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Patterns of Use of Other Drugs Among Those with Alcohol Dependence: Associations with Drinking behavior and Psychopathology

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Abstract

INTRODUCTION—Alcohol dependence (AD) presents with substantial clinical heterogeneity, including concurrent use of non-alcohol drugs. Here, we examine specific patterns of concurrent non-alcohol substance use during the previous year among a nationally representative sample of adults with DSM-IV AD, and estimate their population prevalence in the U.S. We then evaluate alcohol use behavior and comorbid psychopathology among respondents with AD according to their patterns of concurrent non-alcohol substance use.

METHODS—These analyses utilized data from Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. Latent class analyses classified respondents with AD into four clinically-meaningful patterns of concurrent substance use: 1) *Use of alcohol only*; 2) *Use of alcohol and tobacco only*; 3) *Use of alcohol, tobacco and cannabis*; and 4) *Use of alcohol, tobacco, cannabis, cocaine and other illicit drug(s)*.

RESULTS—Among AD respondents, the most prevalent pattern was the *use of alcohol and tobacco only* (weighted percentage 32.4%), followed by the *use of alcohol only* (weighted percentage 27.5%). AD respondents who used *alcohol, tobacco, cannabis, cocaine and other illicit drug(s)* (weighted percentage 25.3%) manifested the most severe pattern of alcohol consumption, and had significant overrepresentations of major depression, panic and other anxiety disorder, and paranoid, schizotypal, borderline, antisocial, and histrionic personality disorders, compared to those with those who used *alcohol alone*.

CONCLUSIONS—Specific patterns of concurrent substance use convey important information regarding the clinical presentation and prognosis for AD. In particular, concurrent use of illicit drugs over the past year by AD individuals was associated with greater severity and comorbid psychopathology. These data suggest the need for pragmatic trials of AD interventions that take into account patterns of substance use behavior in addition to an AD diagnosis.

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1. Introduction

Alcohol dependence (AD) is a disorder of multifactorial etiology with a lifetime prevalence of approximately 12.5% in the U.S. adult population (Hasin et al., 2007). In both clinically and epidemiologically ascertained individuals, AD presents with substantial heterogeneity in clinical features, onset age, severity, treatment-seeking, comorbid psychopathology, and non-alcohol substance use (Babor et al., 1992; Bucholz et al., 1996; Cloninger et al., 1988; Jacob et al., 2005; Jellinek, 1960; Lesch et al., 1988; McGue, 1999; Moss et al., 2007, 2008; Schuckit, 1985; Vaillant, 1983; Zucker, 1987). However, as noted by Brecht and colleagues (2008), it is typical in treatment settings to identify substance use problems by the primary substance for which help is sought (e.g., alcohol), without examining additional substance use behavior. While it may be practical to focus solely on the presenting substance use disorder, the use of additional specific or multiple substances may introduce considerable complications with respect to assessment, treatment strategy, and clinical outcome. Furthermore, while evidence-based guidelines exist for the management of single, or “pure,” substance use disorders, little empirically supported guidance is available concerning the management of polysubstance-using patients. This may in part reflect a lack of data about these individuals.

In clinical settings, the use of multiple substances is associated with poorer treatment outcomes for disorders associated with illicit drugs such as heroin, cocaine, and methamphetamine (e.g., Bovasso and Cacciola, 2003; DeMaria et al., 2000; Downey et al., 2000; Williamson et al., 2006). Similar but less extensive data are available examining the negative impact of concurrent non-alcohol substance use on interventions for AD (Malcolm et al., 2006; Martin et al., 1996). Thus, variations in the responses of patients with AD to clinical interventions could reflect confounding by concurrent or recent substance use behavior rather than limitations in treatment efficacy.

In this report, we identify specific patterns of concurrent non-alcohol substance use during the previous year among adult respondents with DSM-IV diagnoses of AD in a nationally representative general population survey, and estimate the population prevalence of each pattern in the U.S. We then examine alcohol use behavior and comorbid psychopathology among respondents with AD classified by specific patterns of concurrent substance use. The results replicate and extend the aforementioned clinical observations (Malcolm et al., 2006; Martin et al., 1996), further delineating of the heterogeneity of AD while illustrating the need for a more personalized treatment approach.

2. Methods

2.1 Sample

These analyses utilized data from Waves 1 (2001–2002) and 2 (2004–2005) of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), conducted by the National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health. As described elsewhere (Grant et al., 2004b), the entire NESARC protocol, including informed consent procedures, received full review and approval from the Institutional Review Board of the United States Census Bureau and the Office of Management and Budget. The Wave 1

NESARC sample represents the civilian, non-institutionalized population aged 18 years and older of the United States, including all 50 states and the District of Columbia, residing in households and selected non-institutional group quarters. Blacks, Hispanics, and young adults 18–24 years of age were oversampled and the overall response rate was 81% ($n=43,093$). Detailed information on the sample design and weighting is available elsewhere (Grant et al., 2003b, 2007, 2009). In Wave 2, face-to-face re-interviews were attempted with all Wave 1 respondents. Of the original Wave 1 sample, 3,134 were classified as ineligible because they were institutionalized, mentally or physically impaired, or on active duty in the armed forces throughout the Wave 2 interview period ($n = 1,731$); or deceased, permanently moved (e.g., out of the country) or deported ($n = 1403$). Of the 39,959 eligible respondents, 34,653 were re-interviewed at Wave 2, reflecting a response rate of 86.7%. The cumulative response rate in Wave 2, the product of the Wave 2 and Wave 1 response rates, was 70.2% and the mean interval between Wave 1 and Wave 2 interviews was 36.6 ($SE = 2.6$) months. The weighted mean age of Wave 2 subjects at Wave 1 were 45.1 years ($SE = 0.2$).

Grant and colleagues (2009) compared Wave 2 respondents with the target population (comprising Wave 2 respondents and eligible non-respondents) on numerous baseline (Wave 1) sociodemographic and diagnostic measures. Results indicated no significant differences between the Wave 2 respondents and the target population on age, race-ethnicity, sex, socioeconomic status, or the presence of any lifetime substance use, mood, and anxiety or personality disorder (PD) diagnoses.

2.2 Measures

The diagnostic interview used in the NESARC was the Alcohol Use Disorders and Associated Disabilities Interview Schedule – *DSM-IV* Version (AUDADIS-IV) for Wave 1 (Grant et al., 2001) and Wave 2 (Grant et al., 2004a). The AUDADIS-IV is a fully structured instrument designed for administration by experienced non-clinician interviewers and includes modules to assess substance use, mood, anxiety, and personality disorders, as well as family histories of alcohol and drug use disorders, depression, and antisocial behavior. It also includes detailed questions concerning patterns of alcohol, tobacco, and other drug use. To obtain a Wave 1 past-year diagnosis of AD, respondents were required to meet at least 3 of the 7 *DSM-IV* symptom criteria during the 12 months prior to the baseline interview. Status of Wave 2 past-year recovery from Wave 1 past-year AD was defined according to the 5-level classification described by Dawson et al. (2005): still positive for AD, in partial remission (not meeting past-year criteria for AD but endorsing at least one symptom of either alcohol abuse or alcohol dependence), asymptomatic risk drinking (no alcohol use disorder symptoms but consumption by men of more than 14 standard drinks per week or 5 or more drinks on any single day, or consumption by women of more than 7 standard drinks per week or 4 or more drinks on any single day), low-risk drinking (past-year alcohol consumption but no alcohol use disorder symptoms and no risk drinking as defined above), or abstinence (no past-year alcohol consumption). The weighted mean age of AD subjects at Wave 1 was 31.2 years ($SE = 0.4$).

Axis I disorders were assessed identically in the Wave 1 and Wave 2 versions of the AUDADIS-IV except for the time frames. Consistent with *DSM-IV*, Wave 1 past-year

primary mood (major depressive and manic episodes) and anxiety (panic with or without agoraphobia, social and specific phobias, and generalized anxiety disorder) diagnoses excluded substance-induced cases and those due to general medical conditions. In addition, diagnoses of major depression ruled out bereavement. Personality disorders (PDs) were assessed on a lifetime basis. Those assessed at Wave 1 included avoidant, dependent, obsessive-compulsive, paranoid, schizoid, and histrionic PDs (Grant et al., 2004c). Antisocial PD was assessed at Wave 1 with a follow-up at Wave 2 to capture individuals who may not have met full diagnostic criteria at Wave 1 but went on subsequently to do so (Goldstein and Grant, 2009). Borderline, narcissistic, and schizotypal PDs were assessed at Wave 2 (Grant et al., 2008). DSM-IV PD diagnoses require evaluation of long-term patterns of functioning. Accordingly, respondents were asked symptom questions about how they felt or acted most of the time, throughout their lives, regardless of the situation or whom they were with, and instructed to exclude symptoms occurring only when they were depressed, manic, anxious, drinking heavily, using medicines or drugs, experiencing withdrawal symptoms, or physically ill. Respondents were also queried about whether they experienced distress or social or occupational impairment related to each reported symptom. To receive a DSM-IV PD diagnosis, respondents needed to endorse the required number of DSM-IV symptom criteria for the specific PD, with at least 1 symptom causing distress or social or occupational impairment.

As described in detail elsewhere, the good to excellent reliability of AUDADIS-IV alcohol use disorders ($\kappa=0.70\text{--}0.84$), and their validity, are extensively documented in general population and clinical samples (Grant et al., 2003a; Hasin et al., 2007). Similarly, the reliability of alcohol and tobacco use (Grant, 1996; Grant and Dawson, 1998; Grant et al., 1995, 2003a, 2004d; Hasin et al., 1997a, 1997b) ranged from fair to excellent. Test-retest reliabilities of AUDADIS-IV mood and anxiety ($\kappa=0.42\text{--}0.65$) and PD ($\kappa=0.40\text{--}0.71$) diagnoses were fair to good (Grant et al., 2003a, 2004c, 2004d, 2005a, 2005b; Ruan et al., 2008). Convergent validity of mood, anxiety, and PD diagnoses was good to excellent (Grant et al., 2004c, 2004d, 2005a, 2005b).

2.3 Analyses

We utilized Latent Class Analysis (LCA) with a posterior mode estimation based on EM and Newton-Raphson algorithms (Garre and Vermunt, 2006), implemented in Latent Gold 4.5 (Statistical Innovations, 2008), to identify polysubstance use patterns among respondents with Wave 1 past-year AD who were re-interviewed in Wave 2. The NESARC Wave 2 sampling weight was taken into account by Latent Gold in determining the class membership. The polysubstance use patterns represented by the latent classes were derived from the dichotomous (yes/no) indicators of past-year use of any tobacco product, cannabis, cocaine, or other illicit drugs. LCA is a data reduction technique that helps increase the interpretability of data by constructing a small number of clusters from a large number of combinations of responses to the observed indicators. With four dichotomous indicators, there were originally 16 possible combinations of polysubstance use. However, LCA was used to reduce the number to four clinically meaningful patterns of polysubstance use. We examined LCA solutions for three to six classes, but selected the 4-class solution for our study objectives based on considerations for the interpretation of class profiles, as well as

classification errors and Bayesian Information Criteria (BIC). Although the 3-class solution had a slightly lower BIC than the 4-class solution (−2280 vs. −2263), it had higher classification errors than the 4-class solution (0.08 vs. 0.03). The first pattern, “alcohol with no other substance use”, was a known class reserved for those who reported not using any of the substances. The rest of the AD respondents were assigned to one of the three patterns of use derived from LCA according to their most likely class membership (i.e., the highest posterior class probabilities). Importantly, this substance use classification was accepted not only on its quantitative indicators, but also because the resulting pattern suggested a scaling of involvement from “legal” to illicit substance use consistent with the oft theorized “gateway hypothesis” of substance involvement (e.g. Kandel et al, 1992).

After grouping respondents with AD into these four patterns of polysubstance use, we compared their prevalence or means (with 95% confidence intervals) on selected Wave 1 and 2 characteristics. The analyses incorporated the Wave 2 sampling weight and were conducted using Stata 12 (StataCorp, 2011), utilizing procedures which adjust for the complex sampling design of the NESARC.

3. Results

Table 1 displays the four LCA-derived patterns of Wave 1 past-year use of tobacco, cannabis, cocaine, and other illicit drugs among respondents with Wave 1 past-year AD. The most prevalent pattern was *alcohol and tobacco use only* (weighted percentage 32.4 %), followed by the *use of alcohol only* (weighted percentage 27.5%), *use of alcohol with tobacco, cannabis, cocaine and other illicit drug use* (weighted percentage 25.3%), and *use of alcohol with tobacco and cannabis use only* (weighted percentage 14.8%). Thus, while tobacco was clearly the substance most commonly used by individuals with AD, over 40% also used at least one illicit drug (including cannabis) during that time frame.

Sociodemographic characteristics of respondents with AD classified by polysubstance use pattern are shown in Table 2. Group-wise comparisons among the four polysubstance use patterns in this and subsequent tables were indicated by omnibus p-values. For each group, significant pairwise comparisons with the Bonferroni adjusted p-value < 0.05 were indicated by a superscript to note the pattern number of the comparison group. There were significant differences in mean ages as well as the distribution by sex. Alcohol dependent individuals with *alcohol use only* and both *alcohol and tobacco use* tended to be older than those with *alcohol, tobacco and cannabis use* and those with *alcohol, tobacco, cannabis, cocaine and other illicit drug use*. Men were overrepresented in each substance use group, most notably for those with *alcohol, tobacco and cannabis use*.

Differences were also observed in co-occurring substance use patterns by racial or ethnic identification. Whites made up the majority of respondents with AD and showed no clearly dominant pattern of substance use behavior. However, Blacks were least likely to be classified in the group with *alcohol, tobacco, cannabis, cocaine and other illicit drug use*, and most likely to be assigned to the *alcohol, tobacco and cannabis use* group. Hispanic/Latino respondents diagnosed with AD were least likely to be classified in the group with *alcohol, tobacco, cannabis, cocaine and other illicit drug use* and most likely to be

classified in the group with *alcohol use only*. Nevertheless, these disparities may be confounded by socioeconomic differences, given the significant differences between drug use patterns based upon college education and income.

Table 3 displays measures of alcohol consumption, number of DSM-IV alcohol use disorder criteria endorsed, past-year treatment seeking, and Wave 2 AD recovery status according to the four substance use patterns. Respondents classified in the *alcohol use only* group had the latest onsets of both drinking and AD, while those in *alcohol, tobacco and cannabis use* and *alcohol, tobacco, cannabis, cocaine and other illicit drug use* groups had the earliest onset of drinking and the earliest onset of AD. Respondents in the *alcohol use only* group met the fewest diagnostic criteria for AD and alcohol abuse, while those in the *alcohol, tobacco, cannabis, cocaine and other illicit drug use* met the most criteria for both DSM-IV AD and alcohol abuse diagnoses. Those individuals in the *alcohol use only* group also reported the fewest past-year drinking days, exceeded low-risk daily drinking limits the least, drank the fewest drinks (both usual and maximum numbers of drinks) on drinking days, and consumed the lowest daily volume of ethanol. Respondents in the group using *alcohol, tobacco, cannabis, cocaine and other illicit drug(s)* consumed the greatest number of drinks on drinking days (both usual and maximum) and consumed the greatest average daily volume of ethanol. A similar pattern emerged with respect to treatment utilization. Respondents in *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group sought treatment the most (17.7%), while those in the *alcohol use only* group sought treatment the least (5.4%), over the past year. However, at Wave 2 the largest percentage of individuals still alcohol dependent were those in *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group (43.5%), while those in the *alcohol use only* group had the lowest rate of persistent AD (27.8%) and the greatest percentage transitioning from AD to low-risk drinking (9%) despite their lack of any treatment. Thus, across several indicators of AD severity, *alcohol use only* respondents appeared to be least severe, while *alcohol, tobacco, cannabis, cocaine and other illicit drug use* individuals appeared to be the most severe and had the most pernicious longitudinal course.

Comorbid mood, anxiety, and personality disorders according to substance use patterns are displayed in Table 4. Respondents in *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group demonstrated significantly higher past-year prevalence rates of major depressive episodes, panic disorder, and social and specific phobias (28.9%, 10.9%, 9.0%, and 20.2%, respectively) than respondents in alcohol use only group (14.9%, 3.1%, 3.0%, and 8.5%, respectively). Social phobia was also significantly more prevalent in the *alcohol and tobacco use* group than in the *alcohol use only* group. PDs overrepresented among respondents in *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group relative to those in the *alcohol use only* group include paranoid, schizotypal, borderline, histrionic, and obsessive-compulsive PDs. However, the largest disparity in PD rates was between antisocial PD in the *alcohol use only* group (6.7%) versus the *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group (33%). Other pairwise differences for antisocial PD were also noted between the *alcohol and tobacco* (17.9%) and the *alcohol, tobacco and cannabis* groups (22%) relative to the *alcohol only* group (6.7%). Other significant pairwise differences were observed for schizotypal PD (*alcohol, tobacco, cannabis, cocaine and*

other illicit drug use group > alcohol and tobacco group), borderline PD (*alcohol, tobacco and cannabis group > alcohol use only group*), histrionic PD (*alcohol and tobacco group and alcohol, tobacco, cannabis, cocaine and other illicit drug use group each > alcohol only group*), and narcissistic PD (*alcohol, tobacco and cannabis group > alcohol only group*).

4. Discussion

The results of this study confirm the clinical heterogeneity of AD across multiple domains (Babor et al., 1992; Bucholz et al., 1996; Cloninger et al., 1988; Jacob et al., 2005; Jellinek, 1960; Lesch et al., 1988; McGue, 1999; Moss et al., 2007, 2008; Schuckit, 1985; Vaillant, 1983; Zucker, 1987), and support the assertion of Martin et al. (1996) that the presentation and prognosis of AD patients cannot be understood only in terms of alcohol consumption behaviors. It is now widely recognized that AD is a complex disorder whose etiology is influenced by the interplay of biological, behavioral, and socio-environmental factors. Thus, given the panoply of etiological influences, it is hardly surprising that the clinical presentations are so diverse.

In this study, we focused on patterns of concurrent use of additional psychoactive substances, both licit and illicit, among those with AD. We found in a nationally representative general population sample that concurrent use of additional substances, particularly a multiplicity such as tobacco, cannabis, cocaine, and other illicit drugs, was associated with more severe clinical presentation of AD, including earlier onsets of drinking and dependence, and more frequent and extreme drinking. Additionally, these subjects manifested substantial excess psychopathology in terms of mood, anxiety, and Cluster A and Cluster B personality disorders. It is noteworthy that respondents in the *alcohol, tobacco, cannabis, cocaine and other illicit drug use* group were also the ones most likely to engage in treatment for their alcohol use disorder, although they manifested the greatest persistence of syndromal AD over time. This suggests a paradoxical situation wherein treatment providers are tasked with the care of the more complex and clinically severe AD patients, yet the research field has few evidence-based treatment guidelines at present to address their specific needs. Our findings suggest that AD in the absence of concurrent substance use occurs in a little more than a quarter of the AD population (27.5 %), is less severe, and seen infrequently in community treatment settings. However, it is this AD group that is most typically represented in clinical trials of AD interventions, since they are a “clean” clinical trial population for whom the clearest inferences may most readily be drawn. Nevertheless, they are not representative of the majority of AD individuals in the community and in treatment settings. There is a critical need to address this public health paradox through the conduct of pragmatic effectiveness trials wherein a wider range of patients with AD are enrolled, and the randomization scheme includes those with known alcoholism subtypes and relevant comorbidities to improve the field’s evidence base about what works with whom.

We recently examined the role of patterns of substance use behavior during early adolescence in predicting young adult DSM-IV substance use disorders (Moss et al., 2014). We reported a significant relationship between use of multiple substances prior to age 16 and liability for both a substance use disorder and comorbid psychopathology during young adulthood. We argued that these data support the hypothesis of an underlying addiction-

prone diathesis associated with behavioral disinhibition and conduct deviancy (e.g. Vanyukov and Ridenour, 2012) rather than a developmental pattern (or “gateway”) of use behaviors. Our present findings of associations between patterns of use of multiple substances and increased severity of AD-associated behaviors, as well as comorbid psychopathology including antisocial and borderline PDs, support a similar pattern among adults. Also consistent with these data are findings from our previous efforts at subtyping those with AD (Moss et al., 2007), which revealed an AD type associated with multiple forms of substance use and abuse, indicators of severe alcohol use behavior, and multiple forms of comorbid psychopathology, while “pure” AD individuals had a far more benign clinical presentation. Taken together, the aforementioned studies suggest that polysubstance use is a poor prognostic sign and an indicator of heightened severity among adults with AD, as well as among adolescents, calling urgently for further research.

These findings should be considered in light of potential study limitations. While the NESARC identified types of drugs used over the past year by respondents, including those with AD diagnoses, it is not clear whether respondents used these additional substances concurrently (within a specified timeframe), or simultaneously, i.e., use of alcohol and these other drugs in combination on the same day (Grant and Harford, 1990). Thus, our results should not be interpreted in the context of pharmacological interactions of multiple substances and their potential toxicities. We also do not know the precise temporal sequences in which these substances were taken. Another unresolved issue is whether or not the patterns of substance use we have reported among AD subjects reflect prior drug use disorders which had fully or partially resolved by the year preceding the Wave 1 interview. We attempted to address this question by narrowing our sample to that of AD individuals without any lifetime drug use disorder. However, analyses of the subsample of AD respondents with “no lifetime drug use disorder” became constrained by limitations of sample size and power. Thus, the group effects reported in this paper may be confounded by a history of prior drug use disorders rather than the propensity towards concurrent drug use behaviors.

In summary, non-alcohol substance use is one of the many facets of syndromal AD that can predict variations in the endorsement of AD diagnostic criteria, clinical severity, and engagement in treatment-seeking, longitudinal course and comorbid psychopathology. To address adequately the needs of the heterogeneous AD patient population, it is essential to understand which environmental, behavioral, and pharmacological interventions can provide clinical improvements to those with which variants of AD. Specific efficacy trials targeting subtypes of AD, as well clinical effectiveness trials (pragmatic trials) which measure beneficial effect under “real world” conditions in the clinic are needed to understand what works, with whom, when, and why.

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Highlights

- Specific patterns of concurrent non-alcohol substance use during the previous year were examined among a nationally representative sample of adults with DSM-IV Alcohol Dependence employing Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC).
- Latent class analyses classified respondents with Alcohol Dependence into four clinically-meaningful patterns of concurrent substance use: 1) *Use of alcohol only*; 2) *Use of alcohol and tobacco only*; 3) *Use of alcohol, tobacco and cannabis*; and 4) *Use of alcohol, tobacco, cannabis, cocaine and other illicit drug(s)*.
- Among Alcohol Dependent respondents, the most prevalent pattern was the *use of alcohol and tobacco only*, followed by the *use of alcohol only*.
- Alcohol Dependent respondents that used *alcohol, tobacco, cannabis, cocaine and other illicit drug(s)* manifested the most severe pattern of alcohol consumption compared to those who used *alcohol only*.
- Alcohol Dependent respondents that used *alcohol, tobacco, cannabis, cocaine and other illicit drug(s)* and had significant overrepresentations of major depression, panic and other anxiety disorder, and paranoid, schizotypal, borderline, antisocial, and histrionic personality disorders, compared to those with those who used *alcohol only*.

Table 1

Patterns of polysubstance use characterized by past-year use of tobacco, cannabis, cocaine, or other illicit drugs among NESARC respondents with alcohol dependence at Wave 1 (n = 1,172)

Past-year use (Wave 1)	Alcohol Use Only (n= 351)		Alcohol and Tobacco Use (n= 402)		Alcohol, Tobacco and Cannabis Use (n= 171)		Alcohol, Tobacco Cannabis, Cocaine and other Illicit Drug Use illicit drug(s) (n= 248)	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Weighted Percentages	27.5	[24.2, 31.1]	32.4	[28.8, 36.2]	14.8	[12.6, 17.4]	25.3	[21.7, 29.2]
Tobacco use	0	[0, 0]	100	[100.0, 100.0]	76.8	[68.8, 83.3]	76.8	[69.1, 83.0]
Cannabis use	0	[0, 0]	0	[0, 0]	100	[100, 100]	73.6	[66.9, 79.4]
Cocaine use	0	[0, 0]	1.8	[0.8, 4.3]	8.3	[4.5, 14.9]	26.9	[20.4, 34.5]
Other illicit drug use	0	[0, 0]	0	[0, 0]	0	[0, 0]	100	[100, 100]

Note: The four patterns of polysubstance use are identified by latent class analysis of four binary indicators for the past-year use of tobacco, cannabis, cocaine, and other illicit drugs, by allocating persons to their modal class (i.e., the class in which a person has the highest posterior probability), where pattern 1 is a known class (i.e., class membership is assumed, a priori, for persons who had no use of substances other than alcohol).

Table 2

Percentage distribution of demographics, by pattern of polysubstance use among NESARC respondents with alcohol dependence at Wave 1 (n = 1,172)

Wave 2 demographics	Alcohol Use Only (n = 351)		Alcohol and Tobacco Use (n = 402)		Alcohol, Tobacco, and Cannabis Use (n = 171)		Alcohol, Tobacco Cannabis, Cocaine and other Illicit Drug Use illicit drug(s) (n = 248)		P-value
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Mean age (yr)	36.6 ^{3,4}	[35.0, 38.3]	37.1 ^{3,4}	[35.7, 38.4]	31.4 ^{1,2}	[29.5, 33.3]	30.1 ^{1,2}	[28.8, 31.3]	<.0001
Sex									
Male	59.9 ³	[53.4, 66.1]	68.4	[62.5, 73.7]	76.4 ¹	[67.5, 83.4]	71.5	[64.6, 77.5]	0.0166
Female	40.1 ³	[33.9, 46.6]	31.6	[26.3, 37.5]	23.6 ¹	[16.6, 32.5]	28.5	[22.5, 35.4]	0.0166
Race/ethnicity									
White, Not Hispanic or Latino	63.8	[54.5, 72.2]	71.9	[66.0, 77.1]	64.8	[55.5, 73.1]	77.1	[70.0, 83.0]	0.0345
Black, Not Hispanic or Latino	13.3 ⁴	[9.4, 18.6]	9.6	[6.8, 13.3]	17.5 ⁴	[11.7, 25.4]	5.8 ^{1,3}	[3.3, 10.0]	0.0048
American Indian/Alaska Native, not Hispanic or Latino	0.7 ⁴	[0.2, 2.9]	2.6	[1.0, 6.2]	4.2	[1.6, 10.8]	6.4 ¹	[3.4, 11.8]	0.0399
Asian/Native Hawaiian/Pacific Islander, not Hispanic or Latino	1.6	[0.4, 6.1]	3.5	[1.7, 7.2]	0.9	[0.1, 6.6]	2.4	[0.8, 7.2]	0.4392
Hispanic or Latino	20.6 ⁴	[12.7, 31.8]	12.5	[8.9, 17.2]	12.5	[7.6, 20.0]	8.2 ¹	[5.2, 12.6]	0.0345
Current marital status									
Currently married	45.0 ^{3,4}	[38.5, 51.7]	37.2 ³	[31.2, 43.6]	20.0 ^{1,2}	[13.5, 28.7]	24.5 ¹	[18.0, 32.4]	0.0002
Never married	36.6 ^{3,4}	[30.6, 43.0]	33.5 ^{3,4}	[28.0, 39.5]	54.5 ^{1,2}	[45.0, 63.7]	53.2 ^{1,2}	[45.4, 60.9]	0.0001
Highest grade or year of school completed									
Less than HS	13.6	[9.6, 18.9]	15.6	[11.6, 20.8]	17.9	[11.6, 26.5]	14.4	[9.7, 20.8]	0.7737
HS or GED	23.0	[18.1, 28.8]	26.1	[21.1, 31.8]	20.8	[14.3, 29.2]	25.9	[19.5, 33.7]	0.6712
College degree or higher	29.2 ^{2,3}	[23.4, 35.8]	16.4 ¹	[12.0, 21.9]	16.9 ¹	[11.2, 24.8]	19.2	[14.1, 25.8]	0.0083
Total family income									
\$0 to \$19,999	20.4 ⁴	[15.7, 26.0]	20.4 ⁴	[16.0, 25.6]	32.0	[23.5, 41.8]	32.2 ^{1,2}	[25.8, 39.4]	0.0086
\$20,000 to \$34,999	18.9	[14.3, 24.5]	24.4	[19.6, 29.8]	17.4	[11.5, 25.5]	27.1	[20.6, 34.8]	0.1840
\$35,000 to \$59,999	22.6	[18.0, 27.9]	25.2	[20.4, 30.6]	19.8	[13.7, 27.7]	18.7	[13.5, 25.4]	0.3810
\$60,000 or more	38.2 ⁴	[32.2, 44.5]	30.1	[24.8, 35.9]	30.8	[21.9, 41.5]	22.0 ¹	[16.3, 28.9]	0.0061

Note: The superscript i (i = 1, 2, 3, 4) indicates a significant pairwise comparison with the pattern i (Bonferroni adjusted p < 0.05).

Table 3

Mean measures related to alcohol use behaviors and alcohol use disorders, prevalence (%) of treatment at Wave 1, and recovery status at Wave 2 by pattern of polysubstance use among NESARC respondents with alcohol dependence at Wave 1

Wave 1 alcohol use and alcohol use disorders	Alcohol Use Only (n = 351)		Alcohol and Tobacco Use (n = 402)		Alcohol, Tobacco, and Cannabis Use (n = 171)		Alcohol, Tobacco, Cannabis, Cocaine and other Illicit Drug Use illicit drug(s) (n = 248)		P-value
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	
Age when started drinking, not counting small tastes or sips	18.0 ^{2,3,4}	[17.6, 18.4]	16.7 ¹	[16.3, 17.2]	16.4 ¹	[15.9, 16.9]	16.3 ¹	[15.6, 17.1]	<.0001
Age at onset of alcohol dependence	28.6 ^{3,4}	[27.0, 30.1]	27.4 ^{3,4}	[26.1, 28.6]	23.2 ^{1,2}	[21.7, 24.7]	22.4 ^{1,2}	[21.4, 23.4]	<.0001
Duration (months) of longest/only episode of alcohol dependence	18.5	[12.3, 24.6]	20.2	[16.1, 24.4]	21.5	[13.6, 29.4]	24.0	[16.6, 31.4]	0.7020
# DSM-IV past-year alcohol dependence criteria	3.8 ^{3,4}	[3.7, 3.9]	3.9 ⁴	[3.8, 4.1]	4.2 ¹	[4.0, 4.4]	4.5 ^{1,2}	[4.3, 4.7]	<.0001
# DSM-IV past-year alcohol abuse criteria	0.7 ^{3,4}	[0.6, 0.8]	1.0 ⁴	[0.8, 1.1]	1.3 ¹	[1.1, 1.6]	1.5 ^{1,2}	[1.3, 1.6]	<.0001
# Days drank any alcohol in last 12 months	141 ^{2,3,4}	[126, 157]	187 ¹	[172, 201]	183 ¹	[159, 206]	180 ¹	[162, 198]	0.0005
# Days exceeding daily drinking limits in last 12 months	100 ^{2,3,4}	[87, 113]	148 ¹	[132, 165]	147 ¹	[126, 168]	142 ¹	[124, 160]	<.0001
Usual number of drinks on days when drank alcohol	5.3 ^{3,4}	[4.7, 5.8]	6.3	[5.7, 6.9]	7.1 ¹	[6.1, 8.0]	7.6 ¹	[6.6, 8.5]	0.0004
Largest number of drinks on days when drank alcohol	10.4 ^{2,3,4}	[9.3, 11.4]	13.2 ¹	[12.0, 14.4]	14.0 ¹	[12.0, 16.1]	15.7 ¹	[14.1, 17.3]	<.0001
Average daily volume of ethanol (fluid ounces)	1.9 ^{2,3,4}	[1.6, 2.2]	3.2 ¹	[2.8, 3.7]	3.4 ¹	[2.6, 4.2]	4.2 ¹	[3.0, 5.3]	<.0001
Wave 1 past-year alcohol treatment and Wave 2 recovery status	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Wave 1-Past-year treatment for alcohol problems	5.4 ^{2,4}	[3.1, 9.1]	13.0 ¹	[9.6, 17.4]	9.3	[5.4, 15.7]	17.7 ¹	[12.8, 23.9]	0.0038
Wave 2- Still alcohol dependent	27.8 ⁴	[22.5, 33.8]	36.4	[31.0, 42.1]	39.9	[31.1, 49.5]	43.5 ¹	[35.9, 51.5]	0.0278
Wave 2- Partial remission	42.4	[36.4, 48.7]	40.6	[34.9, 46.6]	41.7	[32.6, 51.4]	34.8	[28.4, 41.7]	0.3855
Wave 2- Asymptomatic risk drinker	13.7	[9.6, 19.2]	11.5	[8.2, 15.8]	10.3	[6.1, 17.0]	14.4	[9.2, 21.6]	0.6810
Wave 2- Low-risk drinker	9.0 ⁴	[6.1, 13.0]	6.0	[3.8, 9.5]	5.0	[2.6, 9.5]	2.5 ¹	[1.2, 5.4]	0.0292
Wave 2- Abstainer	7.1	[4.4, 11.4]	5.5	[3.5, 8.6]	3.1	[1.3, 6.9]	4.8	[2.5, 9.0]	0.3779

Note: The superscript i (i = 1, 2, 3, 4) indicates a significant pairwise comparison with the pattern i (Bonferroni adjusted p < 0.05).

Table 4

Prevalence (%) of DSM-IV mood, anxiety, and personality disorders, by pattern of polysubstance use among NESARC respondents with alcohol dependence at Wave 1

Wave 1 diagnoses	Alcohol Use Only (n = 351)		Alcohol and Tobacco Use (n = 402)		Alcohol, Tobacco, and Cannabis Use (n = 171)		Alcohol, Tobacco Cannabis, Cocaine and other Illicit Drug Use (n = 248)		P-value
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	
Mood and anxiety disorders (past-year):									
Major depressive episode	14.9 ⁴	[10.9, 20.1]	19.4	[15.1, 24.6]	20.6	[13.9, 29.5]	28.9 ¹	[22.5, 36.3]	0.0157
Manic episode	5.9	[3.2, 10.7]	5.8	[3.7, 8.9]	8.5	[5.0, 14.0]	10.9	[7.1, 16.6]	0.1661
Panic disorder with/without agoraphobia	3.1 ⁴	[1.7, 5.7]	6.7	[4.3, 10.4]	7.2	[3.7, 13.6]	10.9 ¹	[7.3, 16.1]	0.0154
Social phobia	3.0 ^{2,4}	[1.5, 5.7]	9.6 ¹	[6.4, 14.1]	7.4	[3.6, 14.7]	9.0 ¹	[5.6, 14.3]	0.0307
Specific phobia	8.5 ⁴	[5.4, 13.2]	14.6	[10.9, 19.3]	16.0	[10.5, 23.5]	20.2 ¹	[14.5, 27.3]	0.0269
Generalized anxiety disorder	3.4	[1.5, 7.5]	4.9	[3.0, 8.0]	5.4	[2.8, 10.2]	10.6	[6.7, 16.5]	0.0576
Personality disorders (lifetime):									
Paranoid Personality Disorder	9.0 ⁴	[5.7, 13.8]	15.8	[11.8, 20.7]	14.7	[9.4, 22.2]	24.6 ¹	[18.7, 31.8]	0.0040
Schizoid Personality Disorder	6.0	[3.8, 9.5]	6.9	[4.6, 10.3]	7.7	[3.8, 15.0]	13.4	[8.7, 20.0]	0.0821
Schizotypal Personality Disorder (Wave 2)	5.5 ⁴	[3.2, 9.3]	6.9 ⁴	[4.6, 10.2]	10.4	[5.8, 17.9]	15.8 ^{1,2}	[10.7, 22.6]	0.0108
Antisocial Personality Disorder (Wave 2)	6.7 ^{2,3,4}	[4.1, 10.7]	17.9 ^{1,4}	[13.8, 23.0]	22.0 ¹	[15.6, 30.2]	33.0 ^{1,2}	[26.7, 40.0]	<.0001
Borderline Personality Disorder (Wave 2)	11.2 ^{3,4}	[7.8, 15.8]	17.8	[13.7, 22.8]	27.8 ¹	[20.4, 36.7]	25.0 ¹	[18.9, 32.3]	0.0028
Histrionic Personality Disorder	8.8 ⁴	[5.8, 13.0]	7.9 ⁴	[5.4, 11.5]	8.9	[5.0, 15.3]	17.6 ^{1,2}	[12.4, 24.4]	0.0179
Narcissistic Personality Disorder (Wave 2)	11.5 ³	[8.0, 16.1]	13.5	[10.4, 17.4]	22.9 ¹	[16.0, 31.6]	20.1	[14.4, 27.2]	0.0312
Avoidant Personality Disorder	4.8	[3.0, 7.6]	8.6	[5.8, 12.5]	8.1	[4.2, 15.0]	11.5	[7.2, 17.9]	0.0808
Dependent Personality Disorder	0.4	[0.1, 2.2]	1.8	[0.8, 4.1]	2.3	[0.7, 7.0]	5.0	[2.3, 10.7]	0.0595
Obsessive-Compulsive Personality Disorder	10.3 ⁴	[7.7, 13.7]	16.5	[12.5, 21.3]	13.8	[8.5, 21.6]	21.2 ¹	[15.5, 28.4]	0.0197

Notes: The superscript i (i = 1, 2, 3, 4) indicates a significant pairwise comparison with the pattern i (Bonferroni adjusted $p < 0.05$). Personality disorders were diagnosed at Wave 1 unless otherwise noted.