High Risk of Alcohol-Impaired Driving in Adults With Comorbid Alcohol and Substance Use Disorders in the U.S. Population

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ABSTRACT. Objective: Alcohol-impaired driving is a significant source of injury and morbidity in the United States. People with alcohol use disorder (AUD) are more likely to drive while impaired by alcohol than their nonclinical counterparts. Less is known about rates of impaired driving in people with AUD and a comorbid substance use disorder (SUD). The current study examined the association among AUD, other SUDs, and alcohol-impaired driving in a nationally representative sample of adults in the United States. **Method:** Data were from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC-III; $n = 36,309$). AUD and SUD diagnoses according to DSM-5 criteria were determined using the Alcohol Use Disorder and Associated Disabilities Interview Schedule-5. We compared rates of past-year alcohol-impaired driving in people with AUD, another SUD (i.e., cannabis use disorder, stimulant use disorder, opioid use disorder), or AUD comorbid with another SUD against those with no past-year

AUD or SUD diagnoses. **Results:** People with AUD had increased odds (adjusted odds ratios [AORs] = 15.85–28.27) of past-year alcohol-impaired driving behavior compared with past-year drinkers with no AUD or SUD. Although other SUDs per se were not consistently associated with increased odds of these behaviors (AORs = 0.28–4.07), people with AUD comorbid with SUD showed comparatively higher odds of these behaviors (AORs = 30.46–93.97). These effects held even when alcohol use quantity/frequency and AUD severity were controlled for. **Conclusions:** People with AUD and a comorbid SUD are at high risk for alcohol-impaired driving. More research is needed to understand the factors mediating increased odds of driving while impaired in people with substance use comorbidities, especially considering societal movement toward cannabis legalization. (*J. Stud. Alcohol Drugs*, 80, 114–119, 2019)

ALCOHOL-IMPAIRED DRIVING is a pervasive societal problem resulting in significant death and economic damages in the United States (National Highway Traffic Safety Administration, 2015). Given the high rates of recidivism among those who engage in this behavior (Nochajski & Stasiewicz, 2006), an important goal for researchers has been to identify characteristics associated with increased risk of driving under the influence (DUI). One consistent finding has been that DUI offenders show higher rates of alcohol use disorder (AUD) than the general population (Caetano & Rasberry, 2000; Carruth et al., 2016; Lapham et al., 2001; Pristach et al., 1991). Indeed, alcohol-impaired driving is a common behavioral feature of

AUD. Estimates of the number of DUI offenders who meet criteria for AUD are typically based on forensic samples identified after they are arrested (Lapham et al., 2001; Windle & Miller, 1989). Less research has examined rates of DUI using population-based samples (but see Hingson et al., 2002). Examining alcohol-impaired driving behavior in a population sample is important, because only a subset of people who engage in DUI are arrested (Beitel et al., 2000), a fact that may bias estimates of DUI risk in people with AUD.

Less is known about the risk of alcohol-impaired driving in people who abuse other drugs alongside alcohol. Co-occurrence of AUD with other substance use disorders (SUDs) is common (Stinson et al., 2005) and increases the risk of negative substance-related outcomes (Grodin et al., 2013; Moss et al., 2014) and comorbid psychopathology (Conway et al., 2013). Polysubstance users show high rates of negative behavioral and health outcomes (e.g., sexual risk taking; Connor et al., 2014). With regard to DUI, post-accident analysis studies have found that drivers who recently used both alcohol and another drug were more likely to cause traffic collisions than those under the influence of alcohol alone (Drummer et al., 2004; Movig et al., 2004). These findings for additive risk suggest that people with AUD who use other substances may be more

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likely to engage in alcohol-impaired driving compared with those with AUD only. However, this hypothesis had yet to be tested in a population-based sample.

The current study was conducted using data from a large, nationally representative survey to examine rates of alcohol-impaired driving in people with and without AUD and another SUD. We examined rates of alcohol-impaired driving in four separate groups of drinkers classified based on their past-year alcohol or substance use disorder diagnoses: (a) no AUD or SUD diagnosis, (b) AUD without comorbid SUD, (c) SUD without AUD, and (d) AUD with one or more comorbid SUDs. We ran separate models to examine the odds of alcohol-impaired driving in people reporting a disordered use of different drug classes (i.e., cannabis, stimulants, opioids). We hypothesized that people with AUD or another SUD would show heightened risk of alcohol-impaired driving compared with those with no past-year diagnosis. We further predicted that those with AUD and a comorbid SUD would show the highest odds of alcohol-impaired driving.

Method

Participants and procedures

National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III). The primary source of data for this study was the NESARC-III, a survey of 36,309 non-incarcerated adults in the United States conducted by the National Institute on Alcohol Abuse and Alcoholism (for more information on NESARC-III methods, see Grant et al., 2014). Participants completed an in-person computer-assisted interview (Alcohol Use Disorder and Associated Disabilities Interview Schedule-5; AUDADIS-5), which is a reliable and valid measure of AUD and other SUDs (Hasin et al., 2015). This instrument measures AUD/SUD according to current criteria from the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5; American Psychiatric Association, 2013). The current article includes data only from participants who reported consuming alcohol in the past year ($n = 25,778$).

Measures

Alcohol-impaired driving. Three questions were used to assess past-year history of alcohol-impaired driving. All participants were asked whether during the past year they (a) “more than once dr[o]ve a car, motorcycle, truck, boat, or other vehicle AFTER having too much to drink”; (b) “more than once dr[o]ve a car or other vehicle WHILE [they] were drinking”; and (c) “dr[o]ve a car, motorcycle, truck, boat, or other vehicle and [had] an accident while [they] were under the influence of alcohol.” Possible responses were *yes*, *no*, or *unknown*. Responses of “unknown” were coded as missing.

It should be noted that items 1 and 2 were designed to detect participants who engaged in the behavior more than once over the past year. Those who engaged in the behavior only once were categorized in the same group as those who did not engage in the behavior. As such, this classification scheme detected those who engaged in patterns of impaired driving over the past year rather than a single episode of the behavior.

Past-year alcohol and substance use. Past-year alcohol and substance use disorder diagnoses were determined using DSM-5 criteria as determined by the AUDADIS. SUD categories were grouped as follows: cannabis use disorder, stimulant use disorder (cocaine use disorder or other stimulant use disorder), and opioid use disorder (heroin use disorder or other opioid use disorder). Several of our analyses considered AUD severity as a stratification variable or covariate. AUD symptoms were counted to create an AUD severity variable: (a) no AUD (0–1 symptoms), (b) mild AUD (2–3 symptoms), (c) moderate AUD (4–5 symptoms), or (d) severe AUD (≥ 6 symptoms). Past-year alcohol use quantity and frequency were used as covariates in supplemental analyses. Drinking frequency was measured by asking respondents “how often [they] drank any alcoholic beverage in the last 12 months,” ranging from 1 (*1 to 2 times in the last year*) to 10 (*every day*). Drinking quantity was defined as the number of drinks respondents usually consumed on days when they drank in the last 12 months.

Covariates. Demographic variables that may be related to substance use–impaired and alcohol-impaired driving (i.e., age, race/ethnicity, sex, income) were included as covariates. Sex was coded dichotomously (male/female), and race was coded into five categories (White, Black, American Indian/Alaska Native, Asian/Pacific Islander, Hispanic). Yearly personal income was coded into 17 continuous income range categories.

Data analysis

Data were analyzed using PROC SURVEYLOGISTICS in SAS Version 9.4 (Cary, NC). This procedure allowed for incorporating the stratification, clustering (i.e., primary sampling unit), and unequal weighting of the sampling design. Logistic regression analyses were used to test our hypotheses. All analyses are adjusted for covariates (i.e., sex, race, income, age).

The primary set of logistic regression analyses tested the association between alcohol-impaired driving, AUD, and SUD. Participants were coded into one of four groups, including a normative reference group (no AUD or SUD), AUD only, SUD only, or AUD with comorbid SUD. Separate models were run for each drug category. We also ran a similar model to test the association between alcohol-impaired driving and level of AUD severity.

Three sets of supplemental analyses were conducted to address potential confounds. The first set reran the primary analyses controlling for alcohol use quantity/frequency. Alcohol use quantity was defined as the average number of drinks consumed per drinking session, and frequency was defined categorically. We reasoned that participants with AUD/SUD show higher rates of alcohol consumption compared with their nonclinical peers, which may account for more frequent alcohol-impaired driving. The second set reran the primary models controlling for AUD severity. It is possible that group differences in rates of alcohol-impaired driving can be explained by differences in AUD severity (i.e., more severe AUD in the AUD with comorbid SUD groups). These models examined the risk of alcohol-impaired driving independent of disease severity. In the final supplemental analysis, we recoded participants' AUD diagnostic status such that alcohol-impaired driving did not contribute to the physically hazardous use criteria (i.e., "more than once gotten into a situation while or after drinking that increased your chances of getting hurt"). This model was conducted to reduce the risk of criterion contamination, because prior research has shown that this symptom is often endorsed because of alcohol-impaired driving (Babor & Caetano, 2008).

Results

Demographic information

Demographic information and base rates of alcohol-impaired driving behaviors in the NESARC-III are presented in a supplemental table. (Supplemental material appears as an online-only addendum to the article on the journal's website.)

Risk of alcohol-impaired driving in AUD with and without SUD

Odds ratios of past-year alcohol-impaired driving behavior in people with AUD, SUD (i.e., cannabis, stimulant, and opioid use disorder), and AUD comorbid with these SUDs are presented in Table 1. These models show that people with AUD had greater odds of past-year alcohol-impaired driving behaviors. People with cannabis use disorder alone showed greater odds of alcohol-impaired driving. However, those with stimulant use disorder or opioid use disorder alone did not differ from those with no diagnosis. Consistent with our hypothesis, those who met criteria for any SUD comorbid with AUD had higher odds of past-year alcohol-impaired driving than people with AUD alone. People with comorbid AUD plus stimulant use disorder showed the highest odds of alcohol-impaired driving compared with people with AUD plus opioid use disorder or cannabis use disorder.

Risk of alcohol-impaired driving and AUD severity

AUD severity was associated with greater odds of alcohol-impaired driving, although each level of severity was associated with increased odds compared with those with no AUD diagnosis. Results of these analyses are presented in Table 1.

Supplemental analyses

Results of the three sets of supplemental analyses are reported in supplemental tables. All analyses are presented in supplemental tables. Although the effects of these models were attenuated compared with the primary analyses, the general patterns of findings are consistent with the above-described results.

Discussion

This study examined the risk of alcohol-impaired driving over the past year among people with AUD, another SUD, and AUD comorbid with another SUD. Consistent with prior research, AUD alone conferred a significant increase in the risk of alcohol-impaired driving relative to the general population of alcohol users. As expected, alcohol users who met criteria for AUD comorbid with another SUD were more likely to report past-year alcohol-impaired driving than were people with AUD alone. In the primary analysis, this pattern of findings was consistent across all three categories of SUD, including cannabis use disorder, stimulant use disorder, and opioid use disorder. These findings cannot be explained solely by diagnostic group differences in alcohol use quantity/frequency, because people with comorbid AUD + SUD showed an increased risk of alcohol-impaired driving even in models that controlled for potential confounds (e.g., alcohol use quantity/frequency, AUD severity) and statistical artifacts (i.e., inflated rates of impaired driving in AUD groups because of impaired driving contributing to hazardous use criteria). As such, the elevated risk of alcohol-impaired driving in the AUD + SUD and AUD-alone groups cannot be attributed entirely to differences in alcohol exposure. Instead, group differences may reflect patterns of dysregulated, maladaptive behavior during alcohol use episodes that occur in heavy drinking groups (Marczinski et al., 2007). Similarly, the increased risk in individuals with AUD + SUD cannot be attributed entirely to more severe AUD in this group, because the effects persisted even when AUD severity was controlled for.

These findings have implications for clinical practice and policy aimed at reducing alcohol-impaired driving. From a predictive standpoint, these findings suggest that people with AUD and a comorbid SUD are at considerably greater risk for alcohol-impaired driving relative to those with no disorder or AUD alone. Given that almost half of drivers

TABLE 1. Risk of alcohol-impaired driving behavior in past-year drinkers with current alcohol use disorder (AUD) and comorbid substance use disorders in the National Epidemiologic Survey on Alcohol and Related Conditions-III ($n = 25,778$)

Variable	Past-year driving after drinking too much		Past-year driving while drinking		Past-year alcohol-involved accident	
	OR [95% CI]	% ^c	OR [95% CI]	% ^c	OR [95% CI]	% ^c
Model 1: Cannabis use disorder (CUD)						
No diagnosis	Ref.	0.94%	Ref.	2.18%	Ref.	0.19%
AUD with no CUD	28.27 ^a [23.18, 34.48]	22.55%	20.58 ^a [17.61, 23.86]	31.10%	15.85 ^a [10.32, 24.34]	3.68%
CUD with no AUD	4.07 ^{a,b} [1.33, 12.40]	1.60%	2.73 ^{a,b} [1.12, 6.74]	2.57%	N/A	
AUD with comorbid CUD	47.95 ^{a,b} [34.72, 66.22]	31.82%	34.75 ^{a,b} [27.05, 44.65]	39.12%	30.46 ^{a,b} [16.85, 55.04]	6.40%
Model 2: Stimulant use disorder (StUD)						
No diagnosis	Ref.	0.95%	Ref.	2.18%	Ref.	0.18%
AUD with no StUD	27.00 ^a [22.01, 33.11]	22.89%	20.17 ^a [17.44, 23.32]	31.32%	16.87 ^a [10.98, 25.93]	3.88%
StUD with no AUD	0.28 ^b [0.04, 2.10]	1.37%	0.34 ^b [0.08, 1.47]	2.74%	1.45 ^b [0.19, 11.26]	1.37%
AUD with comorbid StUD	93.97 ^{a,b} [57.89, 152.53]	46.84%	65.58 ^{a,b} [40.44, 99.95]	54.43%	41.32 ^{a,b} [20.48, 83.37]	7.59%
Model 3: Opioid use disorder (OUD)						
No diagnosis	Ref.	0.95%	Ref.	2.19%	Ref.	0.19%
AUD with no OUD	26.89 ^a [21.91, 32.99]	23.07%	20.27 ^a [17.51, 23.48]	31.82%	16.59 ^a [10.88, 25.29]	3.79%
OUD with no AUD	0.31 ^b [0.04, 2.36]	0.54%	0.31 ^b [0.08, 1.29]	1.08%	N/A	
AUD with comorbid OUD	60.95 ^{a,b} [40.52, 91.66]	37.13%	34.09 ^{a,b} [23.27, 49.94]	37.13%	33.86 ^{a,b} [15.13, 75.79]	8.91%
Model 4: Alcohol use disorder severity						
No AUD	Ref.	1.82%	Ref.	3.68%	Ref.	0.33%
Mild AUD	7.78 ^a [6.26, 9.66]	13.97%	6.18 ^a [5.26, 7.26]	20.19%	3.48 ^a [2.09, 5.79]	1.52%
Moderate AUD	17.09 ^a [13.87, 21.05]	25.12%	12.15 ^a [9.98, 14.79]	31.07%	12.13 ^a [7.23, 20.36]	4.44%
Severe AUD	33.91 ^a [26.96, 42.67]	39.11%	22.86 ^a [18.81, 27.78]	46.17%	22.53 ^a [14.26, 35.60]	8.56%

Notes: All models were adjusted for income, race, gender, and age. All models included only participants who reported any alcohol use during the past year. OR = odds ratio; CI = confidence interval; ref. = reference; N/A = no participants in corresponding group reported past-year instances of that behavior, and therefore an OR could not be estimated for that group. ^aSignificantly different from the no-diagnosis group, $p < .05$; ^bsignificantly different from the AUD-only group, $p < .05$; ^cunweighted percentages.

with AUD and stimulant use disorder reported driving while impaired by alcohol in the past year, it may be necessary for clinicians to screen for and address this behavior when providing services to this population. From a prevention standpoint, however, it is important to note that people with neither SUD nor AUD make up a significant proportion of alcohol-impaired drivers. Even though a smaller percentage of respondents with no AUD or SUD (~0.9%) reported past-year alcohol-impaired driving, there are many more drivers without than with AUD. Indeed, a study of psychiatric disorders in DUI offenders found that approximately 63% of those convicted for DUI did not meet criteria for current AUD (Lapham et al., 2001). This rate was consistent with results of the National Roadside Survey, which found that nearly half of intoxicated drivers (BAC ≥ 80 mg/dl) met current AUD criteria (Furr-Holden et al., 2011). As such,

DUI prevention efforts should focus on drivers both with and without AUD, because these groups may generate similar numbers of alcohol-impaired driving events due to their relative base rates.

Evidence for additive risk is particularly important given the rapid shift toward cannabis legalization in the United States, which will likely increase rates of co-occurring AUD and cannabis use disorder (Cerdeira et al., 2012).

Although the current study clearly documents an increased risk of alcohol-impaired driving among people with AUD with SUD comorbidity, the nature of the study does not allow us to examine potential mechanisms of this increased alcohol-impaired driving risk. One possibility is that pharmacological interactions between alcohol and other drugs lead to an increased risk of impaired driving, although it is not clear from the survey questions whether people are

driving after using alcohol only or after alcohol and another drug. It is well known that co-administration of alcohol and other drugs can potentiate alcohol impairment of behavioral control (e.g., cannabis; Bramness et al., 2010) or antagonize the subjective effects of alcohol, which may result in users perceiving themselves as fit to drive despite high levels of behavioral impairment (e.g., stimulants; Foltin et al., 1993; Marczyński & Fillmore, 2006). Along these lines, we found interesting differences among drug classes. For example, a stimulant use disorder alongside AUD appeared to confer significantly greater risk than an opioid use disorder + AUD. These differences among drug classes may relate to the pharmacological profiles of the different drug classes and their interactions with alcohol.

Nonpharmacological factors also may explain the increased risk of alcohol-impaired driving in those with AUD + SUD. Higher rates of impulsivity (Conway et al., 2003) and sensation seeking (Ball et al., 1994) among polysubstance abusers may also explain high rates of impaired driving in this group. More research, including laboratory-based behavioral pharmacology studies (e.g., Roberts & Fillmore, 2017), will be necessary to understand the causal pathways that explain the heightened risk of alcohol-impaired driving in people with AUD + SUD. Another approach toward identifying causal associations will be to include more detailed questions in future large-scale population-based surveys. As an example, future surveys could assess under which intoxicants (e.g., alcohol alone, alcohol and cocaine) respondents are driving.

Limitations

There are several limitations that should be considered. First, data are cross sectional and cannot test causal associations among AUD/SUD and impaired driving behavior. Second, our primary outcome variables were self-reported and contained elements of subjectivity that may have biased response. For example, participants with AUD may define “driving after drinking too much” differently than do non-hazardous drinkers. Third, the NESARC did not include a measure of driving frequency; it is possible that group differences in driving exposure account for some of the observed effects. Finally, despite the overall large sample size of the NESARC-III, some of the cell sizes in our analyses were small, resulting in imprecise effect size estimates. Comparisons involving these smaller cells should be interpreted with this limitation in mind.

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