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The relationship between past-year drinking behaviors and nonmedical use of prescription drugs: Prevalence of co-occurrence in a national sample

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Abstract

This study examined the relationship between past-year drinking behaviors and nonmedical use of prescription drugs (NMUPD) in a nationally representative sample. Prevalence estimates in the United States were derived based on data collected from face-to-face interviews using the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) (n = 43,093 individuals aged 18 years and older). Nonmedical use of prescription opioids, stimulants, tranquilizers, and sedatives was more prevalent among individuals with alcohol use disorders (AUDs) than those without AUDs. The odds of reporting NMUPD were 18 times higher among alcohol dependent participants compared to past-year abstainers (OR = 18.2, 95% CI = 13.9–23.8). Although individuals with AUDs constituted less than 9% of the total sample, those with AUDs accounted for more than one in every three nonmedical users of prescription drugs. The past-year co-occurrence of AUDs and NMUPD was more prevalent among young adults 18–24 years of age than individuals 25 years and older. More than one in every four young adults aged 18–24 years who met the criteria for past-year DSM-IV alcohol dependence also reported past-year NMUPD. These findings suggest that the treatment for AUDs should include a thorough assessment of NMUPD, especially among young adults.

Keywords

Epidemiology; Prescription drugs; Nonmedical use; Alcohol use; DSM-IV alcohol abuse; DSM-IV alcohol dependence

1. Introduction

In the United States, the past-year prevalence of alcohol misuse, alcohol use disorders (AUDs), nonmedical use of prescription drugs (NMUPD), and substance use disorders (SUDs) is higher among young adults than any other age group (e.g., Dawson et al., 2004; Grant et al., 2004; Johnston et al., 2004a,b; Kandel et al., 1997; Substance Abuse and Mental Health Services Administration, 2004a). Adolescents and young adults have particularly high rates of concurrent polydrug use (co-occurrence) which refers to different drugs consumed on separate occasions (Newcomb and Bentler, 1988). While the prevalence of binge drinking and AUDs among young adults in the United States has remained steady for the past decade, NMUPD among young adults has increased significantly during this same time period (e.g., Grant et al., 2004; Johnston et al., 2004a; Mohler-Kuo et al., 2003). Substance abuse researchers are just

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beginning to identify individual characteristics and vulnerabilities associated with NMUPD (McCabe et al., 2005a,b; Simoni-Wastila and Strickler, 2004); to date, there has been very little research on the co-occurrence of AUDs and NMUPD.

For purposes of this investigation, NMUPD refers to the use of a scheduled psychotherapeutic drug for which the user has no prescription, or the use of a psychotherapeutic drug for which the user has a prescription, but in a manner not intended by the prescribing clinician. Several anecdotal case reports document the severe consequences that can result from co-ingestion of prescription drugs and other substances, including alcohol (e.g., Barrett and Pihl, 2002; Coetzee et al., 2002; Koski et al., 2002; Reynaud et al., 1998; Sellers et al., 1993; Sheehan et al., 1991). In addition, Toxic Exposure Surveillance System data document fatal exposures from co-ingestion of prescription drugs and alcohol along with the suspected reason for exposure (Watson et al., 2004). Furthermore, according to the Drug Abuse Warning Network (DAWN), a national surveillance system that monitors trends in drug-related emergency department (ED) visits and deaths (including suicide attempts), the drug most frequently used in combination with prescription drugs was alcohol (Substance Abuse and Mental Health Services Administration, 2003a,b, 2004b). For example, about one-third of oxycodone and hydrocodone ED visits also involved alcohol. Taken together, these data reinforce the fact that there are possible adverse consequences associated with the co-occurrence of NMUPD and alcohol use.

Despite the harmful consequences associated with the co-occurrence of NMUPD and alcohol use, the relationship between drinking behaviors and NMUPD has received relatively little attention. Although a substance abuse history has been shown to be associated with an increased risk for nonmedical use of prescription benzodiazepines (Griffiths and Weerts, 1997), there are relatively few epidemiological studies examining the increased risk of NMUPD as a function of various drinking behaviors. Accordingly, the main objective of this secondary analysis was to examine data from two groups of adults, 18–24 year olds and adults over 25 years of age, in order to determine the prevalence of nonmedical use of four classes of prescription drugs (i.e., sedatives, tranquilizers, opioids, and stimulants) based on the subjects' past-year drinking status. A secondary objective was to identify individual characteristics associated with NMUPD.

2. Methods

The 2001–2002 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) was used as the primary dataset to obtain information regarding alcohol use and NMUPD among the general population in the United States. The NESARC is based on a representative sample of the U.S. population and is an important source of national data on alcohol and other drug use, abuse, and dependence (Grant et al., 2003, 2004). The target population for the NESARC was the civilian noninstitutionalized population residing in the United States aged 18 years or older. The NESARC sample included persons living in households, military personnel living off base, and persons residing in the following group quarters: boarding or rooming houses, nontransient hotels, shelters, facilities for housing workers, college quarters, and group homes. A total of 43,093 participants completed face-to-face personal interviews. The response rates were 81% overall, 99% for the sampling frame, 89% for households, and 93% for persons.

The NESARC included the NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version (AUDADIS-IV), which is a fully structured diagnostic interview (Grant et al., 2004). The AUDADIS-IV was computerized and responses were entered directly into laptop computers.

2.1. Sample

The overall sample (n = 43,093) consisted of 52% women, 48% men, 71% White, 11% African American, 4% Asian, 12% Hispanic, and 2% Native American or another racial category. In addition, 20% of the sample lived in the Northeast, 35% in the South, 23% in the Midwest, and 22% in the West. Approximately 12% of the sample were 18–24 years of age and 88% were adults 25 years of age or older. Table 1 illustrates the demographic characteristics for the overall sample and broken down by age (18–24 years of age and 25 years and older).

2.2. Measures

The measures in the NESARC survey assessed demographic characteristics, alcohol use, tobacco use, illicit drug use, NMUPD, and AUDs. Many of the substance use items are known to be valid and reliable for population-based research. Further, many items are similar to those from other national studies, which permits comparisons between their data and the findings from the present study.

Demographic and environmental characteristics were measured with several items including gender, age, and race/ethnicity.

Alcohol use was measured with several items including the following question: “During the last 12 months, did you have at least one drink of any kind of alcohol?” The response scale was (1) yes and (2) no. Another question used to measure alcohol use was: “During the last 12 months, about how often did you drink ANY alcoholic beverage?” The response scale ranged from (1) every day to (10) 1 or 2 times. Finally, the following question was also posed to measure binge drinking: “During the last 12 months, about how often did you drink five or more drinks (four or more drinks for women) in a single day?” The response scale ranged from (1) every day to (11) never.

Alcohol use disorders (*AUDs*) were assessed according to the criteria of the DSM-IV using the AUDADIS-IV, which contains symptom questions that separately operationalize DSM-IV criteria for alcohol abuse and dependence. Consistent with the DSM-IV and previous research (e.g., Grant et al., 2004), a diagnosis of past-year alcohol abuse required the absence of a dependence diagnosis and at least one positive response to four criteria defined for abuse in the past-year period preceding the interview: (1) recurrent use resulting in failure to fulfill major role obligations; (2) recurrent drinking in hazardous situations; (3) recurrent drinking-related legal problems; (4) continued drinking despite recurrent social or interpersonal problems caused or exacerbated by drinking. A past-year alcohol dependence diagnosis was defined as a positive response to at least three of the seven dependence criteria: (1) tolerance; (2) withdrawal; (3) drinking larger amounts or for a longer period than intended; (4) persistent desire or unsuccessful efforts to quit; (5) spending much time obtaining or recovering from its effects; (6) giving up or reducing occupational, social or recreational activities; (7) and continuing to use despite a physical or psychological problem caused or exacerbated by drinking. Reliability and validity of the DSM-IV, AUDADIS-IV diagnoses of past-year AUDs have been established in numerous national and international psychometric studies (e.g., Canino et al., 1999; Cottler et al., 1997; Grant, 1996; Grant et al., 1995; Hasin et al., 1996, 1997a, Hasin et al., b,c; Muthen et al., 1993; Nelson et al., 1999; Pull et al., 1997). For the purposes of this study, a five-category drinking outcome variable in the past 12 months was created with the following drinking behaviors: (1) abstainer (no use in the past year), (2) non-binge drinking (use which does not exceed five or more drinks in a single day for men, four or more drinks for women) with no diagnosis of AUDs, (3) binge drinking (use which exceeds five or more drinks in a single day for men, four or more drinks for women) with no diagnosis of AUDs, (4) DSM-IV diagnosis of past-year alcohol abuse only, and (5) DSM-IV diagnosis of past-year alcohol dependence.

Nonmedical use of prescription drugs (*NMUPD*) was measured with several items including the following: "Have you ever used any of these medicines or drugs?" For this question, respondents were asked to consider their lifetime non-medical use as using drugs that were not prescribed to them by a doctor, or using drugs in a manner not intended by the prescribing clinician (e.g., to get high). Each of the following classes of prescription medications were listed separately: (1) sedatives (e.g., sleeping pills, barbiturates, Seconal, Quaaludes); (2) tranquilizers or anti-anxiety drugs (e.g., Valium, Librium, Xanax); (3) painkillers (e.g., Codeine, Darvon, Percodan, Dilaudid, Demerol); (4) stimulants (e.g., Preludin, Benzedrine, Methedrine, uppers, speed). The response scale was (1) yes and (2) no. NMUPD was also assessed with an item that asked about use in the past 12 months. Previous research has established the reliability and validity of similar drug use measures (e.g., Johnston and O'Malley, 1985; O'Malley et al., 1983). For the purposes of the present study, four binary variables indicating past-year NMUPD of each class of prescription drug were created, in addition to an overall binary index (NMUPD of any of the four classes of prescription drugs in the past year).

2.3. Data analysis

Individuals living in households and group quarters were assigned case weights reflecting the products of the inverse of their probabilities of selection at each stage of the sample design. These weights were adjusted to account for nonresponse, and a poststratification adjustment factor was incorporated to ensure that weighted NESARC estimates matched the target population within cells determined by age, gender, and race/ethnicity (e.g., Grant et al., 2004). The standard procedure for design-based analysis of weighted and clustered survey data is to use a statistical software package with commands capable of taking a complex sample design into account when calculating parameter estimates and standard errors. Accordingly, we used the SUDAAN 9.0.0 statistical software program for all analyses.

To determine the prevalence of alcohol use, the prevalence of NMUPD of each of the four classes of prescription drugs, and the prevalence of co-occurrence of alcohol use and NMUPD among young adult (18–24 years of age) and general adult (25 years and older) populations in the past year, we estimated weighted, design-based proportions of each subpopulation reporting: (a) each type of alcohol use (abstinence, non-binge drinking, binge drinking, DSM-IV alcohol abuse, and DSM-IV alcohol dependence) and (b) NMUPD of each class of prescription drug. We also estimated weighted design-based prevalence rates of each type of co-occurrence of alcohol use and NMUPD. Design-based standard errors for the estimated proportions were computed, allowing for the calculation of 95% confidence intervals (CIs). Multiple logistic regression models were used to compare NMUPD across the five distinct groups of drinking behaviors in the past year. Odds ratios were also adjusted for gender, age, and race/ethnicity, and 95% confidence intervals were reported. These factors were chosen as control variables because they have been shown to be significantly associated with alcohol use and/or NMUPD (e.g., Bachman et al., 2002; Johnston et al., 2004a,b; McCabe et al., 2005a,b).

In order to test the hypothesis that the co-occurrence of alcohol use and NMUPD varies by age we conducted a series of multiple logistic regression analyses using procedures outlined by Jaccard (2001). In line with our interest in possible moderators of the co-occurrence of alcohol use and NMUPD, we limited our focus to 2-way interaction effects. Product terms were calculated based on the dummy variables for age and alcohol status. Coefficients for the interaction terms represent single degree of freedom interaction contrasts (Jaccard, 2001) that are designed to test hypothesized moderators of the association between alcohol status and NMUPD.

3. Results

Table 1 presents the prevalence estimates for past-year drinking behaviors and NMUPD overall and within the two subgroups based on age. Most notably, young adults 18–24 years of age had higher rates of binge drinking, AUDs, and NMUPD than adults 25 years or older. For example, the nonmedical use of any prescription drug class was considerably higher among individuals 18–24 years of age than individuals 25 years and older (8% versus 3%, $\chi^2 = 215.9$, d.f. = 1, $p < 0.01$). In addition, the young adult group (18–24 years of age) differed from adults 25 years and older on every past-year drinking behavior and NMUPD. The older adults were more likely than the young adults to be abstainers and non-binge drinkers and less likely to report binge drinking, DSM-IV alcohol abuse only, or DSM-IV alcohol dependence.

Table 2 presents the overall crude prevalence estimates (statistically unadjusted) of the relationship between past-year drinking behavior and NMUPD. Although individuals with AUDs constituted less than 9% of the total sample, those with AUDs represented more than one in every three nonmedical users. The past-year co-occurrence of AUDs and NMUPD was more prevalent among young adults 18–24 years of age than adults 25 years and older. For example, approximately 3 in every 10 alcohol dependent young adults 18–24 years of age reported NMUPD in the past year. In contrast, less than one in every five alcohol dependent adults 25 years of age and older reported NMUPD in the past year.

Overall, nonmedical use of prescription drugs increased significantly as a function of drinking severity. For example, NMUPD was highest among those individuals who reported binge drinking or AUDs. DSM-IV alcohol dependent individuals reported the highest past-year prevalence rate of NMUPD (22.02%), followed by those individuals who met the criteria for DSM-IV alcohol abuse only (8.27%), individuals who reported binge drinking without AUDs (4.01%), non-binge drinkers (2.13%), and abstainers (1.26%).

As shown in Table 3, the multiple logistic regression results revealed significant age and racial/ethnic differences in NMUPD. For example, White individuals were approximately two to five times more likely than African American individuals to report NMUPD in the past year. The logistic regression results reinforced the bivariate findings in that drinking severity was significantly associated with NMUPD after statistically adjusting for age, gender, and race/ethnicity. For example, the odds of reporting any NMUPD was approximately 18 times higher among alcohol dependent individuals compared to abstainers (OR = 18.2, 95% CI = 13.9–23.8, $p < 0.01$). Finally, results showed that three of the four interaction contrasts for the association between alcohol status and NMUPD were statistically significantly stronger among young adults ages 18–24 compared to those in the 25 years and older age group, with one exception: the association between alcohol abuse and NMUPD was not moderated by age.

4. Discussion

Despite steady increases in nonmedical use of prescription drugs (NMUPD) (e.g., Johnston et al., 2004a; Mohler-Kuo et al., 2003; Substance Abuse and Mental Health Services Administration, 2004a; Zacny et al., 2003), few studies have systematically examined the relationship between past-year drinking behaviors and NMUPD, or identified subgroups at particular risk for either NMUPD or the co-occurrence of alcohol use and NMUPD. Consistent with previous research, the present study found that young adults 18–24 years of age had higher rates of binge drinking, AUDs, and NMUPD than adults 25 years of age and older (e.g., Babcock and Byrne, 2000; Dawson et al., 2004; Johnston et al., 2004a; Substance Abuse and Mental Health Services Administration, 2004b). The present study also found that young adults 18–24 years old are more likely than adults 25 years of age and older to report co-occurrence of alcohol use and NMUPD. Most importantly, the present study found that the past-year

prevalence of NMUPD was highest among those individuals who reported binge drinking or AUDs, especially alcohol dependent young adults between 18 and 24 years of age. This pattern was present across all four classes of prescription drugs (i.e., opioid analgesics, stimulants, tranquilizers, and sedatives) and did not change when gender, age and race/ethnicity were statistically controlled.

There is growing evidence documenting the association between alcohol use and NMUPD (Johansson et al., 2003; McCabe et al., 2005a,b; Simoni-Wastila and Strickler, 2004; Teter et al., 2003). For example, one recent study found that problem use of prescription drugs was significantly higher among daily alcohol drinkers (Simoni-Wastila and Strickler, 2004). In another study, college students who engaged in the nonmedical use of prescription stimulants were over six times more likely to report frequent binge drinking and over five times more likely to drive after binge drinking than college students who did not report nonmedical use of prescription stimulants (McCabe et al., 2005b). In addition, college students who engaged in nonmedical use of prescription opioids were over four times more likely to report frequent binge drinking and drive after binge drinking than college students who did not report non-medical use of prescription opioids (McCabe et al., 2005a). At least one study found that the rate of dependence on psychotropic drugs among individuals with AUDs is significantly higher than healthy controls (Johansson et al., 2003). Furthermore, previous work has shown an increased risk for nonmedical use of prescription benzodiazepines among individuals with a substance abuse history (see Griffiths and Weerts, 1997 for a review). While these previous studies found a strong association between NMUPD and alcohol and other drug use, the findings of the present study extend previous knowledge and demonstrate that NMUPD is significantly higher as a function of drinking severity.

In terms of subgroups at increased risk for NMUPD, at least two national studies have found that young adults from 18 to 24 years of age reported higher rates of NMUPD than other age groups (Johnston et al., 2004a; Substance Abuse and Mental Health Services Administration, 2004a). There is also some evidence that nonmedical use of prescription stimulants is more prevalent among college students who are less than 25 years old than those who are 25 years of age and older (e.g., Babcock and Byrne, 2000; McCabe et al., 2005b). Adding to these previous findings, the present study found that young adults 18–24 years old were considerably more likely to report co-occurrence of alcohol use and NMUPD than adults 25 years and older. Further, African Americans were at much lower risk for NMUPD which is consistent with previous research (e.g., Johnston et al., 2004b; Substance Abuse and Mental Health Services Administration, 2004a). The present study also found Native Americans appeared to be at increased risk for many types of NMUPD and this should be the focus of future research.

4.1. Implications for practice and research

It is important to note that prescription opioids, stimulants, sedatives, and tranquilizers are safe and effective medications for the majority of patients who take these drugs as prescribed by a health care professional to treat conditions like acute and chronic pain, attention deficit hyperactivity disorder (ADHD), anxiety disorders, and sleep disorders (Goldman et al., 1998; Greenhill et al., 2002; Savage, 2003; Woods and Winger, 1995). However, based on the high rates of NMUPD among individuals with AUDs, clinicians are encouraged to conduct thorough drug use histories when working with individuals with AUDs. Anecdotal case reports, national surveillance data, and epidemiology studies provide strong evidence that prescription drugs such as stimulants, opioid analgesics, and benzodiazepines are often abused in combination with alcohol and other drugs (e.g., Barrett and Pihl, 2002; Johansson et al., 2003; Koski et al., 2002; Reynaud et al., 1998; Substance Abuse and Mental Health Services Administration, 2003a, 2004b; Sellers et al., 1993; Sheehan et al., 1991). Based on the potential adverse consequences associated with the simultaneous use of alcohol and NMUPD, future

preventative efforts should educate individuals regarding the dangerous interactions between these substances.

The current study focused on the use of at least two substances in the past year but did not differentiate between concurrent and simultaneous polydrug use (Earleywine and Newcomb, 1997; Newcomb and Bentler, 1988). Based on the high prevalence of co-occurrence (concurrent polydrug use) found in the present study, more research is needed to examine the extent of concurrent versus simultaneous use of alcohol and prescription drugs. In addition, more research is needed to examine the age of initiation and the temporal relationship between alcohol use and NMUPD. While the present study focused on past-year alcohol and other drug use, future work is needed to examine more recent use (e.g., past 30 days). Finally, future work needs to examine the stability of these drug use behaviors during adolescence and the transition to young adulthood. For instance, the increased risk for binge drinking and AUDs has been shown to decline substantially among college-graduated young adults as these individuals assume new post-college responsibilities (e.g., Bachman et al., 1997, 2002; Kandel et al., 1997; Schulenberg and Maggs, 2002; Sher and Gotham, 1999; Sher et al., 2001). Future work needs to examine if the post-college decline in binge drinking and AUDs also applies to NMUPD and the co-occurrence of alcohol use and NMUPD.

4.2. Strengths and limitations

The present study has several strengths that build upon past epidemiological research on polydrug use. First, this investigation analyzed data from a nationally representative sample, which allowed us to generalize our findings to the civilian non-institutionalized population aged 18 years and older residing in the United States. Second, the sample was large enough to examine key subgroups (i.e., age, gender, and race/ethnicity). Finally, the focus of the present study included several classes of abusable prescription drugs and different types of drinking behaviors. Most importantly, inclusion of DSM-IV criteria allowed for examination of clinically meaningful categories of past-year drinking behaviors (e.g., DSM-IV alcohol abuse only, DSM-IV alcohol dependence).

In addition to its strengths, the current study has some limitations that should be taken into account when considering implications of the findings. First, past-year NMUPD prevalence rates were lower in the present study than estimates from other national studies in the United States such as Monitoring the Future (MTF) and the National Survey on Drug Use and Health (NSDUH) (e.g., Johnston et al., 2004a; Substance Abuse and Mental Health Services Administration, 2002a,b). The discrepancy between results from the present study and those from other national studies could be partially attributed to the fact that the NESARC survey lacks the comprehensiveness of items to assess nonmedical use of prescription drugs found in other national studies. For example, the NESARC did not list some commonly abused prescription drugs (e.g., hydrocodone, Vicodin) that have been shown to have relatively high rates of NMUPD in other national studies (Johnston et al., 2004a; Substance Abuse and Mental Health Services Administration, 2002a,b, 2004a, b). In addition, the differences between the present study and other national studies may be partially due to differences in the wording for classes of prescription drugs (e.g., “narcotics other than heroin” in the MTF, “pain relievers” in the NSDUH and “painkillers” in the NESARC) and/or wording for NMUPD measures (e.g., “. . .to get high” from the NESARC versus “. . .for the experience or feeling it caused” from the NSDUH). Future research should examine the impact of using different terminology to assess prescription drugs. Furthermore, the differences could also be partially due to the mode of data collection used in the NESARC (e.g., CASI versus PAPI) because a large body of research shows that data collection modality can lead to substantially different prevalence estimates regarding sensitive topics such as illicit drug use (e.g., Fendrich and Johnson, 2001; Gfroerer et al., 1997; Sudman, 2001; Turner et al., 1998; Wright et al., 1998). Second,

the present study likely underestimated the prevalence of AUDs and NMUPD because small but high-risk groups of individuals, namely the incarcerated, the homeless, and transients, were not included in the NESARC. Third, based on the cross-sectional nature of the data, inferences about directionality were limited and we could not assess whether alcohol use preceded initiation of NMUPD. Longitudinal data are needed to further examine the temporal order of these associations. Next, there remains some question whether taking a prescribed medication in a manner not intended by the prescribing physician is always a true measure of NMUPD and future work is needed to examine the consequences associated with different types of NMUPD (e.g., self-treatment of pain versus for purposes of intoxication). Finally, the results of the present study may not generalize to populations outside the United States. More research is needed to examine the co-occurrence of alcohol use and NMUPD internationally.

Although the present study demonstrated a strong relationship between alcohol use and NMUPD, more work is needed to examine the simultaneous use of these substances, especially the dangers associated with the co-ingestion of alcohol and prescription drugs. Further work is also needed to better understand the risk factors associated with the co-occurrence of alcohol use and NMUPD. The findings of the present study provide evidence that treatment for AUDs should include a thorough assessment of nonmedical use of prescription drugs, especially among young adults.

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References

Babcock Q, Byrne T. Student perceptions of methylphenidate abuse at a public liberal arts college. J Am Coll Health 2000;49:143–145. [PubMed: 11125642]

Bachman, JG.; O'Malley, PM.; Schulenberg, JE.; Johnston, LD.; Bryant, AL.; Merline, AC. The Decline of Substance Use in Young Adulthood: Changes in Social Activities, Roles, and Beliefs. Lawrence Erlbaum Associates; Mahwah, NJ: 2002.

Bachman, JG.; Wadsworth, KN.; O'Malley, PM.; Johnston, LD.; Schulenberg, JE. Smoking, Drinking and Drug Use in Young Adulthood. Lawrence Erlbaum Associates; Mahwah, NJ: 1997.

Barrett SP, Pihl RO. Oral methylphenidate-alcohol co-abuse. J Clin Psychopharmacol 2002;22:633–634. [PubMed: 12454570]

Canino GJ, Bravo M, Ramfrez R, Febo V, Fernandez R, Hasin D. The Spanish Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): reliability and concordance with clinical diagnoses in a Hispanic population. J Stud Alcohol 1999;60:790–799. [PubMed: 10606491]

Coetzee M, Kaminer Y, Morales A. Megadose intranasal methylphenidate (ritalin) abuse in adult attention deficit hyperactivity disorder. Subst Abus 2002;23:165–169. [PubMed: 12444349]

Cottler LB, Grant BF, Blaine J, Mavreas V, Pull CB, Hasin D, Compton WM, Rubio-Stipee M, Mager D. Concordance of DSM-IV alcohol and drug use disorder criteria and diagnoses as measured by AUDADIS-ADR, CIDI, and SCAN. Drug Alcohol Depend 1997;47:195–205. [PubMed: 9306045]

Dawson DA, Grant BT, Stinson FS, Chou PS. Another look at heavy episodic drinking and alcohol use disorders among college and noncollege youth. J Stud Alcohol 2004;65:477–488. [PubMed: 15378804]

Earleywine M, Newcomb MD. Concurrent versus simultaneous poly-drug use: prevalence, correlates, discriminant validity, and prospective effects on health outcomes. Exp Clin Psychopharmacol 1997;5:353–364. [PubMed: 9386962]

Fendrich M, Johnson TP. Examining prevalence differences in three national surveys of youth: impact of consent procedures, mode and editing rules. J Drug Issues 2001;31:615–642.

Gfroerer J, Wright D, Kopstein A. Prevalence of youth substance use: the impact of methodological differences between two national surveys. Drug Alcohol Depend 1997;47:19–30. [PubMed: 9279494]

Goldman LS, Genel M, Bezman RJ, Slanetz PJ. Diagnosis and treatment of attention-deficit/hyperactivity disorder in children and adolescents. Council on Scientific Affairs, American Medical Association. JAMA 1998;279:1100–1107. [PubMed: 9546570]

Grant BF. DSM-IV, DSM-III-R and ICD-10 alcohol and drug abuse/harmful use and dependence, United States, 1992: a nosological comparison. Alcohol Clin Exp Res 1996;20:1481–1488. [PubMed: 8947328]

Grant BF, Dawson DA, Stinson FS, Chou SP, Dufour MC, Pickering RP. The 12-month prevalence and trends in DSM-IV alcohol abuse and dependence: United States, 1991–1992 and 2001–2002. Drug Alcohol Depend 2004;74:223–234. [PubMed: 15194200]

Grant BF, Dawson DA, Stinson FS, Chou PS, Kay W, Pickering R. The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): reliability of alcohol consumption, tobacco use, family history of depression and psychiatric diagnostic modules in a general population sample. Drug Alcohol Depend 2003;71:7–16. [PubMed: 12821201]

Grant BF, Harford TC, Dawson DA, Chou PS, Pickering R. The Alcohol Use Disorder and Associated Disabilities Schedule (AUDADIS): reliability of alcohol and drug modules in a general population sample. Drug Alcohol Depend 1995;39:37–44. [PubMed: 7587973]

Greenhill LL, Pliszka S, Dulcan MK, Bernet W, Arnold V, Beitchman J, Benson RS, Bukstein O, Kinlan J, McClellan J, Rue D, Shaw JA, Stock S. Practice parameter for the use of stimulant medications in the treatment of children, adolescents, and adults. J Am Acad Child Adolesc Psychiatry 2002;41:26S–49S. [PubMed: 11833633]

Griffiths RR, Weerts EM. Benzodiazepine self-administration in humans and laboratory animals – implications for problems of long-term use and abuse. Psychopharmacology 1997;134:1–37. [PubMed: 9399364]

Hasin D, Carpenter KM, McCloud S, Smith M, Grant BF. The Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS): reliability of alcohol and drug modules in a clinical sample. Drug Alcohol Depend 1997a;44:133–141. [PubMed: 9088785]

Hasin D, Grant BF, Cottler L, Blaine J, Towle L, Ustun B, Sartorius N. Nosological comparisons of alcohol and drug diagnoses: a multisite, multi-instrument international study. Drug Alcohol Depend 1997b;47:217–226. [PubMed: 9306047]

Hasin DS, Van Rossem R, McCloud S, Endicott J. Alcohol dependence and abuse diagnoses: validity in a community sample of heavy drinkers. Alcohol Clin Exp Res 1997c;21:213–219. [PubMed: 9113255]

Hasin D, Li Q, McCloud S, Endicott J. Agreement between DSM-III-R, DSM-IV and ICD-10 alcohol diagnoses in a US community-sample of heavy drinkers. Addiction 1996;91:1517–1527. [PubMed: 8917919]

Jaccard, J. Interaction Effects in Logistic Regression. Sage; Thousand Oaks, CA: 2001.

Johansson BA, Berglund M, Hanson M, Pohlen C, Persson I. Dependence on legal psychotropic drugs among alcoholics. Alcohol Alcohol 2003;38:613–618. [PubMed: 14633651]

Johnston, LD.; O'Malley, PM. Issues of validity and population coverage in student surveys of drug use. In: Rouse, BA.; Kozel, NJ.; Richards, LG., editors. Self-report Methods of Estimating Drug Use: Meeting Current Challenges to Validity. NIDA Res. Monogr., vol. 57. U.S. Government Printing Office; Washington, DC: 1985. p. 31-54.(DHHS Publication 85-1402).

Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future National Survey Results on Drug Use, 1975–2003: College Students and Adults Ages 19–45, vol. 2. NIDA; Bethesda, MD: 2004a. (NIH Publication 04-5508).

Johnston, LD.; O'Malley, PM.; Bachman, JG.; Schulenberg, JE. Monitoring the Future National Survey Results on Drug Use, 1975–2003: Secondary School Students, vol. 1. NIDA; Bethesda, MD: 2004b. (NIH Publication 04-5507)

Kandel DB, Chen K, Warner LA, Kessler RC, Grant B. Prevalence and demographic correlates of symptoms of last year dependence on alcohol, nicotine, marijuana and cocaine in the U.S. population. Drug Alcohol Depend 1997;44:11–29. [PubMed: 9031816]

Koski A, Ojanpera I, Vuori E. Alcohol and benzodiazepines in fatal poisonings. Alcohol Clin Exp Res 2002;26:956–959. [PubMed: 12170103]

McCabe SE, Teter CJ, Boyd CJ. Illicit use of pain medication among college students. Drug Alcohol Depend 2005a;71:37–47.

McCabe SE, Knight JR, Teter CJ, Wechsler H. Non-medical use of prescription stimulants among college students: prevalence and correlates from a national survey. Addiction 2005b;100:96–106. [PubMed: 15598197]

Mohler-Kuo M, Lee JE, Wechsler H. Trends in marijuana and other illicit drug use among college students: results from 4 Harvard School of Public Health College Alcohol Study surveys: 1993–2001. J Am Coll Health 2003;52:17–24. [PubMed: 14717576]

Muthen B, Grant BF, Hasin DS. The dimensionality of alcohol abuse and dependence: factor analysis of DSM-III-R and proposed DSM-IV criteria in the 1988 National Health Interview Survey. Addiction 1993;88:1079–1090. [PubMed: 8401162]

Nelson CB, Rehm J, Usten B, Grant BF, Chatterji S. Factor structure for DSM-IV substance disorder criteria endorsed by alcohol, cannabis, cocaine and opiate users: results from the World Health Organization Reliability and Validity Study. Addiction 1999;94:843–855. [PubMed: 10665074]

Newcomb, MD.; Bentler, PM. Consequences of Adolescent Drug Use: Impact on the Lives of Young Adults. Sage; Newbury Park, CA: 1988.

O'Malley PM, Bachman JG, Johnston LD. Reliability and consistency in self-reports of drug use. Int J Addict 1983;18:805–824. [PubMed: 6605313]

Pull CB, Saunders JB, Mavreas V, Cottler LB, Grant BF, Hasin DS, Blaine J, Mager D, Ustun BT. Concordance between ICD-10 alcohol and drug use disorder criteria and diagnoses as measured by the AUDADIS-ADR, CIDI, and SCAN: results of a cross-national study. Drug Alcohol Depend 1997;47:207–216. [PubMed: 9306046]

Reynaud M, Petit G, Potard D, Courty P. Six deaths linked to concomitant use of buprenorphine and benzodiazepines. Addiction 1998;93:1385–1392. [PubMed: 9926544]

Savage, SR. Opioid medications in the management of pain. In: Graham, AW.; Schultz, TK.; Mayo-Smith, MF.; Ries, RK.; Wilford, BB., editors. Principles of Addiction Medicine. American Society of Addiction Medicine; Chevy Chase, MD: 2003. p. 1451-1463.

Schulenberg JE, Maggs JL. A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. J Stud Alcohol 2002;14 (Suppl):54–70.

Sellers EM, Ciraulo DA, DuPont RL, Griffiths RR, Kosten TR, Romach MK, Woody GE. Alprazolam and benzodiazepine dependence. J Clin Psychiatry 1993;54:64–75. [PubMed: 8262891]

Sheehan MF, Sheehan DV, Torres A, Coppola A, Francis E. Snorting benzodiazepines. Am J Drug Alcohol Abuse 1991;17:457–468. [PubMed: 1684083]

Sher KJ, Bartholow BD, Nanda S. Short- and long-term effects of fraternity and sorority membership on heavy drinking: a social norms perspective. Psychol Addict Behav 2001;15:42–51. [PubMed: 11255938]

Sher KJ, Gotham HJ. Pathological alcohol involvement: a developmental disorder of young adulthood. Dev Psychopathol 1999;11:933–956. [PubMed: 10624733]

Simoni-Wastila L, Strickler G. Risk factors associated with problem use of prescription drugs. Am J Public Health 2004;94:266–268. [PubMed: 14759941]

Substance Abuse and Mental Health Services Administration. Results from the 2001 National Household Survey on Drug Abuse: Summary of National Findings, vol. 1. Office of Applied Studies; Rockville, MD: 2002a.

Substance Abuse and Mental Health Services Administration. Results from the 2001 National Household Survey on Drug Abuse: Detailed Tables, vol. 3. Office of Applied Studies; Rockville, MD: 2002b.

Substance Abuse and Mental Health Services Administration. Emergency Department Trends from the Drug Abuse Warning Network Final Estimates, 1995–2002, DAWN Series: D-24, DHHS Publication No. (SMA) 03-3780. Office of Applied Studies; Rockville, MD: 2003a.

Substance Abuse and Mental Health Services Administration. Emergency Department Trends from the Drug Abuse Warning Network Final Estimates 1995–2002, DAWN Series: D-24, DHHS Publication No. (SMA) 03-3780. Office of Applied Studies; Rockville, MD: 2003b.

Substance Abuse and Mental Health Services Administration. Results from the 2003 National Survey on Drug Use and Health: National Findings (NSDUH Series H-25, DHHS Publication No. SMA 04-3964). Office of Applied Studies; Rockville, MD: 2004a.

Substance Abuse and Mental Health Services Administration. The Dawn Report: Oxycodone, Hydrocodone, and Polydrug Use, 2002. Office of Applied Studies. 2004b [Accessed online October 8, 2004,]. http://oas.samhsa.gov/2k4/oxycodone/oxycodone.cfm

Sudman S. Examining substance abuse data collection methodologies. J Drug Issues 2001;31:695–716.

Teter CJ, McCabe SE, Boyd CJ, Guthrie SK. Illicit methylphenidate use in an undergraduate student sample: prevalence and risk factors. Pharmacotherapy 2003;23:609–617. [PubMed: 12741435]

Turner CF, Ku L, Rogers SM, Lindberg LD, Pleck JH, Sonenstein FL. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. Science 1998;280:867–873. [PubMed: 9572724]

Watson WA, Litovitz TL, Klein-Schwartz W, Rodgers GC Jr, Youniss J, Reid N, Rouse WG, Rembert RS, Borys D. 2003 annual report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. Am J Emerg Med 2004;22:335–404. [PubMed: 15490384]

Woods JH, Winger G. Current benzodiazepine issues. Psychopharmacology 1995;118:107–115. [PubMed: 7617794]

Wright DL, Aquilino WS, Supple AI. A comparison of computer-assisted and paper-and-pencil self-administered questionnaires in a survey on smoking, alcohol, and other drug use. Public Opin Quart 1998;62:331–353.

Zacny J, Bigelow G, Compton P, Foley K, Iguchi M, Sannerud C. College on problems of drug dependence taskforce on prescription opioid non-medical use and abuse: position statement. Drug Alcohol Depend 2003;69:215–232. [PubMed: 12633908]

Table 1

Demographic characteristics, past-year drinking status, and past-year nonmedical use of prescription drugs

	Overall sample (*n* = 43,093[a]), % (S.E.)	18–24 years (*n* = 5199[a]), % (S.E.)	25 years and older (*n* = 37,894[a]), % (S.E.)	Age group differences χ^2 (d.f.) *p*-value
Sex				
Female	52.08 (0.31)	50.01 (0.85)	52.39 (0.33)	6.8 (1) $p < 0.01$
Male	47.92 (0.31)	49.99 (0.85)	47.61 (0.33)	
Race/ethnicity				
White	70.89 (1.63)	61.97 (2.15)	72.22 (1.57)	196.4 (4) $p < 0.01$
African American	11.07 (0.68)	13.48 (0.96)	10.71 (0.66)	
Native American	2.12 (0.17)	1.76 (0.25)	2.17 (0.17)	
Asian	4.36 (0.54)	5.32 (0.79)	4.22 (0.52)	
Hispanic	11.56 (1.26)	17.47 (1.73)	10.68 (1.20)	
Past-year drinking status				
Abstainer	34.64 (0.64)	29.19 (1.05)	35.45 (0.67)	35.5 (1) $p < 0.01$
Non-binge drinking (no AUDs)	40.46 (0.51)	28.58 (0.84)	42.24 (0.54)	223.6 (1) $p < 0.01$
Binge drinking (no AUDs)	16.41 (0.34)	23.77 (0.81)	15.31 (0.34)	147.0 (1) $p < 0.01$
DSM-IV alcohol abuse only	4.67 (0.18)	6.76 (0.46)	4.36 (0.18)	37.6 (1) $p < 0.01$
DSM-IV alcohol dependence	3.82 (0.14)	11.70 (0.61)	2.64 (0.11)	659.9 (1) $p < 0.01$
Past-year nonmedical use				
Any prescription drug	3.17 (0.15)	7.51 (0.53)	2.52 (0.13)	215.9 (1) $p < 0.01$
Opioid analgesic	1.81 (0.11)	4.54 (0.42)	1.40 (0.10)	153.0 (1) $p < 0.01$
Sedative	1.24 (0.08)	2.76 (0.32)	1.02 (0.07)	64.9 (1) $p < 0.01$
Tranquilizer	0.93 (0.07)	2.59 (0.29)	0.69 (0.06)	103.2 (1) $p < 0.01$
Stimulant	0.49 (0.04)	1.81 (0.21)	0.29 (0.04)	129.9 (1) $p < 0.01$

All percentages are based on weighted data, and standard errors are adjusted for the complex sample design. Test statistics are Rao-Scott design-adjusted χ^2 tests.

[a]Unweighted Ns.

Table 2

Unadjusted prevalence estimates of past-year nonmedical use of prescription drugs by past-year drinking status

	Any prescription drug, % (S.E.)	Opioid analgesic, % (S.E.)	Sedative, % (S.E.)	Tranquilizer, % (S.E.)	Stimulant, % (S.E.)
Overall sample (*n* = 43,093)					
Abstainer	1.26 (0.14)	0.59 (0.08)	0.64 (0.10)	0.33 (0.07)	0.12 (0.04)
Non-binge drinking (no AUDs)	2.13 (0.16)	1.08 (0.10)	0.87 (0.09)	0.59 (0.09)	0.14 (0.04)
Binge drinking (no AUDs)	4.01 (0.30)	2.23 (0.24)	1.27 (0.15)	1.19 (0.17)	0.70 (0.12)
DSM-IV alcohol abuse only	8.27 (0.73)	5.09 (0.62)	2.62 (0.41)	1.99 (0.37)	1.09 (0.27)
DSM-IV alcohol dependence	22.02 (1.59)	14.89 (1.41)	8.96 (1.09)	7.78 (0.90)	6.00 (0.69)
18–24 years (*n* = 5199)					
Abstainer	1.24 (0.32)	0.52 (0.22)	0.51 (0.21)	0.06 (0.04)	0.25 (0.15)
Non-binge drinking (no AUDs)	3.95 (0.64)	1.97 (0.48)	1.45 (0.38)	1.36 (0.41)	0.43 (0.18)
Binge drinking (no AUDs)	7.49 (0.97)	4.35 (0.68)	2.62 (0.54)	2.59 (0.59)	1.68 (0.40)
DSM-IV alcohol abuse only	12.36 (2.01)	8.43 (1.72)	3.12 (1.07)	4.06 (1.23)	1.81 (0.92)
DSM-IV alcohol dependence	29.40 (2.71)	19.16 (2.15)	11.75 (1.90)	11.14 (1.65)	9.38 (1.45)
25 years and older (*n* = 37,894)					
Abstainer	1.26 (0.14)	0.60 (0.09)	0.66 (0.10)	0.36 (0.08)	0.10 (0.04)
Non-binge drinking (no AUDs)	1.95 (0.16)	0.99 (0.10)	0.81 (0.10)	0.51 (0.09)	0.11 (0.04)
Binge drinking (no AUDs)	3.20 (0.29)	1.74 (0.23)	0.96 (0.15)	0.87 (0.15)	0.47 (0.11)
DSM-IV alcohol abuse only	7.32 (0.81)	4.32 (0.69)	2.50 (0.46)	1.51 (0.34)	0.92 (0.27)
DSM-IV alcohol dependence	17.14 (1.75)	12.07 (1.58)	7.11 (1.15)	5.57 (0.99)	3.78 (0.72)

Table 3

Adjusted odds ratios of past-year nonmedical use of prescription drugs as a function of past-year drinking status[a]

	Any prescription drug AOR (95% CI)[b]	Opioid analgesic AOR (95% CI)[c]	Sedative AOR (95% CI)[d]	Tranquilizer AOR (95% CI)[e]	Stimulant AOR (95% CI)[f]
Sex					
Female	—	—	—	—	—
Male	0.9 (0.8–1.1)	0.9 (0.7–1.1)	0.9 (0.7–1.2)	1.2 (0.9–1.6)	0.8 (0.6–1.2)
Age					
18–24 years	2.0 (1.7–2.4)**	1.9 (1.5–2.4)**	1.7 (1.3–2.3)**	2.3 (1.7–3.1)**	3.0 (2.0–4.3)**
25 years and older	—	—	—	—	—
Race/ethnicity					
African American	—	—	—	—	—
Asian	1.7 (1.1–2.6)*	1.7 (0.9–3.1)	1.5 (0.9–2.7)	2.5 (0.9–6.7)	4.6 (1.4–15.7)*
Caucasian	1.7 (1.3–2.1)**	1.5 (1.1–2.0)*	1.6 (1.2–2.3)**	3.6 (2.1–6.4)**	5.0 (2.3–10.4)**
Hispanic	1.2 (0.8–1.6)	1.1 (0.7–1.8)	1.2 (0.8–1.8)	2.3 (1.2–4.4)*	2.7 (1.1–10.8)*
Native American	2.3 (1.5–3.5)**	2.7 (1.6–4.3)**	1.5 (0.7–2.3)	4.1 (1.9–8.9)**	16.6 (6.6–42.1)**
Past-year drinking status					
Abstainer	—	—	—	—	—
Non-binge drinking (no AUDs)	1.7 (1.3–2.2)**	1.8 (1.3–2.5)**	1.3 (0.9–1.9)	1.7 (1.0–2.8)*	1.1 (0.5–2.5)
Binge drinking (no AUDs)	3.0 (2.3–3.9)**	3.6 (2.5–5.0)**	1.8 (1.3–2.6)**	3.0 (1.8–5.0)**	5.0 (2.5–10.0)**
DSM-IV alcohol abuse only	6.6 (5.0–8.6)**	8.4 (5.9–11.9)**	3.8 (2.4–6.0)**	4.9 (2.8–8.6)**	7.8 (3.5–17.3)**
DSM-IV alcohol dependence	18.2 (13.9–23.8)**	24.0 (16.7–34.4)**	12.6 (8.5–18.6)**	17.3 (10.7–28.1)**	36.2 (18.1–72.6)**

— reference group.

[a] Odds ratios are adjusted for all predictors in multiple logistic regression models, which included sex, age, race/ethnicity, and past-year drinking status.

[b] Results based on N = 42,913 (unweighted n = 1218 past-year nonmedical prescription drug users).

[c] Results based on N = 42,909 (unweighted n = 646 past-year nonmedical opioid users).

[d] Results based on N = 42,903 (unweighted n = 490 past-year nonmedical sedative users).

[e] Results based on N = 42,910 (unweighted n = 345 past-year nonmedical tranquilizer users).

[f] Results based on N = 42,912 (unweighted n = 186 past-year nonmedical stimulant users).

* $p < 0.05$.

** $p < 0.01$.