. B., Compton, W. M., & Spitznagel, E. L. (1998). Taking chances: Problem gamblers and mental health disorders – Results from the St. Louis Epidemiologic Catchment Area Study. *American Journal of Public Health, 88*, 1093–1096. doi:10.2105/AJPH.88.7.1093
- Desai, R. A., Maciejewski, P. K., Dausey, D., Caldarone, B. J., & Potenza, M. N. (2004). Health correlates of recreational gambling in older adults. *American Journal of Psychiatry, 161*, 1672–1679. doi:10.1176/appi.ajp.161.9.1672
- Desai, R. A., & Potenza, M. N. (2008). Gender differences in the association between gambling problems and psychiatric disorders. *Social Psychiatry and Psychiatric Epidemiology, 43*, 173–183. doi:10.1007/s00127-007-0283-z
- Ennis, E., & Bunting, B. P. (2013). Family burden, family health and personal mental health. *BMC Public Health, 13*, 255. doi:10.1186/1471-2458-13-255
- Faregh, N., & Derevensky, J. (2013). Epidemiology of gambling in a Canadian community. *Community Mental Health Journal, 49*, 230–235. doi:10.1007/s10597-012-9540-z
- Grant, B. F., Dawson, D. A., Stinson, F. S., Chou, P. S., Kay, W., & Pickering, R. (2003). The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): Reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. *Drug and Alcohol Dependence, 71*, 7–16. doi:10.1016/S0376-8716(03)00070-X
- Grant, B. F., Kaplan, K., Shepard, J., & Moore, T. (2003). *Source and accuracy statement for wave 1 of the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions*. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.
- Grant, B. F., Stinson, F. S., Dawson, D. A., Chou, S. P., Dufour, M. C., Compton, W., Pickering, R. P., & Kaplan, K. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry, 61*, 807–816. doi:10.1001/archpsyc.61.8.807
- Grant, J. E., Desai, R. A., & Potenza, M. N. (2009). Relationship of nicotine dependence, subsyndromal and pathological gambling, and other psychiatric disorders: Data from the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of Clinical Psychiatry, 70*, 334–343. doi:10.4088/JCP.08m04211
- Greenberg, P. E., & Birnbaum, H. G. (2005). The economic burden of depression in the US: Societal and patient perspectives. *Expert Opinion on Pharmacotherapy, 6*, 369–376. doi:10.1517/14656566.6.3.369
- Hasin, D., Carpenter, K. M., McCloud, S., Smith, M., & Grant, B. F. (1997). The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): Reliability of alcohol and drug modules in a clinical sample. *Drug and Alcohol Dependence, 44*, 133–141. doi:10.1016/S0376-8716(97)01332-X
- Kessler, R. C., Heeringa, S., Lakoma, M. D., Petukhova, M., Rupp, A. E., Schoenbaum, M., Wang, P. S., & Zaslavsky, A. M. (2008). Individual and societal effects of mental disorders on earnings in the United States: Results from the national comorbidity survey replication. *American Journal of Psychiatry, 165*, 703–711. doi:10.1176/appi.ajp.2008.08010126
- Kyngdon, A., & Dickerson, M. (1999). An experimental study of the effect of prior alcohol consumption on a simulated gambling activity. *Addiction, 94*, 697–707. doi:10.1046/j.1360-0443.1999.9456977.x
- Potenza, M. N., Steinberg, M. A., & Wu, R. (2005). Characteristics of gambling helpline callers with self-reported gambling alcohol use problems. *Journal of Gambling Studies, 21*, 233–254. doi:10.1007/s10899-005-3098-4
- Ruan, W. J., Goldstein, R. B., Chou, S. P., Smith, S. M., Saha, T. D., Pickering, R. P., Dawson, D. A., Huang, B., Stinson, F. S., & Grant, B. F. (2008). The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): Reliability of new psychiatric diagnostic modules and risk factors in a general population sample. *Drug and Alcohol Dependence, 92*, 27–36. doi:10.1016/j.drugalcdep.2007.06.001
- Sareen, J., Affi, T., McMillan, K., & Asmundson, G. (2011). Relationship between household income and mental disorders: Findings from a population-based longitudinal study.

- Archives of General Psychiatry*, 68, 419–427. doi:[10.1001/archgenpsychiatry.2011.15](https://doi.org/10.1001/archgenpsychiatry.2011.15)
- Schissel, B. (2001). Betting against youth: The effects of socioeconomic marginality on gambling among young people. *Youth & Society*, 32, 473–491. doi:[10.1177/0044118X01032004004](https://doi.org/10.1177/0044118X01032004004)
- Slutske, W. S., Eisen, S., True, W. R., Lyons, M. J., Goldberg, J., & Tsuang, M. (2000). Common genetic vulnerability for pathological gambling and alcohol dependence in men. *Archives of General Psychiatry*, 57, 666–673. doi:[10.1001/archpsyc.57.7.666](https://doi.org/10.1001/archpsyc.57.7.666)
- Slutske, W. S., Eisen, S., Xian, H., True, W. R., Lyons, M. J., Goldberg, J., & Tsuang, M. (2001). A twin study of the association between pathological gambling and antisocial personality disorder. *Journal of Abnormal Psychology*, 110, 297–308. doi:[10.1037/0021-843X.110.2.297](https://doi.org/10.1037/0021-843X.110.2.297)
- Toce-Gerstein, M., Gerstein, D. R., & Volberg, R. A. (2003). A hierarchy of gambling disorders in the community. *Addiction*, 98, 1661–1672. doi:[10.1111/add.2003.98.issue-12](https://doi.org/10.1111/add.2003.98.issue-12)
- Welte, J., Barnes, G. M., Wieczorek, W. F., Tidwell, M.-C., & Parker, J. (2001). Alcohol and gambling pathology among U.S. adults: Prevalence, demographic patterns and comorbidity. *Journal of Studies on Alcohol*, 62, 706–712. doi:[10.15288/jsa.2001.62.706](https://doi.org/10.15288/jsa.2001.62.706)
- Welte, J., Barnes, G. M., Wieczorek, W. F., Tidwell, M.-C., & Parker, J. (2002). Gambling participation in the U.S.: Results from a national survey. *Journal of Gambling Studies*, 18, 313–337. doi:[10.1023/A:1021019915591](https://doi.org/10.1023/A:1021019915591)