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Socio-economic status and problem alcohol use: the positive relationship between income and the DSM-IV alcohol abuse diagnosis

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Abstract

Aims—Epidemiological evidence indicates a positive relationship between income and the prevalence of alcohol abuse in the general population, but an inverse relationship between income and alcohol dependence. Among those with a diagnosis of alcohol abuse, the most prevalent criterion is hazardous use, which commonly requires sufficient resources to own or access a car. The present study investigated whether the association between income and the prevalence of current alcohol abuse is accounted for by the hazardous use criterion; specifically, the drinking and driving symptoms of the hazardous use criterion.

Design—Face-to-face survey conducted in the 2001–02 National Epidemiologic Survey on Alcohol and Related Conditions, interviewed with the Alcohol Use Disorders and Associated Disabilities Interview 4th edition (AUDADIS-IV).

Setting—The United States and District of Columbia, including Alaska and Hawaii.

Participants—Household and group-quarters residents aged >18 years. Life-time dependence cases were excluded (n = 4781).

Measurements—Income was defined as past-year personal income. Outcomes were specific alcohol abuse criteria and symptom questions. Logistic regressions were performed controlling for demographics. The relationship between alcohol abuse severity indicators and income was modeled using polytomous regression.

Findings—Among the alcohol abuse criteria, hazardous use is the most prevalent and the only criterion to have a significant positive relationship with income (F = 20.3, df = 3, P < 0.0001). Among the hazardous use symptoms, driving after drinking (F = 13.0, df = 3, P < 0.0001) and driving while drinking (F = 9.2, df = 3, P < 0.0001) were related positively to income.

Conclusions—Because hazardous use is the most commonly endorsed criterion of alcohol abuse, the link with income raises questions about whether the current alcohol abuse diagnosis can capture the full range of alcohol abusers in every socio-economic class. While many psychiatric disorders exhibit an inverse relationship with socioeconomic status, a selection bias may cause the

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alcohol abuse diagnosis to have an artificially positive relationship with income due to the necessity for access to a vehicle to be diagnosed.

Keywords

Alcohol abuse; drinking and driving; hazardous use; socio-economic status

INTRODUCTION

A consistent finding in the medical literature, including psychiatric epidemiology, is that lower socio-economic status (SES) is associated with psychiatric illness [1–3]. Several studies have shown that rates of DSM-IV-diagnosed alcohol dependence are higher in lower SES groups [4–6]. In contrast, evidence is emerging that DSM-IV-diagnosed alcohol abuse is associated positively with higher SES, e.g. higher income in adults [4,5] and educational achievement in college-aged young adults [7]. A positive relationship between SES indicators and a psychiatric disorder is relatively unique in general population samples. The reasons that SES shows a different relationship with alcohol dependence compared with alcohol abuse have not been investigated previously. This is an important issue to address; if alcohol abuse and dependence have validly opposite relationships with SES, it implies different competing risk factors for the development of each disorder. If, however, the opposite relationships are an artifact, the factors giving rise to the relationship should be redressed.

One possible explanation of this positive relationship lies in the nature of the DSM-IV criteria for an alcohol abuse diagnosis. DSM-IV includes four criteria: (i) hazardous use of alcohol; (ii) failure to fulfill major role obligations associated with drinking; (iii) interpersonal problems associated with drinking; and (iv) legal problems associated with drinking. An alcohol abuse diagnosis is made if one or more of these criteria are met, provided that the individual has never met criteria for alcohol dependence [8]. In the general population, DSM-IV alcohol abuse is often (64%) diagnosed on the basis of meeting the hazardous use criterion alone [9,10]. An array of hazardous behaviors falls under this rubric (e.g. swimming, using machinery, walking in a dangerous area or around heavy traffic after drinking). However, the most common way to meet this criterion is driving a vehicle under the influence of alcohol [9].

In DSM-IV, as well as in the previous DSMs that included specific diagnostic criteria (e.g. DSM-III and DSM-III-R), diagnostic criteria were defined as far as possible to be context- and culture-free (DSM-IV introduction, p. 33 [8]). Accordingly, most DSM-IV symptoms are either physiological symptoms or else behaviors that are not conditioned on a particular SES for their occurrence. While such symptoms and behaviors may be associated with a particular SES due to a concentration of risk factors in that status, the symptoms or behaviors could occur at any socio-economic level. The driving–drinking symptom of alcohol abuse departs from this context-free intent in an important way, in that individuals most often must either have sufficient financial resources to own a motor vehicle or have access to someone with such resources. Previous studies have indicated a relationship between higher educational attainment and driving after drinking in both adolescents [11] and adults [12,13]. Thus, alcohol abuse might have a positive relationship with income because those in higher income categories have the economic means to use alcohol in the hazardous manner defined by the criterion. If so, this would imply reconsideration of hazardous use as a criterion towards a more context-free indicator of an alcohol use disorder.

Accordingly, the present study sought to investigate more fully the positive association between one important indicator of SES, personal income and alcohol abuse that has been

reported previously in these data [5]. We explored this aim via a two-stage investigation. First, we sought to determine the extent to which income is associated with the development of alcohol abuse at the symptom and criterion levels. Secondly, we explored whether income is associated with the course of alcohol abuse once an individual is diagnosed. We hypothesized that: (i) the effect of income on the prevalence of current alcohol abuse is accounted for by the hazardous use criterion; and (ii) within the symptoms that define the hazardous use criterion, driving after or while drinking has the strongest relationship with income. Further, while alcohol abuse has been shown to be distinct from alcohol dependence in terms of both course and severity [14–19], information on whether income moderates the course of alcohol abuse is limited. Because those in lower socioeconomic groups often exhibit a more chronic and severe course of other major psychiatric disorders [20,21], a more complete understanding of the characteristics associated with alcohol abuse can aid in developing policy and treatment interventions for this disorder, and may also aid in nosology development. Thus, among those with a diagnosis of alcohol abuse, we explored additionally whether lower income was associated with the following disease characteristics: more severe course, higher drinking level and greater psychiatric comorbidity. Income is an important, although incomplete, indicator of SES. Past-year personal income was chosen as an indicator of SES for this particular study due to the literature suggesting that personal income is the most direct measure of access to material goods (e.g. motor vehicle) [6,22].

METHODS

Sample design and procedures

This sample consists of participants in the 2001–02 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a nationally representative United States survey of civilian non-institutionalized participants aged 18 years and older, interviewed in person. The National Institute on Alcohol Abuse and Alcoholism (NIAAA) sponsored the study and supervised the field-work, conducted by the US Bureau of the Census. The research protocol, including informed consent procedures, received full ethical review and approval from the US Census Bureau and US Office of Management and Budget. Young adults, Hispanics and African Americans were oversampled; the overall response rate was 81%. Further details of the sampling frame and demographics of the sample are described elsewhere [19,23,24]. Details of the interviewers, training and field quality control are described elsewhere [23,24]. Because DSM-IV precludes an abuse diagnosis among those with life-time dependence, analyses were conducted excluding respondents with life-time alcohol dependence (n = 4781), making the total sample for these analyses 38 317. Among this sample, the prevalence of current (i.e. past year) alcohol abuse in the study sample is 3.93% [standard error (SE) = 0.2]; 62.9% (SE = 0.7) of individuals who were current drinkers, 17.3% (SE = 0.4) who were former drinkers and 19.7% (SE = 0.7) who were life-time abstainers. While abstainers and former drinkers did not consume alcohol in the past 12 months, we assumed that these individuals remained in the risk group for the development of alcohol abuse and thus included these individuals in the analyses.

Measures

Alcohol abuse diagnosis—DSM-IV diagnosis of alcohol abuse was made using the Alcohol Use Disorders and Associated Disabilities Interview 4th edition (AUDADIS-IV) [25], a structured interview designed for administration by extensively trained lay interviewers and developed to advance measurement of substance use and mental disorders in large-scale surveys. The interview includes over 30 symptom questions to operationalize DSM-IV criteria for diagnoses of alcohol abuse and dependence [8]. Diagnoses were established explicitly following the DSM-IV; at least one of four criteria was necessary for a diagnosis of alcohol abuse.

The reliability of the alcohol use disorder diagnoses in the AUDADIS-IV has been documented extensively in clinical and general population samples [25–28]; test–retest reliability ranges from good to excellent (K = 0.70–0.84). The convergent, discriminative and construct validity of AUDADIS-IV alcohol use disorder criteria and diagnoses were tested in community samples [9,15,17,29,30] and in international samples [31–36] and shown to be good to excellent. Further, clinical reappraisals documented good criterion validity of DSM-IV alcohol use disorder diagnoses (K = 0.60–0.76) [37]. The alcohol abuse diagnosis specifically, when assessed non-hierarchically (independently of alcohol dependence) as is conducted in the AUDADIS-IV, has adequate reliability [27,37,38].

Hazardous use criterion—The hazardous use criterion is established with three separate questions. The first covers driving *after* drinking, while the second establishes drinking *while* driving. Finally, non-driving-related hazardous use is covered by asking about other activities performed while or after drinking, with examples including swimming, using machinery, walking in a dangerous area or around heavy traffic. If a respondent answers affirmatively, the time-frame is then established (within the past year or prior to the past year). For the present analysis, only current (i.e. past-year) hazardous use cases were included in order to match the time-frame of our income variable.

Income and other demographic characteristics—As stated previously, past-year personal income was chosen as the indicator of SES for this particular study because this is the most direct measure of access to material goods such as a motor vehicle. Income was defined as past-year personal income, categorized into a four-level ordinal variable, consistent with previous research on the association between alcohol disorders and income [5]. The levels were: <$20 000 ($n$ = 21 075), $20 000–34 999 ($n$ = 9999), $35 000–69 999 ($n$ = 9031) and $70 000+ ($n$ = 2988). Other demographic variables associated with both income and alcohol disorders were adjusted for in multivariable models, including age, sex, race/ethnicity, marital status, region and urbanicity (urban versus rural). Further, analyses were replicated with other indicators of SES (i.e. past-year family income, employment and education) to evaluate the sensitivity of the results.

Course, severity and correlates of alcohol abuse—To test the relationship of income to the course, we used two measures: (i) age of onset of first episode of alcohol abuse [mean = 22.5 (SE = 0.1)]; and (ii) alcohol abuse diagnosis in both the prior to past-year time-frame and the past-year time-frame (binary variable).

To test the relationship of income to severity of alcohol abuse, we used four measures: (i) subclinical alcohol dependence, measured by at least one alcohol dependence criterion endorsed (possible range: 0–2); (ii) frequency of drinking in the past year; (iii) frequency of consuming five or more drinks in the past year; and (iv) mean largest drinks in the past year [mean 7.93 (SE = 0.2)]. Due to non-normality of the distribution, variables were categorized into groups.

To test the relationship of income to correlates of alcohol abuse, we used four measures: (i) family history (any parent or sibling) of alcohol problems; any life-time history of (ii) mood or anxiety disorders; (iii) personality disorder; and (iv) drug disorder. Family history was obtained by asking about readily observable manifestations of alcohol use disorders to maximize accuracy [39,40]. Mood, anxiety, personality and drug disorders are combined variables comprising seven independent mood and anxiety disorders, eight independent personality disorders and abuse and/or dependence on 10 separately assessed classes of drugs. All diagnoses are made via strict adherence to DSM-IV guidelines and are evaluated in separate modules of the AUDADIS-IV. The derivation and psychometric properties of

mood, anxiety, personality and drug disorder variables have been described in detail elsewhere [24,41,42].

Statistical analysis

The prevalence of current alcohol abuse criteria and specific symptoms of hazardous use by income category were calculated with cross-tabulations. Odds ratios (ORs) and 95% confidence intervals (CI) were calculated from logistic regressions with income as the main predictor, controlling for age, sex, race/ethnicity, marital status, urbanicity and region. Interactions with sex, age and ethnicity were assessed due to previous research indicating that the effect of income on alcohol-related outcomes varies by these variables [5,43,44]. Associations between income and course, severity and correlates of alcohol abuse were evaluated using polytomous regressions with a four-level ordinal income variable as the outcome. This framework assumes a cumulative logit link function, and was chosen over other models because we assumed homogeneity within income category; thus we were interested in the association of each income category with predictors. Income was used as the outcome for these analyses so that the same regression framework could be used across measures of course, severity and correlates, and was conducted only among those with a current alcohol abuse diagnosis (n = 1385). To adjust for the complex sample characteristics of the NESARC, analyses were conducted using the Software for Survey Data Analysis (SUDAAN) [45].

RESULTS

Of the 1385 individuals diagnosed with current alcohol abuse, 83.6% (SE = 1.3) met criteria based on hazardous use alone. Further, 69.3% (SE = 1.7) of these 1385 individuals met criteria based solely on the drinking/driving variables (either driving after drinking or driving while drinking).

Association between income and alcohol abuse criteria

Table 1 indicates that there was a consistent increase in the prevalence of hazardous use (HU) by income category. Statistical significance (or lack of statistical significance) did not change between unadjusted and adjusted odds ratios (AORs); thus only AORs are presented. AORs indicated that the odds of HU increased in each income group compared to the lowest income group; those in the highest income group had approximately twice the odds of HU compared to those in the lowest. Overall, there was a significant positive relationship between income and HU (F = 20.3, df = 3, P < 0.0001). There were no significant interactions of income with demographic control variables in predicting the four alcohol abuse criteria.

The combined prevalence of the three other alcohol abuse criteria was lower than the prevalence of HU. Role obligation failure and legal problems showed a non-linear relationship with income; adjusted ORs indicated that the difference between the income groups was not statistically significant. No respondents in the highest income group endorsed role obligation failure or legal problems. There was also a non-linear pattern with interpersonal problems; the third income group ($35 000–69 999) had significantly lower odds of interpersonal problems compared with the lowest income group (AOR = 0.39, 95% CI 0.18–0.83).

Association between income and symptoms of hazardous use

Table 2 indicates a consistent increase in the prevalence of driving after or while drinking by income category, with AORs showing that those in the highest income category are 2.01 (95% CI 1.51–2.68) times as likely to drive after drinking compared with those in the

lowest, and 2.46 (95% CI 1.65–3.66) times as likely to drive while drinking compared to those in the lowest. Overall, there was a significant positive relationship between income and driving after drinking ($F = 13.0$, df = 3, $P < 0.0001$) and drinking while driving ($F = 9.2$, df = 3, $P < 0.0001$). Those in the $35 000–69 999 income category have significantly increased odds of reporting any 'other' hazardous use behavior (see Table 2), but overall income is unrelated to other hazardous behavior (F = 2.12, df = 3, $P = 0.12$). There were no significant interactions with demographic control variables.

Because 37.1% of the sample abstained from alcohol in the past year, we also conducted the analysis for Tables 1 and 2 without alcohol abstainers to determine the sensitivity of the results among current drinkers only. Results were unchanged (not shown).

Comparison with other indicators of SES

To assess the consistency of these effects across other commonly used measures of SES, we repeated these analyses using education level (categorized at three levels: less than high school education, high school education and more than high school education), employment status (employed in some way in the last 12 months versus unemployed) and family income in the last 12 months (categorized at identical cut-points to the personal income measure). Similarly to personal income, hazardous use was the only alcohol abuse criterion associated positively with education level ($P = 0.0006$), employment ($P < 0.0001$) and family income ($P = 0.001$) in the past 12 months. With respect to specific symptoms of hazardous use (i.e. driving after drinking, drinking while driving and other hazardous use), generally similar patterns of associations were obtained. Education and employment were associated positively with all three symptoms (P-values all <0.05). Family income was associated with driving after drinking only ($P = 0.01$).

Course, severity and correlates of individuals with current alcohol abuse

Course—By income, 81.7% of those in the lowest income category had a prior diagnosis, whereas 96.9% of those in the highest income category had a previous diagnosis (Table 3). Income was associated significantly with new-onset alcohol abuse (AOR = 2.12, 95% CI 1.49–3.02). In a polytomous regression framework using a cumulative logit link function, this OR can be interpreted as the overall measure of the association between previous diagnosis and the four ordered income categories (i.e. the likelihood of having a previous diagnosis of alcohol abuse increased, on average, by a factor of 2.12 for each one-unit increase in income category).

Severity—Endorsing at least one alcohol dependence symptom (versus none) was related to income in unadjusted analysis (OR = 0.68, 95% CI 0.53–0.86), but the effect was accounted for by demographic characteristics (specifically age). Those in higher income categories were more likely to drink at least once per week (AOR = 1.69, 95% CI 1.26–2.26), but had fewer mean largest drinks per drinking occasion in the past year (AOR = 0.96, 95% CI 0.93–0.99).

Correlates—Unadjusted polytomous regression indicated a relationship between comorbid mood or anxiety and income (OR = 0.58, 95% CI 0.43–0.70), as well as any personality disorder (OR = 0.70, 95% CI 0.52–0.94), but these associations were accounted for by control variables (age and sex). Income was associated inversely with a history of drug disorders (AOR = 0.53, 95% CI 0.35–0.83).

Similar to the analysis presented in Table 3, among those without a current diagnosis of alcohol abuse (results not shown), income is associated significantly positively with a previous diagnosis of alcohol abuse (AOR = 1.29), drinking alcohol more than once per

week (AOR = 1.33), and associated inversely with a history of drug disorder (AOR = 0.33). However, income is also associated slightly but significantly positively with having at least one symptom of alcohol dependence (AOR = 1.12) and associated significantly inversely with binge drinking once per week or more (AOR = 0.72), having a family history of alcohol problems (AOR = 0.80) and a personal history of a mood or anxiety disorder (AOR = 0.71), and personality disorder (AOR = 0.82) in this subset analysis.

DISCUSSION

The results of this investigation demonstrate that among the four DSM-IV alcohol abuse criteria, only hazardous use has a significant positive relationship with income. This relationship is not modified by sex, age or ethnicity. Additionally, among the symptoms that comprise the hazardous use criterion, driving after drinking and driving while drinking have a significant positive relationship with income. 'Other' hazardous use did not have a significant relationship with income, despite power to detect an association. Finally, we examined the severity and correlates of an alcohol abuse diagnosis. Here we found no consistent patterns in the course and severity of alcohol abuse by income category. Similar to previous studies of alcohol consumption by income [46–50], those in higher income categories were more likely to drink at least once per week but had fewer maximum drinks per drinking occasion. Further, while those in higher income categories were more likely to have a prior to past-year diagnosis, income was associated inversely with a current comorbid drug disorder. These associations with income are not unique to individuals diagnosed with alcohol abuse; we found similar associations among those without a diagnosis of alcohol abuse, suggesting that a diagnosis of alcohol abuse does not moderate the relationship between income and alcohol consumption.

This study is the first to demonstrate the associations between personal income and alcohol abuse at the criteria and symptom level in a representative, general population sample of US adults. Studies of the relationship between educational achievement and alcohol have documented that although college students drink more and are more likely to be diagnosed with alcohol abuse compared with non-college attending peers [7,51], those who graduate from college have lower life-time rates of alcohol disorders compared to those who do not [4,52,53]. Similarly, a wide literature has shown that unemployment is associated with increased rates of alcohol disorders among adults [4,49,54]. The results of this study suggest a positive association between personal income and DSM-IV alcohol abuse in the adult population that is not moderated by age category and thus is persistent throughout the life-course, and that this relationship is accounted for by the association with driving after or while drinking.

SES is a construct that is complex and historically difficult to capture in research. While the present study used past-year personal income as an indicator of access to material goods, we also conducted the analysis across other commonly used measures of SES to determine the sensitivity of the results. The consistency of the association across these measures increases our confidence in its validity. That minor variations were found in the results for symptoms of hazardous use could reflect the different dimensions of SES tapped by these measures. For instance, sociological theories suggest that income reflects direct access to material goods, while educational attainment reflects access to non-material goods and occupation taps into power and prestige domains [6,22]. The specific pathways through which different measures of a similar underlying construct may effect symptoms of hazardous use is an important area for continued work.

These results have important implications for psychiatric nosology, especially as these findings are in direct contrast to the negative association between alcohol dependence and

income [5]. As the hazardous use criterion is the most commonly endorsed symptom of alcohol abuse, the link with income raises questions about either the ability of the current alcohol abuse diagnosis to capture the full range of alcohol abusers in every socioeconomic class (sensitivity) or the inability of the diagnosis to properly exclude those without a true disorder (specificity). The existence of a link between income and alcohol abuse does not itself discount the validity of the diagnosis, as many psychiatric disorders have an association with SES, although typically this is an inverse relationship. However, unlike most other symptoms in the DSM-IV, the operationalization of the most commonly endorsed criterion of DSM-IV alcohol abuse requires some amount of economic capital for endorsement. Thus, this particular diagnostic criterion for alcohol abuse is largely conditional on income, in contrast to other criteria that are more common among people of a certain socio-economic class, because of risk factors associated with that SES level. This suggests a selection bias in the diagnosis, in that the current diagnostic criteria are more likely to include those in higher income groups.

Further, studies have documented low reliability of the alcohol abuse diagnosis in the general population [27,28,32,55,56]. It is possible that the operationalization of the alcohol abuse construct in DSM-IV is not capturing adequately the underlying dimensions of consequences related to excessive alcohol use. Although alcohol abuse has been viewed traditionally as indicating a less severe alcohol disorder compared with alcohol dependence [57], recent evidence indicates that some alcohol abuse criteria tap into a more severe range of the continuum of alcohol disorders in the population when assessed non-hierarchically with alcohol dependence [58]. Other measures of alcohol use, such as a measure of quantity and frequency of consumption, may be more valid measures of harmful alcohol use than a behavior that is contingent upon having access to financial resources, although quantity and frequency of alcohol consumption alone are not sufficient to constitute a diagnosis of an alcohol disorder. Stipulating that respondents meeting criteria for alcohol abuse must additionally meet the NIAAA guideline of excessive drinking (five or more drinks for men, four or more drinks for women) at least once in the past year, we found that 17.8% (SE = 1.1) would not receive the diagnosis. Further, those dropped from the diagnosis due to lack of past-year binge drinking are 1.57 times more likely to be in the highest income group (95% CI 1.17–2.10).

Due to the nature of the interview and survey, we cannot determine the specific mechanism by which income affects drinking and driving. While an obvious explanation is that those in higher socio-economic groups are more likely to own a car, we do not have information on vehicle ownership. While the US has one of the highest car ownership per capita rates in the world [59], estimates of the number of low-income households without a vehicle vary [60]. Further, those in higher socio-economic groups may be more likely to feel ‘above the law’ or believe that they are less likely to be arrested for driving after or while drinking, partly mediating the relationship between income and drinking/driving. While these psychological variables are not included in the data set, these are important considerations for future studies. A probable follow-up hypothesis also comes from the alcohol literature on ‘premise utilization’. This literature suggests that the relationship between higher income and driving after drinking is mediated through the premise in which drinking occurs, i.e. consuming alcohol at bars and restaurants outside the home, leading to driving after consuming [61–63]. A recent study showed that income is an independent predictor of bar and restaurant utilization as well as driving after drinking any alcohol, but unrelated to driving while intoxicated [13]. While our finding that income is also related to driving while drinking is inconsistent with the premise utilization hypothesis as a complete explanation, this is an important conceptual framework to test in future analyses.

Regardless of the specific mechanism between income and drinking after or while driving, this study contributes substantially to our understanding of the alcohol abuse diagnosis. Specifically, the alcohol abuse diagnosis has a selection bias towards those in higher socio-economic groups. The study indicates two directions for future research. First, the psychometric performance characteristics of new definitions of alcohol abuse that rely less heavily on drinking/driving should be compared to the existing DSM-IV definition. Secondly, the mechanisms through which income affects drinking/driving (e.g. vehicle ownership or premise utilization) should be isolated more formally, and modifiers of the relationship between income and hazardous use should be identified to characterize further this unique relationship.

In this paper we have highlighted the selection bias in the current diagnosis of alcohol abuse towards those in higher socio-economic groups. As alcohol policy and developments in nosology are developed further, attention to characteristics of the population of individuals who engage in hazardous alcohol behavior should be considered, and the development of more sensitive measures that may capture the full range of alcohol abusers is an important next step for nosology.

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Table 1

Prevalence and odds of current alcohol abuse criteria by income category among respondents without life-time alcohol dependence (n = 38 317).*

		Hazardous use		Role obligation failure		Legal problems		Interpersonal problems	
	n	% (SE)	AOR†	% (SE)	AOR†	% (SE)	AOR†	% (SE)	AOR†
$70 000+	2 628	5.76 (0.6)	**2.04 (1.59–2.62)**	–	–	–	–	0.14 (0.1)	0.30 (0.09–1.15)
$35 000–69 999	7 904	4.92 (0.3)	**1.81 (1.50–2.17)**	0.03 (0.0)	1.22 (0.28–5.22)	0.14 (0.0)	0.54 (0.27–1.09)	0.19 (0.1)	**0.39 (0.18–0.83)**
$20 000–34 999	8 785	4.37 (0.3)	**1.69 (1.41–2.01)**	0.02 (0.0)	0.70 (0.08–6.17)	0.29 (0.1)	0.95 (0.51–1.79)	0.53 (0.1)	0.95 (0.55–1.66)
<$20 000	18 995	2.23 (0.2)	1.00	0.03 (0.0)	1.00	0.30 (0.1)	1.00	0.51 (0.1)	1.00
Total		3.58 (0.2)		0.03 (0.0)		0.24 (0.0)		0.42 (0.0)	

*Bold text indicates statistical significance at $P < 0.05$ alpha level.

†Adjusted odds ratio (AOR). Models are adjusted for sex, age, marital status, urbanicity, region and race/ethnicity. No relevant interactions between income and demographic variables were detected. SE: standard error.

Table 2

Prevalence and odds of current hazardous use symptoms by income category among respondents without life-time alcohol dependence (n = 38 317).*

		Driving after drinking		Driving while drinking		Other hazardous behavior	
	n	% (SE)	AOR†	% (SE)	AOR†	% (SE)	AOR†
$70 000+	2 628	4.50 (0.6)	**2.01 (1.51–2.68)**	2.49 (0.4)	**2.46 (1.65–3.66)**	0.78 (0.2)	1.76 (0.92–3.38)
$35 000–69 999	7 904	3.65 (0.3)	**1.72 (1.37–2.15)**	1.88 (0.2)	**1.94 (1.41–2.67)**	0.73 (0.1)	**1.60 (1.05–2.44)**
$20 000–34 999	8 785	3.38 (0.3)	**1.74 (1.40–2.16)**	1.62 (0.2)	**1.80 (1.34–2.42)**	0.68 (0.1)	1.30 (0.84–2.03)
<$20 000	18 995	1.56 (0.1)	1.00	0.77 (0.1)	1.00	0.53 (0.1)	1.00
Total		2.66 (0.2)		1.34 (0.1)		0.63 (0.1)	

*Bold text indicates statistical significance at $P < 0.05$ alpha level.

†Adjusted odds ratio (AOR). Models are adjusted for sex, age, marital status, urbanicity, region and race/ethnicity. SE: standard error.

Table 3

Course, severity and correlates* of an alcohol abuse diagnosis by income category (presented as prevalence and standard error (SE) unless noted otherwise).†

	Total % (SE)*	<$20 000 % (SE)*	$20 000–34 999 % (SE)*	$35 000–69 999 % (SE)*	$70 000+ % (SE)*	OR (95% confidence interval) for association with income	AOR‡ (95% confidence interval) for association with income
Course of alcohol abuse							
Mean age of onset of alcohol abuse (IQR 18–25)	23.1 (0.3)	22.6 (0.5)	23.6 (0.5)	23.2 (0.5)	23.3 (0.7)	1.01 (0.99–1.02)	0.99 (0.97–1.00)
Percentage with a prior to past-year alcohol abuse diagnosis	89.0 (0.8)	81.7 (1.9)	90.0 (1.5)	93.1 (1.2)	96.9 (1.6)	**3.05 (2.17–4.28)**	**2.12 (1.49–3.02)**
Severity of alcohol abuse							
At least one alcohol dependence criteria endorsed (versus none)	55.5 (1.5)	61.4 (2.6)	57.7 (2.6)	50.0 (2.3)	47.8 (4.4)	**0.68 (0.53–0.86)**	0.93 (0.72–1.20)
Frequency of any drinking in the past year: once per week or more (versus less than once per week)	77.3 (1.2)	72.0 (2.6)	72.7 (2.3)	83.0 (1.9)	89.1 (2.6)	**1.99 (1.50–2.65)**	**1.69 (1.26–2.26)**
Frequency of consuming 5+ drinks in the past year							
Once per week or more	35.9 (1.5)	35.6 (2.6)	38.6 (2.9)	37.4 (2.6)	26.0 (4.5)	0.84 (0.61–1.15)	0.71 (0.49–1.01)
Less than once per week	41.9 (1.3)	39.9 (2.4)	43.0 (2.7)	40.5 (2.7)	48.0 (4.4)	0.88 (0.63–1.23)	0.89 (0.64–1.23)
Never	22.3 (1.2)	24.5 (2.2)	18.4 (2.0)	22.1 (1.9)	26.0 (3.6)	1.00	1.00
Mean largest number of drinks in the past year (IQR 4–10)	8.7 (0.2)	8.9 (0.4)	9.0 (0.3)	8.3 (0.3)	7.9 (0.5)	0.97 (0.95–1.00)	**0.96 (0.93–0.99)**
Correlates of alcohol abuse							
Family history of alcohol problems	40.9 (1.4)	41.4 (2.4)	44.1 (2.7)	36.6 (2.5)	43.1 (3.8)	1.03 (0.81–1.30)	1.01 (0.79–1.29)
Any mood or anxiety disorder	19.6 (1.1)	24.5 (2.1)	20.6 (2.3)	15.8 (1.8)	13.2 (2.8)	**0.58 (0.43–0.77)**	0.80 (0.57–1.12)
Any personality disorder	21.0 (1.2)	22.5 (2.1)	26.2 (2.4)	16.7 (1.8)	15.3 (3.2)	**0.70 (0.52–0.94)**	0.82 (0.58–1.16)
Any drug disorder	6.8 (0.6)	10.7 (1.2)	8.0 (1.4)	3.5 (0.8)	1.4 (0.9)	**0.38 (0.25–0.60)**	**0.53 (0.35–0.83)**

*Estimates indicate prevalence (%) unless noted in the table as ‘mean’.

†Bold text indicates statistical significance at $P < 0.05$ alpha level.

‡Adjusted odds ratio (AOR). Models are adjusted for sex, age, marital status, urbanicity, region and race/ethnicity. IQR: interquartile range; OR: odds ratio.