

Binge Drinking and Prescription Opioid Misuse in the  
U.S., 2012–2014Marissa B. Esser, PhD, MPH,<sup>1</sup> Gery P. Guy Jr., PhD, MPH,<sup>2</sup> Kun Zhang, PhD, MA,<sup>2</sup>  
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**Introduction:** Prescription opioids were responsible for approximately 17,000 deaths in the U.S. in 2016. One in five prescription opioid deaths also involve alcohol. Drinkers who misuse prescription opioids (i.e., use without a prescription or use only for the experience or feeling it causes) are at a heightened risk of overdose. However, little is known about the relationship between drinking patterns and prescription opioid misuse.

**Methods:** Data were analyzed from 160,812 individuals (aged  $\geq 12$  years) who responded to questions about prescription opioid misuse and alcohol consumption in the 2012, 2013, or 2014 National Survey on Drug Use and Health (analyzed in 2017–2018). The prevalence of self-reported past-30-days prescription opioid misuse was assessed by sociodemographic characteristics, other substance use (i.e., cigarettes, marijuana), and drinking patterns. Multiple logistic regression analyses were used to calculate AORs.

**Results:** From 2012 to 2014, 1.6% (95% CI=1.5, 1.7) of all individuals aged  $\geq 12$  years (estimated 4.2 million) and 3.5% (95% CI=3.3, 3.8) of binge drinkers (estimated 2.2 million) reported prescription opioid misuse. Prescription opioid misuse was more common among binge drinkers than among nondrinkers (AOR=1.7, 95% CI=1.5, 1.9). Overall, the prevalence of prescription opioid misuse increased significantly with binge drinking frequency ( $p$ -value<0.001).

**Conclusions:** More than half of the 4.2 million people who misused prescription opioids during 2012–2014 were binge drinkers, and binge drinkers had nearly twice the odds of misusing prescription opioids, compared with nondrinkers. Widespread use of evidence-based strategies for preventing binge drinking might reduce opioid misuse and overdoses involving alcohol.

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## INTRODUCTION

Prescription opioids were involved in approximately 17,000 deaths in the U.S. in 2016,<sup>1</sup> tripling since 1999.<sup>2,3</sup> The number of opioid prescriptions written also tripled during this time, substantially increasing opioid availability.<sup>4</sup> In addition, prescription opioid overdose, abuse, and dependence cost the U.S. \$78.5 billion in 2013, including healthcare claims, substance use disorder treatment, criminal justice costs, and lost productivity.<sup>5</sup> Consequently, the opioid overdose epidemic has been declared a public health emergency.<sup>6</sup>

Compared with those who use opioids as prescribed, people who misuse prescription opioids (defined in this analysis as using an opioid without a prescription, or

using these drugs only for the experience or feeling it caused) may consume higher doses of these drugs, use them more frequently, or both, increasing the risk of non-fatal and fatal overdoses.<sup>7–9</sup> One study analyzed data from the Drug Abuse Warning Network on emergency department (ED) visits and found that there were 305,900

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ED visits because of prescription opioid misuse in 2008, which was double the number reported in 2004.<sup>10</sup>

An important, though generally under-recognized, risk factor for opioid misuse is alcohol consumption, particularly excessive drinking. For example, a study using 2006 data from the National Survey on Drug Use and Health (NSDUH) found that men and women who consumed alcohol during the previous year were 70% and 90% more likely to misuse opioids during the previous year, respectively, than their nondrinker counterparts.<sup>11</sup> However, the authors did not assess the association between prescription opioid misuse and alcohol use by sociodemographic characteristics other than gender, nor did they examine this relationship by drinking patterns (e.g., binge drinking). Another study using the 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions found that 1.1% of past-year drinkers who did not binge drink, and 2.2% of binge drinkers who did not have alcohol abuse or dependence, misused prescription opioids during the past year.<sup>12</sup> After controlling for sex, age, and race or ethnicity, past-year drinkers who did not binge drink, and binge drinkers who did not meet DSM-IV criteria for alcohol abuse or dependence, were 1.8 and 3.6 times more likely to report past-year prescription opioid misuse than nondrinkers, respectively. However, the authors did not assess this relationship by sociodemographic characteristics, nor did they control for differences in annual household income, which has been shown to be associated with both binge drinking and prescription opioid misuse.<sup>13,14</sup> In addition, the authors were unable to fully assess the relationship between binge drinking and prescription opioid misuse because of the exclusion of respondents who met DSM-IV criteria for alcohol abuse or dependence from their binge drinking population.

Alcohol consumption has also been associated with prescription opioid overdoses. In 2010, one in five opioid-involved deaths in the U.S. also involved alcohol.<sup>15</sup> In addition, alcohol was involved in 18% of the prescription opioid-involved ED visits in 2010, and more than 40% of these prescription opioid-involved overdoses were among ED patients aged 30–54 years.<sup>15</sup> Similarly, in 2008, a nationwide study found that 20% of hospitalizations for prescription opioid overdoses among young adults aged 18–24 years involved excessive alcohol use (i.e., ICD-9-CM codes 980, E860, 303.0, 305.0, or 790.3), which is similar to the proportion of opioid overdoses among people in this age group that involved excessive alcohol use in 1999 (17%).<sup>16</sup> The concurrent use of alcohol and prescription opioids is concerning because both have a depressant effect on the central nervous system, and the concurrent use of these drugs could therefore lead to a dangerous drug interaction that could significantly increase the risk of respiratory depression and death.<sup>17–21</sup>

The purpose of this study is to assess the association between past-30-days drinking patterns (e.g., current nonbinge drinking and binge drinking) and prescription opioid misuse among U.S. adults and adolescents. In addition, this study seeks to examine the relationship between binge drinking frequency and prescription opioid misuse.

## METHODS

### Study Sample

The NSDUH is a nationally representative, cross-sectional household survey of the noninstitutionalized U.S. adult and adolescent population aged  $\geq 12$  years residing in the 50 states and the District of Columbia that is conducted annually by the Substance Abuse and Mental Health Services Administration. For each state and the District of Columbia, a multistage probability sample was independently determined. A computer-assisted personal interview and audio computer-assisted self-interview (to improve respondents' privacy during visits to households and group living residences) were used to collect survey data. Respondents were given \$30 as compensation for their participation in the survey. More details on the NSDUH methods are available elsewhere.<sup>22</sup>

Data for this study were pooled from the 2012, 2013, and 2014 NSDUH public use files to smooth out random fluctuations in self-reported alcohol use and prescription opioid misuse, particularly when assessing prescription opioid misuse by drinking patterns and sociodemographic characteristics. Weighted response rates were 73.0% (2012), 71.7% (2013), and 71.2% (2014). There were 204,048 survey respondents during the 3-year study period. The study sample included 160,812 (78.8%) of the total respondents who answered questions about the misuse of prescription opioids and alcohol consumption.

### Measures

Respondents were categorized into three drinking categories (i.e., nondrinkers, current/nonbinge drinkers, and binge drinkers) based on their responses to the following questions:

1. *During the past 30 days, on how many days did you drink one or more drinks of an alcoholic beverage?*
2. *During the past 30 days, that is since (datefill), on how many days did you have 5 or more drinks on the same occasion? By "occasion," we mean at the same time or within a couple of hours of each other. (Question for male respondents)*
3. *During the past 30 days, that is since (datefill), on how many days did you have 4 or more drinks on the same occasion? (Question for female respondents)*

Nondrinking was defined as not consuming an alcoholic drink on any day during the past 30 days, including lifetime abstainers. Current drinking was defined as consuming one or more alcoholic drinks on  $\geq 1$  day during the past 30 days. Binge drinking was defined as consuming five or more drinks (for male respondents) or four or more drinks (for female respondents), per occasion, on  $\geq 1$  day during the past 30 days. Current/nonbinge drinking was defined as current drinking below binge levels. Binge drinking frequency was defined as the number of days a respondent

consumed five or more drinks (for male respondents) or four or more drinks (for female respondents) per occasion during the past 30 days.

In the survey section on use of prescription medications, the NSDUH interviewers asked a series of questions about use of specific types of opioids (e.g., codeine, hydrocodone, and morphine). This study assessed prescription opioid misuse based on responses to the following question: *How long has it been since you last used any prescription pain reliever that was not prescribed for you or that you took only for the experience or feeling it caused?* Prescription opioid misuse was defined as the use of an opioid without a prescription, or the use of these drugs only for the experience or feeling it caused, at least one time during the past 30 days.

### Statistical Analysis

The prevalence of past-30-days prescription opioid misuse, non-drinking, current/nonbinge drinking, and binge drinking were assessed overall and by sociodemographic characteristics and other substance use (i.e., past-30-days cigarette use or marijuana use). Prescription opioid misuse was also assessed by drinking pattern, sociodemographic characteristics, and other substance use. The relationship between binge drinking frequency and prescription opioid misuse was assessed overall and by age group. NSDUH survey weights and design variables were used to compute prevalence estimates and 95% CIs. A new population weight was created for this 3-year dataset by dividing the single-year dataset weights by three. *p*-values were calculated using Pearson's chi-squared tests (*p*-values < 0.05 were used to assess statistical significance). When measuring the association between prescription opioid misuse and binge drinking, multiple logistic regression was used to adjust ORs for potential confounders, including age group, sex, race or ethnicity, total annual family income, rural or urban status,<sup>22</sup> cigarette use,<sup>23,24</sup> and marijuana use.<sup>23–25</sup>

Respondents who were missing data on sociodemographic characteristics or on drinking patterns were excluded from item-specific analyses (missing data were < 3%). Data were analyzed using Stata, version 14.2 (analyses were conducted in 2017–2018).

## RESULTS

During 2012–2014, 1.6% (95% CI=1.5, 1.7) of U.S. adults and adolescents, or an estimated 4.2 million people, reported past-30-days prescription opioid misuse (Table 1). Prescription opioid misuse was most common among male respondents (1.9%, 95% CI=1.7, 2.1), those aged 18–25 years (2.9%, 95% CI=2.7, 3.1) and 26–34 years (2.8%, 95% CI=2.4, 3.1), those with an annual family income of < \$20,000 (2.3%, 95% CI=2.1, 2.6), and those with no health insurance coverage (2.9%, 95% CI=2.6, 3.2). Current/nonbinge drinking was most common among adults aged ≥ 50 years (33.4%, 95% CI=32.6, 34.3); white, non-Hispanic adults (31.1%, 95% CI=30.5, 31.6); college graduates (43.4%, 95% CI=42.5, 44.4); and those with an annual family income of > \$75,000 (36.9%, 95% CI=36.1, 37.6). Binge drinking was most common among male respondents (29.6%, 95% CI=29.0, 30.2); those aged 18–25 years (40.4%, 95% CI=39.7, 41.1) and

26–34 years (38.8%, 95% CI=38.0, 39.7); white, non-Hispanic adults (25.8%, 95% CI=25.3, 26.3); and adults with some college education (28.7%, 95% CI=28.0, 29.5).

The prevalence of prescription opioid misuse was similar among nondrinkers (1.0%, 95% CI=0.9, 1.2) and current/nonbinge drinkers (1.0%, 95% CI=0.9, 1.2), but was 3.5 times higher among binge drinkers (3.5%, 95% CI=3.3, 3.8; Table 2). This translates to an estimated 2.2 million binge drinkers engaging in prescription opioid misuse in the past 30 days. Across all sociodemographic groups, prescription opioid misuse was more common among binge drinkers than among nondrinkers and current/nonbinge drinkers. Prescription opioid misuse was most common among nondrinkers aged 18–25 years (1.5%, 95% CI=1.3, 1.8) and 26–34 years (1.7%, 95% CI=1.4, 2.2), current/nonbinge drinkers aged 12–17 years (3.6%, 95% CI=2.8, 4.7), and binge drinkers aged 12–17 years (8.1%, 95% CI=6.8, 9.7). However, about 1.4 million (65%) of the estimated 2.2 million binge drinkers who reported misusing prescription opioids were aged ≥ 26 years.

Among binge drinkers, prescription opioid misuse was most common among black, non-Hispanic people (4.6%, 95% CI=3.7, 5.6; Table 2). Among binge drinkers, having no health insurance coverage (prevalence of prescription opioid misuse: 5.6%, 95% CI=4.9, 6.4) or having public health insurance (prevalence of prescription opioid misuse: 5.0%, 95% CI=4.2, 6.0) was also associated with a higher prevalence of prescription opioid misuse, whereas having private health insurance coverage was associated with a lower rate of prescription opioid misuse (2.6%, 95% CI=2.4, 2.9). The prevalence of prescription opioid misuse was inversely related to education and family income across all drinking categories but was similar among male and female respondents. Across all drinking categories, prescription opioid misuse was more common among those who used marijuana than those who smoked cigarettes. Prescription opioid misuse was also more common among binge drinkers who smoked cigarettes (5.6%, 95% CI=5.1, 6.0) or used marijuana (10.1%, 95% CI=9.3, 11.1) than among nondrinkers and current/nonbinge drinkers who used these substances, respectively.

After adjusting for potential confounders, binge drinkers had 1.7 times greater odds (95% CI=1.5, 1.9, *p*<0.001) of reporting prescription opioid misuse than nondrinkers (Table 3). Current/nonbinge drinking was not associated with prescription opioid misuse (AOR=1.0, 95% CI=0.8, 1.1, *p*=0.580).

The overall prevalence of prescription opioid misuse increased significantly with the frequency of binge drinking (*p*<0.001), ranging from 2.4% (95% CI=2.2, 2.7) among those who reported binge drinking one to two times during the past 30 days to 6.5% (95% CI=5.6, 7.6) among those who reported binge drinking ten or

**Table 1.** Prevalence of Past-30-Days Prescription Opioid<sup>a</sup> Misuse and Drinking Patterns by Characteristics

Characteristics	Prescription opioid misuser <sup>a</sup> (n=160,812)		Weighted total population who misused prescription opioids <sup>a</sup> n	Nondrinkers <sup>b</sup> (n=89,898)		Current/nonbinge drinkers <sup>c</sup> (n=30,296)		Binge drinkers <sup>d</sup> (n=40,618)	
	Weighted % (95% CI)	p-value		Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value
Overall	1.6 (1.5, 1.7)		4,196,285	48.7 (48.2, 49.1)		27.0 (26.6, 27.5)		24.3 (23.9, 24.7)	
Sex		<0.001			<0.001		0.003		<0.001
Male	1.9 (1.7, 2.1)		2,335,637	44.0 (43.4, 44.6)		26.4 (25.8, 27.0)		29.6 (29.0, 30.2)	
Female	1.4 (1.3, 1.5)		1,860,648	53.1 (52.4, 53.7)		27.7 (27.0, 28.3)		19.3 (18.8, 19.8)	
Age group, years		<0.001			<0.001		<0.001		<0.001
12–17	1.7 (1.5, 1.8)		402,186	89.3 (89.0, 89.7)		4.5 (4.3, 4.8)		6.1 (5.8, 6.5)	
18–25	2.9 (2.7, 3.1)		980,231	41.1 (40.7, 41.7)		18.5 (18.0, 19.1)		40.4 (39.7, 41.1)	
26–34	2.8 (2.4, 3.1)		1,005,464	35.1 (34.1, 36.1)		26.1 (25.2, 27.1)		38.8 (38.0, 39.7)	
35–49	1.7 (1.5, 1.9)		996,565	40.3 (39.3, 41.2)		30.6 (29.7, 31.4)		29.2 (28.4, 30.1)	
≥50	0.8 (0.6, 1.0)		811,839	51.3 (50.4, 52.1)		33.4 (32.6, 34.3)		15.3 (14.6, 16.0)	
Race or ethnicity		<0.001			<0.001		<0.001		<0.001
White, non-Hispanic	1.7 (1.5, 1.8)		2,757,801	43.2 (42.6, 43.8)		31.1 (30.5, 31.6)		25.8 (25.3, 26.3)	
Black, non-Hispanic	2.0 (1.7, 2.3)		598,615	57.2 (56.0, 58.3)		21.6 (20.6, 22.7)		21.2 (20.4, 22.0)	
Hispanic or Latino	1.6 (1.4, 1.8)		634,783	58.6 (57.3, 60.0)		17.0 (16.0, 18.0)		24.4 (23.4, 25.3)	
Other <sup>e</sup>	1.1 (0.8, 1.3)		205,087	61.7 (60.2, 63.2)		21.8 (20.3, 23.3)		16.5 (15.4, 17.7)	
Education <sup>f</sup>		<0.001			<0.001		<0.001		<0.001
Less than high school	2.3 (2.0, 2.6)		710,396	65.9 (64.4, 67.4)		11.8 (11.0, 12.7)		22.3 (21.1, 23.5)	
High school graduate	1.8 (1.6, 2.0)		1,204,632	51.1 (50.2, 52.0)		22.0 (21.2, 22.8)		26.9 (26.1, 27.7)	
Some college	1.8 (1.6, 2.0)		1,101,217	40.9 (39.8, 41.9)		30.4 (29.4, 31.4)		28.7 (28.0, 29.5)	
College graduate	2.3 (2.1, 2.6)		777,854	31.6 (30.7, 32.5)		43.4 (42.5, 44.4)		25.0 (24.3, 25.7)	
Family income, annual		<0.001			<0.001		<0.001		<0.001
<\$20,000	2.3 (2.1, 2.6)		1,079,547	60.6 (59.6, 61.6)		15.1 (14.3, 15.8)		24.3 (23.5, 25.1)	
\$20,000–<\$50,000	1.8 (1.6, 1.9)		1,414,192	54.7 (53.9, 55.4)		22.2 (21.5, 23.0)		23.1 (22.5, 23.7)	
\$50,000–<\$75,000	1.4 (1.2, 1.6)		603,652	46.0 (44.9, 47.2)		29.5 (28.4, 30.6)		24.5 (23.7, 25.3)	
≥\$75,000	1.3 (1.1, 1.5)		1,098,894	37.8 (37.1, 38.6)		36.9 (36.1, 37.6)		25.3 (24.6, 26.0)	
Rural or urban status <sup>g</sup>		<0.001			<0.001		<0.001		<0.001
Large metropolitan	1.7 (1.5, 1.8)		2,310,371	46.5 (45.8, 47.1)		28.6 (28.0, 29.2)		24.9 (24.4, 25.5)	
Small metropolitan	1.8 (1.6, 2.0)		1,372,597	49.1 (48.0, 50.2)		26.6 (25.8, 27.4)		24.3 (23.6, 25.1)	
Nonmetropolitan	1.3 (1.1, 1.4)		513,317	55.4 (54.2, 56.4)		22.5 (21.7, 23.4)		22.2 (21.4, 23.0)	

(continued on next page)

**Table 1.** Prevalence of Past-30-Days Prescription Opioid<sup>a</sup> Misuse and Drinking Patterns by Characteristics (*continued*)

Characteristics	Prescription opioid misuser <sup>a</sup> (n=160,812)		Weighted total population who misused prescription opioids <sup>a</sup> n	Nondrinkers <sup>b</sup> (n=89,898)		Current/nonbinge drinkers <sup>c</sup> (n=30,296)		Binge drinkers <sup>d</sup> (n=40,618)	
	Weighted % (95% CI)	p-value		Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value
Health insurance <sup>h</sup>		<b>&lt;0.001</b>			<b>&lt;0.001</b>		<b>&lt;0.001</b>		<b>&lt;0.001</b>
Private	1.3 (1.2, 1.4)		2,136,255	42.9 (42.4, 43.4)		32.1 (31.5, 32.6)		25.0 (24.6, 25.5)	
Public	1.9 (1.7, 2.2)		954,184	67.1 (66.1, 68.1)		16.9 (16.1, 17.7)		16.0 (15.3, 16.7)	
Other	2.0 (1.5, 2.6)		94,362	47.9 (45.1, 50.7)		20.5 (18.3, 23.0)		31.5 (29.2, 34.0)	
No coverage	2.9 (2.6, 3.2)		1,011,484	50.2 (48.9, 51.4)		18.4 (17.4, 19.4)		31.5 (30.3, 32.6)	
Other substance use									
Cigarette <sup>i</sup>	4.0 (3.7, 4.3)	<b>&lt;0.001</b>	2,163,917	35.8 (34.9, 36.7)	<b>&lt;0.001</b>	19.3 (18.5, 20.1)	<b>&lt;0.001</b>	44.9 (44.1, 45.7)	<b>&lt;0.001</b>
Marijuana <sup>j</sup>	8.7 (8.0, 9.5)	<b>&lt;0.001</b>	1,681,373	19.0 (18.0, 20.2)	<b>&lt;0.001</b>	21.3 (20.1, 22.6)	<b>&lt;0.001</b>	59.6 (58.2, 61.0)	<b>&lt;0.001</b>

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Used an opioid pain reliever without a prescription or use only for the experience or feeling it caused  $\geq 1$  time in the past 30 days.

<sup>b</sup>Did not consume an alcoholic drink on any day in past 30 days, including lifetime abstainers.

<sup>c</sup>Consumed  $\geq 1$  alcoholic drink on  $\geq 1$  day but did not consume  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on  $\geq 1$  day in the past 30 days.

<sup>d</sup>Consumed  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on  $\geq 1$  day in the past 30 days.

<sup>e</sup>Including Asian, American Indian, Alaskan Native, Native Hawaiian or other Pacific Islander, or more than one race or ethnicity.

<sup>f</sup>Includes adults aged  $\geq 18$  years only.

<sup>g</sup>Based on the "Rural/Urban Continuum Codes" developed in 2003 by the U.S. Department of Agriculture. Large metropolitan counties have a total population of 1 million or more. Small metropolitan counties have a total population of fewer than 1 million. Nonmetropolitan areas include counties in micropolitan statistical areas as well as counties outside of both metropolitan and micropolitan statistical areas.<sup>19</sup>

<sup>h</sup>Respondents could indicate more than one type of health insurance. Public includes Medicaid, Medicare, Children's Health Insurance Program (CHIP), CHAMPUS, TRICARE, CHAMPVA, the VA, or military health care.

<sup>i</sup>Smoked part or all of a cigarette in the past 30 days.

<sup>j</sup>Used marijuana or hashish in the past 30 days.

**Table 2.** Prevalence of Past-30-Days Prescription Opioid Misuse<sup>a</sup> by Drinking Pattern and by Characteristics

Characteristics	Nondrinkers <sup>b</sup> (n=89,898)		Current/nonbinge drinkers <sup>c</sup> (n=30,296)		Binge drinkers <sup>d</sup> (n=40,618)		Weighted population of binge drinkers who misused prescription opioids n
	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	
Overall	1.0 (0.9, 1.2)		1.0 (0.9, 1.2)		3.5 (3.3, 3.8)		2,179,386
Sex		0.060		0.197		0.385	
Male	1.2 (1.0, 1.4)		1.1 (0.9, 1.5)		3.6 (3.3, 3.9)		1,319,366
Female	0.9 (0.8, 1.1)		0.9 (0.8, 1.1)		3.4 (3.1, 3.7)		860,019
Age group, years		<0.001		<0.001		<0.001	
12–17	1.1 (1.0, 1.3)		3.6 (2.8, 4.7)		8.1 (6.8, 9.7)		120,781
18–25	1.5 (1.3, 1.8)		2.1 (1.8, 2.5)		4.7 (4.3, 5.2)		639,454
26–34	1.7 (1.4, 2.2)		1.7 (1.2, 2.3)		4.4 (3.8, 5.1)		625,088
35–49	1.2 (1.0, 1.5)		1.1 (0.8, 1.4)		3.0 (2.5, 3.5)		511,513
≥50	0.6 (0.5, 0.9)		0.6 (0.4, 0.9)		1.8 (1.4, 2.4)		282,550
Race or ethnicity		0.163		0.014		0.025	
White, non-Hispanic	1.1 (0.9, 1.2)		1.0 (0.8, 1.2)		3.5 (3.2, 3.8)		1,485,165
Black, non-Hispanic	1.2 (0.9, 1.5)		1.6 (1.1, 2.3)		4.6 (3.7, 5.6)		292,410
Hispanic or Latino	1.1 (0.9, 1.4)		1.0 (0.7, 1.4)		3.1 (2.6, 3.7)		304,823
Other <sup>e</sup>	0.7 (0.5, 1.0)		0.6 (0.4, 1.0)		3.0 (2.2, 4.1)		96,987
Education <sup>f</sup>		0.306		<0.001		<0.001	
Less than high school	1.2 (0.9, 1.5)		2.1 (1.5, 3.0)		5.7 (4.8, 6.7)		391,773
High school graduate	1.0 (0.9, 1.3)		1.2 (0.9, 1.5)		3.7 (3.2, 4.2)		670,387
Some college	1.1 (0.9, 1.5)		1.2 (0.9, 1.6)		3.3 (2.9, 3.7)		587,635
College graduate	0.8 (0.5, 1.2)		0.6 (0.4, 1.0)		2.3 (1.9, 2.8)		408,810
Family income, annual		0.004		0.007		<0.001	
<\$20,000	1.4 (1.1, 1.6)		1.7 (1.3, 2.3)		5.1 (4.4, 5.8)		575,338
\$20,000–<\$50,000	1.1 (0.9, 1.3)		1.2 (0.9, 1.7)		3.8 (3.4, 4.3)		710,241
\$50,000–<\$75,000	1.0 (0.7, 1.4)		0.7 (0.5, 1.0)		3.0 (2.4, 3.6)		309,855
≥\$75,000	0.7 (0.5, 0.9)		0.9 (0.7, 1.2)		2.7 (2.3, 3.1)		583,952
Rural or urban status <sup>g</sup>		<0.001		0.183		0.236	
Large metropolitan	1.1 (0.9, 1.3)		1.1 (0.9, 1.4)		3.4 (3.1, 3.7)		1,163,677
Small metropolitan	1.3 (1.0, 1.5)		0.9 (0.7, 1.2)		3.8 (3.4, 4.4)		712,754
Nonmetropolitan	0.6 (0.5, 0.8)		0.8 (0.6, 1.1)		3.4 (2.8, 4.0)		302,955

(continued on next page)

**Table 2.** Prevalence of Past-30-Days Prescription Opioid Misuse<sup>a</sup> by Drinking Pattern and by Characteristics (*continued*)

Characteristics	Nondrinkers <sup>b</sup> (n=89,898)		Current/nonbinge drinkers <sup>c</sup> (n=30,296)		Binge drinkers <sup>d</sup> (n=40,618)		Weighted population of binge drinkers who misused prescription opioids n
	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	Weighted % (95% CI)	p-value	
Health insurance <sup>h</sup>		<b>&lt;0.001</b>		<b>&lt;0.001</b>		<b>&lt;0.001</b>	
Private	0.8 (0.7, 1.0)		0.9 (0.7, 1.0)		2.6 (2.4, 2.9)		1,103,411
Public	1.4 (1.2, 1.7)		1.2 (0.8, 1.6)		5.0 (4.2, 6.0)		394,563
Other	0.6 (0.3, 1.0)		2.2 (1.2, 4.0)		4.0 (2.7, 5.9)		59,998
No coverage	1.4 (1.2, 1.7)		2.1 (1.5, 3.0)		5.6 (4.9, 6.4)		621,414
Other substance use							
Cigarette <sup>i</sup>	2.6 (2.2, 3.0)	<b>&lt;0.001</b>	3.1 (2.4, 3.9)	<b>&lt;0.001</b>	5.6 (5.1, 6.0)	<b>&lt;0.001</b>	1,348,826
Marijuana <sup>j</sup>	6.6 (5.4, 7.9)	<b>&lt;0.001</b>	6.6 (5.3, 8.3)	<b>&lt;0.001</b>	10.1 (9.3, 11.1)	<b>&lt;0.001</b>	1,166,856

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Used an opioid pain reliever without a prescription or used only for the experience or feeling it caused  $\geq 1$  time in the past 30 days.

<sup>b</sup>Did not consume an alcoholic drink on any day in past 30 days, including lifetime abstainers.

<sup>c</sup>Consumed  $\geq 1$  alcoholic drink on  $\geq 1$  day but did not consume  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on  $\geq 1$  day in the past 30 days.

<sup>d</sup>Consumed  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on  $\geq 1$  day in the past 30 days.

<sup>e</sup>Including Asian, American Indian, Alaskan Native, Native Hawaiian or other Pacific Islander, or more than one race or ethnicity.

<sup>f</sup>Includes adults aged  $\geq 18$  years only.

<sup>g</sup>Based on the "Rural/Urban Continuum Codes" developed in 2003 by the U.S. Department of Agriculture. Large metropolitan counties have a total population of 1 million or more. Small metropolitan counties have a total population of fewer than 1 million. Nonmetropolitan areas include counties in micropolitan statistical areas as well as counties outside of both metropolitan and micropolitan statistical areas.<sup>19</sup>

<sup>h</sup>Respondents could indicate more than one type of health insurance. Public includes Medicaid, Medicare, Children's Health Insurance Program (CHIP), CHAMPUS, TRICARE, CHAMPVA, the VA, or military health care.

<sup>i</sup>Smoked part or all of a cigarette in the past 30 days.

<sup>j</sup>Used marijuana or hashish in the past 30 days.

**Table 3.** Odds of Reporting Past-30-Days Prescription Opioid Misuse<sup>a</sup> by Drinking Pattern and Characteristics

Drinking pattern and characteristics	Unadjusted ORs		AORs <sup>b</sup>	
	OR (95% CI)	p-value	AOR (95% CI)	p-value
Drinking pattern				
Nondrinking <sup>c</sup>	Ref		Ref	
Current drinking/nonbinge <sup>d</sup>	1.0 (0.8, 1.2)	0.869	1.0 (0.8, 1.1)	0.580
Binge drinking <sup>e</sup>	3.4 (3.0, 3.9)	<0.001	1.7 (1.5, 1.9)	<0.001
Sex				
Male	1.3 (1.2, 1.5)	<0.001	1.0 (0.9, 1.2)	0.871
Female	Ref		Ref	
Age group, years				
12–17	2.1 (1.7, 2.7)	<0.001	2.2 (1.7, 2.8)	<0.001
18–25	3.8 (3.1, 4.6)	<0.001	1.7 (1.4, 2.1)	<0.001
26–34	3.5 (2.8, 4.5)	<0.001	2.0 (1.6, 2.6)	<0.001
35–49	2.1 (1.7, 2.7)	<0.001	1.6 (1.3, 2.1)	<0.001
≥50	Ref		Ref	
Race or ethnicity				
White, non-Hispanic	1.6 (1.3, 2.0)	<0.001	1.4 (1.1, 1.8)	<0.01
Black, non-Hispanic	1.9 (1.4, 2.5)	<0.001	1.5 (1.1, 2.1)	<0.01
Hispanic or Latino	1.5 (1.2, 2.0)	<0.01	1.3 (1.0, 1.8)	<0.05
Other <sup>f</sup>	Ref		Ref	
Family income, annual				
<\$20,000	1.8 (1.5, 2.2)	<0.001	1.3 (1.1, 1.5)	<0.01
\$20,000–<\$50,000	1.4 (1.2, 1.6)	<0.001	1.2 (1.0, 1.4)	0.111
\$50,000–<\$75,000	1.1 (0.9, 1.3)	0.332	1.0 (0.8, 1.2)	0.993
≥\$75,000	Ref		Ref	
Rural or urban status <sup>g</sup>				
Large metropolitan	1.3 (1.1, 1.6)	<0.01	1.3 (1.1, 1.6)	<0.01
Small metropolitan	1.4 (1.2, 1.7)	<0.001	1.4 (1.2, 1.6)	<0.001
Nonmetropolitan	Ref		Ref	
Other substance use				
Cigarette <sup>h</sup>	4.1 (3.7, 4.5)	<0.001	2.1 (1.9, 2.4)	<0.001
Marijuana <sup>i</sup>	8.8 (7.8, 10.0)	<0.001	4.6 (4.0, 5.3)	<0.001

Note: Boldface indicates statistical significance ( $p < 0.05$ ).

<sup>a</sup>Used an opioid pain reliever without a prescription or used only for the experience or feeling it caused  $\geq 1$  time in the past 30 days.

<sup>b</sup>Multivariable logistic regression models adjusted for sex, age group, race or ethnicity, total annual family income, rural or urban status, cigarette use, and marijuana use.

<sup>c</sup>Did not consume an alcoholic drink on any day in past 30 days, including lifetime abstainers.

<sup>d</sup>Consumed  $\geq 1$  alcoholic drink on  $\geq 1$  day but did not consume  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on at  $\geq 1$  day in the past 30 days.

<sup>e</sup>Consumed  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, on  $\geq 1$  day in the past 30 days.

<sup>f</sup>Including Asian, American Indian, Alaskan Native, Native Hawaiian or other Pacific Islander, or more than one race or ethnicity.

<sup>g</sup>Based on the "Rural/Urban Continuum Codes" developed in 2003 by the U.S. Department of Agriculture. Large metropolitan counties have a total population of 1 million or more. Small metropolitan counties have a total population of fewer than 1 million. Nonmetropolitan areas include counties in micropolitan statistical areas as well as counties outside of both metropolitan and micropolitan statistical areas.<sup>19</sup>

<sup>h</sup>Smoked part or all of a cigarette in the past 30 days.

<sup>i</sup>Used marijuana or hashish in the past 30 days.

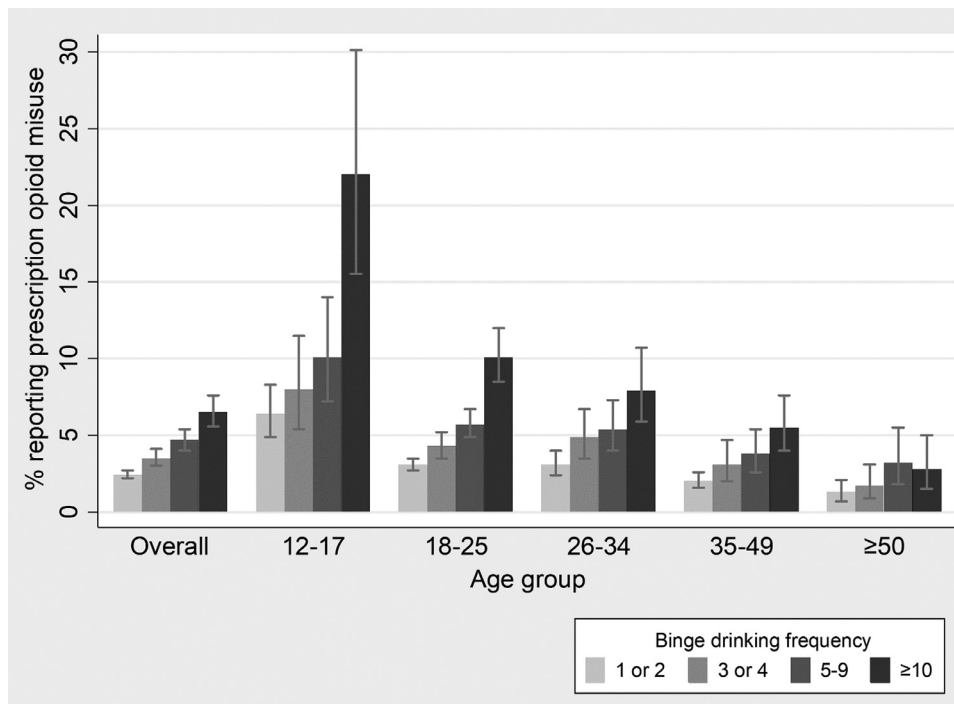
more times (Figure 1). When stratified by age group, the prevalence of prescription opioid misuse increased significantly with the frequency of binge drinking among those aged 12–49 years ( $p < 0.001$ ), as well as among adults aged  $\geq 50$  years ( $p = 0.04$ ). Among adults aged  $\geq 50$  years, the prevalence of opioid misuse was similar for those who reported either binge drinking five to nine

times (3.2%, 95% CI=1.8, 5.5) or ten or more times (2.8%, 95% CI=1.5, 5.0) during the previous 30 days.

## DISCUSSION

The results of this study indicate that more than half (2.2 million) of the estimated 4.2 million adolescents and adults





**Figure 1.** Prevalence and 95% CI<sup>a</sup> of Past-30-Days Prescription Opioid Misuse<sup>b</sup> by Age Group and Binge Drinking Frequency<sup>c</sup> Among Binge Drinkers.

<sup>a</sup>95% CIs denoted by bracketed lines on each bar.

<sup>b</sup>Used a prescription opioid without a prescription or used only for the experience or feeling it caused  $\geq 1$  time in the past 30 days.

<sup>c</sup>Number of days consuming  $\geq 5$  drinks (men) or  $\geq 4$  drinks (women), per occasion, in the past 30 days.

who reported past-30-days misuse of prescription opioids during 2012–2014 were binge drinkers. Binge drinkers had nearly twice the odds of misusing prescription opioids compared with nondrinkers, even after controlling for other factors that could affect the relationship between binge drinking and prescription opioid misuse. Prescription opioid misuse was most common among youth aged 12–17 years who were binge drinkers, but about 1.4 million (65%) of the estimated 2.2 million binge drinkers who reported prescription opioid misuse were aged 26 years or older. The prevalence of prescription opioid misuse increased with the frequency of binge drinking, particularly among youth and young adults.

Across drinking categories, this study generally did not find differences in the prevalence of prescription opioid misuse by sex or by rural or urban status. However, among binge drinkers, this study found a higher prevalence of prescription opioid misuse among those with lower levels of education, lower household incomes, and those who were either covered by publicly funded health insurance or were uninsured. This finding is consistent with the findings of other research that has shown that prescription opioid misuse is generally more common among low-income populations, including those on Medicaid.<sup>26</sup> It is also consistent with a recent study

showing that binge drinkers with lower household incomes consume significantly more total binge drinks per binge drinker annually than those with higher household incomes (532.3 drinks versus 419.0 drinks, respectively).<sup>13</sup> However, people with higher household incomes (e.g., \$75,000 or more) have a higher prevalence of binge drinking than those with lower household incomes (<\$25,000), underscoring the importance of addressing binge drinking among the entire population.<sup>13</sup>

The finding that the prevalence of prescription opioid misuse generally increased with binge drinking frequency is consistent with literature showing that the likelihood of engaging in alcohol-related health risk behaviors increases with the number of binge drinking occasions. For example, a study of U.S. high school students found a positive relationship between binge drinking frequency and use of other drugs, including tobacco, marijuana, cocaine, and inhalants (prescription opioid misuse was not assessed).<sup>27</sup>

Adult binge drinkers tend to binge about once a week on average and consume an average of seven drinks per binge,<sup>13</sup> and people who misuse prescription opioids also report doing so about once a week (an average of 54 days a year).<sup>7</sup> This is concerning given that the risk of a dangerous interaction between alcohol and opioids is likely to

be greatest among those who are misusing opioids and binge drinking frequently and at high intensity.

The odds of prescription opioid misuse among binge drinkers being nearly twice that of nondrinkers suggests the importance of population-level policies to reduce binge drinking. The U.S. Community Preventive Services Task Force recommends several effective strategies for reducing binge drinking, including increasing alcohol taxes,<sup>28</sup> regulating the density of alcohol outlets,<sup>29</sup> and having commercial host liability laws.<sup>30</sup> In addition, the U.S. Preventive Services Task Force recommends screening and brief intervention for adults as a strategy to reduce excessive alcohol use.<sup>31</sup> This intervention may also be effectively administered electronically (also known as e-screening and brief intervention) using computers, tablets, smartphones, and other electronic tools in a variety of settings (e.g., primary care clinics, health departments, and on college campuses).<sup>32</sup> Effective strategies to reduce overdoses involving prescription opioids include safe prescribing practices, as described in the Centers for Disease Control and Prevention Guideline for Prescribing Opioids for Chronic Pain,<sup>33</sup> as well as strategies to prevent and treat opioid use disorder,<sup>34</sup> and reverse opioid overdoses.<sup>35</sup>

Finally, the 2015–2020 U.S. Dietary Guidelines for Americans indicate that some people should not drink at all, including those who are taking medications that could interact with alcohol, as well as youth under age 21 years and women who are pregnant or might be pregnant.<sup>36</sup> The U.S. Food and Drug Administration has also advised healthcare professionals to avoid prescribing opioids to patients using alcohol or other central nervous system depressants.<sup>17</sup> Therefore, adult drinkers aged 21 years or older should only do so in moderation (i.e., consume up to one drink per day for women and up to two drinks per day for men) or not drink at all, particularly while using prescription opioids.<sup>17,36</sup>

Future research examining the relationship between evidence-based alcohol policies (e.g., increasing alcohol taxes<sup>28</sup> and regulating the density of alcohol outlets<sup>30</sup>), total binge drinks per binge drinker, and the risk of opioid overdoses in states could help guide the prevention of opioid misuse and opioid overdoses involving alcohol. In addition, future research could assess whether improved opioid prescribing could also help reduce opioid misuse and opioid overdoses involving alcohol.

### Limitations

This study has limitations. First, this study was not able to examine whether alcohol and opioids were used concurrently. Second, data were based on self-reports, and therefore, both prescription opioid misuse and alcohol consumption (particularly binge drinking) are likely to have been under-reported. However, the NSDUH audio

computer-assisted self-interview process assesses the internal consistency of responses, which has been shown to improve the sensitivity of NSDUH estimates of binge drinking among adults.<sup>37</sup> Third, because this study was focused on the misuse of prescription opioids, it did not consider the use of illicit opioids, such as heroin and illicitly manufactured fentanyl, which has been increasing,<sup>38</sup> including among people who binge drink and people who misuse prescription opioids.<sup>39</sup>

### CONCLUSIONS

Binge drinking is associated with prescription opioid misuse, and the prevalence of prescription opioid misuse increased with the frequency of binge drinking. Binge drinkers who misuse prescription opioids are likely to be at substantially increased risk of overdose because of the combined effect of high blood alcohol levels and prescription opioids on the central nervous system.<sup>17</sup> The high prevalence, frequency, and intensity of binge drinking among adults and adolescents in the U.S.,<sup>13,40</sup> along with the heightened prevalence of prescription opioid misuse among binge drinkers, emphasizes the importance of adopting a comprehensive and coordinated approach to addressing both binge drinking and prescription opioid misuse to reduce the risk of opioid overdoses.

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