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RESEARCH ARTICLE

Multiple DSM-5 substance use disorders: A national study of US adults

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Abstract

Objective: Our aim is to determine the lifetime and past-year prevalence estimates of multiple *Diagnostic and Statistical Manual of Mental Disorders* fifth edition (DSM-5) substance use disorders (SUDs) among U.S. adults.

Methods: The 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions featured in-person interviews with a nationally representative sample of adults aged 18 and older.

Results: The majority of past-year nonalcohol DSM-5 SUDs had at least 1 other co-occurring past-year SUD, ranging from 56.8% (*SE* = 3.4) for past-year prescription opioid use disorder to 97.5% (*SE* = 2.7) for past-year hallucinogen use disorder. In contrast, only 15.0% (*SE* = 0.6) of past-year alcohol use disorders had a co-occurring past-year SUD. The odds of past-year multiple SUDs were greater among males, younger adults, African-Americans, and those with mood, personality, posttraumatic stress, or multiple psychiatric disorders.

Conclusions: Assessment, diagnosis, and treatment often focus on individual substance-specific SUDs rather than multiple SUDs, despite evidence for substantial rates of polysubstance use in clinical and epidemiological studies. There are notable differences in the prevalence of multiple SUDs between alcohol use disorders and other nonalcohol SUDs that have important clinical implications; for example, multiple SUDs are more persistent than individual SUDs. These findings suggest that clinical assessment and diagnosis should screen for multiple SUDs, especially among adults with nonalcohol DSM-5 SUDs.

KEYWORDS

DSM-5, epidemiology, polysubstance, substance use disorders

1 | INTRODUCTION

Substance use disorders (SUDs) contribute substantially to morbidity and mortality in the United States and worldwide (Compton, Thomas, Stinson, & Grant, 2007; Grant et al., 2016; Hasin et al., 2016). Drug overdose deaths are the leading cause of injury death in the United States, with over 47,000 drug overdose deaths occurring in 2014 and many involving polysubstance use behaviors (Centers for Disease Control and Prevention, 2014; Rudd, Aleshire, Zibbell, & Gladden, 2016). Approximately one in every 10 U.S. adults will develop a nonalcohol drug use disorder involving cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, and/or other drugs in their lifetime (Grant et al., 2016; Hasin et al., 2016). Although several studies have documented high rates of polysubstance use behaviors, these studies often fail to examine concurrent or multiple *Diagnostic and Statistical Manual of Mental Disorders* fifth edition (DSM-5) SUDs (Armour, Shorter, Elhai, Elklit, & Christoffersen, 2014; Carter et al., 2013; Chen, Yi, & Moss, 2014; Connor, Gullo, White, & Kelly, 2014; McCabe, West, Schepis, & Teter, 2015; Midanik, Tam, & Weisner, 2007; Olthuis, Darredeau, & Barrett, 2013; Quek et al., 2013; Reyes, Pérez, Colón, Dowell, & Cumsille, 2013; Smith, Farrell, Bunting, Houston, & Shevlin, 2011). On the basis of these high rates of polysubstance use behaviors, future research is needed that shifts from measures that are substance specific to more sophisticated measures that account for multiple SUDs (Connor et al., 2014).

There is also evidence that the profile of substance use behaviors among individuals entering U.S. substance abuse treatment facilities has changed dramatically over the past two decades based on the Treatment Episode Data Set (Substance Abuse and Mental Health

Services Administration [SAMHSA], 2006, 2012, 2014a). More specifically, there has been a significant shift in the primary substances of abuse observed in those entering substance abuse treatment facilities. For instance, the percentage of substance abuse treatment facility admissions reporting alcohol as the primary substance of abuse has decreased from 57% in 1993 to 38% in 2013, whereas the percentage of substance abuse treatment facility admissions for cannabis, opioids, and stimulants as the primary substance increased from 22% in 1993 to 53% in 2013 (SAMHSA, 2006, 2012, 2014a). In addition, there is growing evidence that adverse consequences appear to be more severe among polysubstance users relative to single-drug users (Abé et al., 2013; McCabe, Cranford, Morales, & Young, 2006; SAMHSA, 2014a).

Although prior studies have found that DSM-IV and DSM-5 alcohol and cannabis use disorders often co-occur with other SUDs, most of these studies have aggregated less prevalent substance-specific SUDs such as cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, and/or other drugs (Compton et al., 2007; Grant & Pickering, 1996; Grant et al., 2016; Hasin et al., 2016; Stinson et al., 2005). As a result, several studies have concluded that more in-depth investigations regarding the prevalence of multiple DSM-5 SUDs for these less prevalent substance-specific SUDs are warranted because the epidemiology of SUDs may differ across individual drug classes (Compton et al., 2007, 2013; Grant et al., 2016). Although prior research has found that substance-specific SUDs are significantly associated with sociodemographic characteristics (e.g., sex, race, and age) and other psychiatric disorders (e.g., anxiety, eating, mood, and personality disorders), the associations with these and multiple SUDs have not been well examined (Grant, Goldstein, Saha, et al., 2015; Grant et al., 2004; Hasin et al., 2016; Kessler, Chiu, Demler, Merikangas, & Walters, 2005).

The current lack of information regarding multiple DSM-5 SUDs for these less studied drug classes represents an important gap in our knowledge with direct relevance for enhanced screening, diagnosis, prevention, and treatment efforts. Therefore, the primary objective of this study was to examine the lifetime, prior-to-past-year, and past-year prevalence and correlates associated with multiple DSM-5 SUDs for 10 drug classes among U.S. adults based on a large nationally representative sample: the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions (NESARC-III).

2 | METHODS

2.1 | Sample

This study used data collected from the 2012–2013 NESARC-III as the primary source of information regarding DSM-5 SUDs among the general civilian noninstitutionalized population of individuals 18 years of age and older in the United States. The NESARC-III included the National Institute on Alcohol Abuse and Alcoholism Alcohol Use Disorder and Associated Disabilities Interview Schedule 5 (AUDADIS-5), a fully structured diagnostic interview conducted in households. The NESARC-III 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. In-person interviews were conducted, and the household, person, and overall response rates were 72%, 84%, and 60.1%, respectively. The NESARC-III sample design and weighting procedures, which adjust for potential biases introduced by nonresponse, have been described in more detail elsewhere (Grant, Chu, Sigman, et al., 2015; Grant, Goldstein, Saha, et al., 2015). All procedures, including informed consent, received full human subjects review and institutional review board approval, and all relevant ethical safeguards have been met in relation to human subject protection.

2.2 | Measures

The measures in the AUDADIS-5 assessed several domains, including sociodemographic and background characteristics, DSM-5 SUDs, and other DSM-5 psychiatric disorders.

Sociodemographic and background characteristics were measured with several items, including sex, age, race or ethnicity, marital status, and geographical region based on the U.S. Census (northeast, south, north central, and west).

DSM-5 SUDs were assessed according to the criteria of the DSM-5 using the AUDADIS-5, including drug-specific diagnoses for 10 substances: alcohol, cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, and other drugs (e.g., ecstasy and ketamine). Substance-specific diagnoses were made for three different timeframes: past year, prior to past year, and lifetime. Each DSM-5 SUD diagnosis required positive responses to two or more of the 11 criteria in the 12 months preceding the interview or previously for each drug-specific SUD. In this study, remission from SUDs was defined as not meeting criteria for SUD for a period of 12 months or longer among those who met full criteria for at least one SUD previously. The test–retest reliability and validity of each AUDADIS-5 DSM-5 SUD diagnosis have been examined in psychometric studies, with test–retest reliability ranging from *fair* to *good* (κ = .4–.7) and dimensional criterion scales (intraclass correlation coefficient = .5–.9, respectively) ranging from *fair* to *excellent* in a large general population sample (Grant, Goldstein, Smith, et al., 2015; Grant, Goldstein, Saha, et al., 2015; Grant et al., 2016; Hasin, Greenstein, et al., 2015). More specifically, the procedural validity of the SUD diagnoses of the AUDADIS-5 was previously assessed using a clinician-administered semistructured interview Psychiatric Research Interview for Substance and Mental Disorders DSM-5 version (PRISM-5) in a large general population sample (Hasin, Greenstein, et al., 2015). The concordance between AUDADIS-5 and PRISM-5 diagnoses of lifetime, prior-to-past-year, and past-year DSM-5 binary diagnoses were good for all substances except for lifetime stimulants, prior-to-past-year hallucinogens and stimulants, and past-year opioids.

DSM-5 other psychiatric disorders were assessed using the AUDADIS-5, including lifetime anxiety disorders (i.e., agoraphobia, generalized anxiety disorder, panic, and social and specific phobias), mood disorders (i.e., bipolar, dysthymia, and major depressive

disorder), eating disorders (i.e., anorexia nervosa, binge eating disorder, and bulimia nervosa), personality disorders (i.e., antisocial personality disorders, borderline, and schizotypal), and posttraumatic stress disorder. Consistent with DSM-5, all these diagnoses excluded substance- and medical-illness-induced disorders. Reliability and validity of the DSM-5-based AUDADIS-5 diagnoses of other psychiatric disorders have been established in numerous psychometric studies (Grant, Goldstein, Smith, et al., 2015; Hasin, Shmulewitz, et al., 2015).

2.3 | Data analyses

All analyses in this study were design-based, using the survey weights provided in the NESARC-III data set to compute unbiased population estimates of the descriptive parameters of interest and the available codes describing the sampling strata and sampling clusters from the multistage stratified cluster sampling design to compute linearized variance estimates for the weighted estimates. Initial analyses focused on estimation of the lifetime, prior-to-past-year, and past-year prevalence of SUDs for specific drugs, multiple SUDs for specific drug classes, and ratios of the prevalence of multiple SUDs to the prevalence of individual SUDs for 10 specific drug classes. Ratios closer to 100% in this case would indicate that nearly all of the SUDs for a specific drug were accompanied by other SUDs.

Subsequent analyses focused on differences between subgroups defined by sociodemographic characteristics and prior psychiatric history in the prevalence of individual and multiple SUDs. These differences were tested using design-adjusted Rao–Scott chi-square tests. The lifetime, prior-to-past-year, and past-year prevalence of multiple SUDs were compared for subgroups defined by sex (female or male), race or ethnicity (White, African American, Native American, Asian or Pacific Islander, or Hispanic), age (18–29, 30–44, 45–64, or 65 years and over), and presence of other DSM-5 psychiatric conditions including anxiety, eating, mood, personality, and posttraumatic stress disorders (yes or no), in both bivariate analyses and multivariate logistic regression models. Importantly, given the overlap in some of the sociodemographic variables used to compute poststratification adjustments for the NESARC-III weights (Grant, Chu, Sigman, et al., 2015) and the variables used as covariates in our analytic models, we considered both weighted and unweighted estimates of the coefficients to assess possible inflation of the standard errors of the weighted estimates relative to changes in the actual estimates of the coefficients (Korn & Graubard, 1999). Finally, males and females were compared in terms of the probability of having any past-year SUD, having only one past-year SUD, and having multiple past-year SUDs, as a function of prior-to-past-year SUD status. The svy: commands in the Stata software (Version 14.1) were used for all analyses.

3 | RESULTS

3.1 | Estimated population characteristics and prevalence of multiple DSM-5 SUDs

The NESARC-III sample consisted of 36,309 adults and, after the final survey weights were applied, represented a population that was 51.9% women, 66.2% White, 14.7% Hispanic, 11.8% African American, 5.7% Asian, and 1.6% Native American or other racial category.

As shown in Table 1, the estimated prevalence ratios indicate that the majority of lifetime, prior-to-past-year, and past-year nonalcohol drug-specific DSM-5 SUDs (i.e., cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, or other drugs) were accompanied by at least one other DSM-5 SUD. More specifically, the prevalence ratios for past-year nonalcohol drug use disorders ranged from 56.8% for prescription opioid use disorder to 97.5% for inhalant use disorder, indicating that the majority of past-year nonalcohol drug-specific SUDs were part of multiple past-year SUDs. The exception was alcohol use disorder, which regardless of the timeframe had significantly lower prevalence ratios of multiple SUDs.

3.2 | Prevalence and adjusted odds of multiple SUDs by sex, race, age, and other psychiatric disorders

The overall prevalence rates of multiple DSM-5 SUDs among U.S. adults were 7.8% (lifetime), 6.2% (prior to past year), and 2.3% (past year), whereas the prevalence rates of individual nonmultiple DSM-5 SUDs were 23.8% (lifetime), 19.2% (prior to past year), and 13.4% (past year). As illustrated in Table 2, there were significant differences in rates of multiple DSM-5 SUDs by sex, race, age, and other psychiatric disorders. Multiple SUDs were generally more prevalent among males, young adults aged 18–29, African Americans, Native Americans, Whites, and those with a lifetime history of DSM-5 anxiety, mood, personality, eating, and posttraumatic stress disorders, in addition to those with multiple psychiatric disorders.

As shown in Table 3, the adjusted odds of past-year multiple SUDs were greater among males, younger adults, African Americans, and those with mood, personality, or posttraumatic stress disorders, after adjusting for the other covariates. In addition, the adjusted odds of past-year multiple SUDs were over 3 times greater among adults with one lifetime psychiatric disorder (AOR = 3.40, 95% CI [2.68, 4.32], $p < .001$) compared to those with no lifetime psychiatric disorder. Furthermore, the adjusted odds of past-year multiple SUDs were nearly 9 times greater among those with multiple psychiatric disorders (AOR = 8.97, 95% CI [7.22, 11.14], $p < .001$; weighted estimates, not shown in Table 3), relative to those with no lifetime history of psychiatric disorders, after adjusting for the other covariates.

When comparing the weighted and unweighted estimates of the coefficients in our models, we found evidence of some increases in efficiency (i.e., lower standard errors and narrower confidence intervals) for the unweighted estimates, as might be expected given the covariates that were also used to develop weighting adjustments, but no changes were substantial enough to change the inferences that we would make using the weighted estimates (see Table 3). In general, the lack of substantial changes in the estimates of the adjusted odds ratios does suggest that using the weights to fit these models may be unnecessary, given the factors that were used for poststratification. This is also evidence that our model has been well specified (Heeringa, West, & Berglund, 2017, Chapter 7).

TABLE 1 Prevalence of multiple DSM-5 drug-specific use disorders

Disorder timeframe	Prevalence of SUD % (*SE*)	Prevalence of multiple SUDs % (*SE*)	Ratio of prevalence estimates (*SE*)
Lifetime disorder			
Lifetime alcohol use disorder	29.1 (0.5)	7.4 (0.2)	25.5 (0.6)
Lifetime cannabis use disorder	6.3 (0.2)	5.1 (0.2)	80.8 (1.0)
Lifetime cocaine use disorder	2.4 (0.1)	2.2 (0.1)	91.9 (1.0)
Lifetime prescription opioid use disorder	2.1 (0.1)	1.7 (0.1)	83.9 (1.6)
Lifetime prescription stimulant use disorder	1.7 (0.1)	1.5 (0.1)	89.1 (1.5)
Lifetime prescription sedative use disorder	1.1 (0.1)	1.0 (0.1)	93.4 (1.2)
Lifetime hallucinogen use disorder	0.6 (0.1)	0.6 (0.1)	97.1 (1.2)
Lifetime other drug use disorder	0.5 (<0.1)	0.5 (<0.1)	93.7 (2.1)
Lifetime heroin use disorder	0.5 (<0.1)	0.4 (<0.1)	92.0 (2.8)
Lifetime inhalant use disorder	0.2 (<0.1)	0.2 (<0.1)	95.8 (2.5)
Prior to past year (PPY) disorder			
PPY alcohol use disorder	23.1 (0.5)	5.8 (0.2)	25.2 (0.6)
PPY cannabis use disorder	5.0 (0.2)	3.9 (0.2)	77.6 (1.2)
PPY cocaine use disorder	2.3 (0.1)	2.0 (0.1)	89.0 (1.2)
PPY prescription opioid use disorder	1.6 (0.1)	1.3 (0.1)	85.7 (2.0)
PPY prescription stimulant use disorder	1.6 (0.1)	1.4 (0.1)	87.1 (1.6)
PPY prescription sedative use disorder	0.9 (0.1)	0.8 (0.1)	94.3 (1.6)
PPY hallucinogen use disorder	0.6 (0.1)	0.5 (0.1)	97.0 (1.3)
PPY other drug use disorder	0.4 (<0.1)	0.4 (<0.1)	95.3 (2.0)
PPY heroin use disorder	0.4 (<0.1)	0.4 (<0.1)	91.5 (3.0)
PPY inhalant use disorder	0.1 (<0.1)	0.1 (<0.1)	95.1 (2.9)
Past-year disorder			
Past-year alcohol use disorder	13.9 (0.3)	2.1 (0.1)	15.0 (0.6)
Past-year cannabis use disorder	2.5 (0.1)	1.6 (0.1)	63.5 (1.6)
Past-year prescription opioid use disorder	0.9 (0.1)	0.5 (<0.1)	56.8 (3.4)
Past-year prescription sedative use disorder	0.4 (<0.1)	0.3 (<0.1)	73.7 (4.0)
Past-year cocaine use disorder	0.3 (<0.1)	0.3 (<0.1)	86.0 (3.7)
Past-year prescription stimulant use disorder	0.3 (<0.1)	0.2 (<0.1)	73.1 (4.3)
Past-year other drug use disorder	0.2 (<0.1)	0.1 (<0.1)	82.3 (5.5)
Past-year heroin use disorder	0.1 (<0.1)	0.1 (<0.1)	77.1 (8.3)
Past-year hallucinogen use disorder	<0.1 (<0.1)	<0.1 (<0.1)	91.0 (4.9)
Past-year inhalant use disorder	<0.1 (<0.1)	<0.1 (<0.1)	97.5 (2.7)

Note. All percentages weighted using AUDWEIGHT. SUD = substance use disorder; PPY = prior to past year; DSM-5 = *Diagnostic and Statistical Manual of Mental Disorders* fifth edition. Source: National Epidemiologic Survey on Alcohol and Related Conditions III.

3.3 | Prevalence of past-year SUDs as a function of prior-to-past-year SUD status

Table 4 shows that individuals with multiple prior-to-past-year SUDs are less likely to remit from SUDs than those with an individual (nonmultiple) prior-to-past-year DSM-5 SUD. The estimated past-year prevalence rate of any SUD among those with no prior-to-past-year DSM-5 SUDs was lowest at 8.2%. In contrast, the past-year prevalence rate of any SUD was highest among those with multiple prior-to-past-year alcohol and other drug use disorders (49.9%), followed by those with only a prior-to-past-year nonalcohol drug use disorder (40.5%) and those with only a prior-to-past-year alcohol drug use disorder (32.9%). There were also sex differences in the past-year prevalence rates of any SUD among adults with no prior-to-past-year SUDs or only alcohol use disorders. However, once individuals had multiple prior-to-past-year SUDs or prior-to-past-year nonalcohol other drug SUDs, the prevalence of any past-year SUDs was high in general, and male versus female differences in the past-year SUD prevalence rates were no longer present.

3.4 | Prevalence of substance-specific versus any SUDs as a function of prior SUD for 10 drug classes

As illustrated in Table 5, the past-year prevalence rates of any DSM-5 SUD among those with prior-to-past-year drug-specific DSM-5 drug use disorders ranged from 37.2% for prior-to-past-year DSM-5 alcohol use disorder to 53.5% for prior-to-past-year DSM-5 prescription opioid use disorder. There were no significant sex differences in the past-year prevalence rates of any SUD among adults with prior-to-past-year SUDs. Among individuals with a prior-to-past-year alcohol use disorder, other SUDs involving different substances were quite unlikely to develop in the past year (3.0%). However, among individuals with prior-to-past-year SUDs not related to alcohol, the development of

TABLE 2 Prevalence of multiple DSM-5 substance use disorders by sex, age, race, and other psychiatric disorders

Sociodemographic characteristics and other psychiatric disorders	Lifetime % (*SE*)	Prior to past year % (*SE*)	Past year % (*SE*)
Sex			
Female	5.9 (0.2)	4.8 (0.2)	1.6 (0.1)
Male	9.9 (0.4)***	7.7 (0.3)***	3.0 (0.2)***
Age			
65 years and older	1.2 (0.2)	1.0 (0.2)	0.1 (<0.1)
45–64 years	7.5 (0.4)	6.6 (0.4)	1.2 (0.1)
30–44 years	9.7 (0.4)	8.0 (0.4)	2.3 (0.2)
18–29 years	11.4 (0.5)***	7.7 (0.4)***	5.6 (0.4)***
Race			
Hispanic	5.4 (0.4)	3.9 (0.4)	2.2 (0.2)
Black	6.8 (0.5)	4.4 (0.4)	3.5 (0.3)
Native American	15.1 (2.3)	12.3 (2.1)	3.6 (1.1)
Asian/Pacific Islander	2.8 (0.5)	2.2 (0.4)	0.7 (0.2)
White	8.8 (0.3)***	7.3 (0.3)***	2.2 (0.1)***
Any psychiatric disorder			
No	3.3 (0.2)	2.5 (0.2)	0.8 (0.1)
Yes	15.4 (0.4)***	12.5 (0.4)***	4.7 (0.2)***
Anxiety disorder			
No	6.0 (0.2)	4.6 (0.2)	1.8 (0.1)
Yes	16.7 (0.7)***	14.1 (0.7)***	4.6 (0.3)***
Mood disorder			
No	5.1 (0.2)	3.8 (0.2)	1.4 (0.1)
Yes	16.4 (0.6)***	13.7 (0.6)***	5.0 (0.3)***
Personality disorder			
No	4.6 (0.2)	3.5 (0.1)	1.1 (0.1)
Yes	25.9 (0.7)***	21.2 (0.8)***	8.7 (0.5)***
Eating disorder			
No	7.6 (0.2)	6.0 (0.2)	2.2 (0.1)
Yes	18.0 (1.6)***	15.9 (1.6)***	6.0 (1.0)***
Posttraumatic stress disorder			
No	6.7 (0.2)	5.2 (0.2)	1.9 (0.1)
Yes	25.3 (1.3)***	21.2 (1.2)***	8.0 (0.8)***
Multiple psychiatric disorders			
None	3.3 (0.2)	2.5 (0.2)	0.8 (0.1)
One	8.8 (0.5)	6.7 (0.4)	2.6 (0.2)
Multiple (2+)	21.5 (0.6)***	17.8 (0.6)***	6.6 (0.4)***

Note. All percentages weighted using AUDWEIGHT. Tests of association are based on design-adjusted Rao–Scott tests. Any lifetime psychiatric disorders refer to any history of lifetime anxiety, mood, eating, personality, or posttraumatic stress disorders. Anxiety disorders refer to agoraphobia, generalized anxiety disorder, panic, and social and specific phobias; mood disorders refer to bipolar, dysthymia, and major depressive disorders; personality disorders refer to antisocial, borderline, and schizotypal personality disorders; eating disorders refer to anorexia nervosa, binge-eating disorder, and bulimia nervosa. DSM-5 = *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition. Source: National Epidemiologic Survey on Alcohol and Related Conditions III.

***$p < .001$ (for Rao–Scott test of bivariate association).

other SUDs in the past year was more prevalent. For example, approximately one third of individuals with prior-to-past-year cocaine use disorder were estimated to develop a different SUD in the past year.

4 | DISCUSSION

This study represents the first investigation to examine the prevalence of multiple DSM-5 SUDs for 10 different substances among noninstitutionalized U.S. adults. The findings of the study indicate that more than four in every five U.S. adults with a lifetime nonalcohol substance-specific SUDs involving cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, or other drugs also meet criteria for at least one other lifetime SUD (ranging from 80.8% for cannabis use disorder to 97.1% for hallucinogen use disorder). The past-year prevalence rates of multiple SUDs for nonalcohol SUDs ranged from 56.8% for prescription opioid use disorder to 97.5% for inhalant use disorder. In contrast, we found that the majority of those with lifetime, prior-to-past-year, or past-year alcohol use disorders did not meet DSM-5 criteria for a second SUD. These findings were similar to trends based on the National Survey on Drug Use and Health and NESARC that found the majority of those with a past-year alcohol use disorder not meeting DSM-IV criteria for a second SUD (Center for Behavioral Health Statistics and Quality, 2015; Grant & Pickering, 1996; Stinson et al., 2005).

The findings of this study have important implications not only for clinical practice and treatment, but also for human, preclinical, and neurobiological research investigating the mechanisms of SUDs. We found evidence for a more persistent pattern associated with multiple SUDs as compared to nonmultiple SUDs among U.S. adults, although drug classes differed. More specifically, U.S. adults with multiple prior-to-past-year SUDs were considerably more likely to report a past-year SUD and less likely to remit than those with a prior-to-past-year nonmultiple SUD. This finding is in line with a recent study that found that U.S. adults with multiple past-year DSM-IV SUDs are more likely than those with an individual past-year DSM-IV SUD to report at least one past-year SUD 3 years later, suggesting a more persistent 3-year course of disease associated with multiple SUDs over time relative to individual SUDs (McCabe & West, 2017). Despite evidence indicating high rates and increases in polysubstance use behaviors, increases in multiple SUDs, and a more persistent course associated with multiple SUDs, there is no current diagnosis involving multiple SUDs in the DSM-5 (Connor et al., 2014; McCabe et al., 2008). More long-term prospective investigations are needed to examine the developmental course and associated disabilities of multiple SUDs over time as well as the causative mechanisms that lead to the persistent course of multiple SUDs.

The age-adjusted drug overdose death rate has more than doubled from 6.2 per 100,000 persons in 2000 to 14.7 per 100,000 in 2014, and many of these deaths involve polysubstance use (Rudd et al., 2016). There has also been a significant shift nationally in the profile of individuals entering U.S. substance abuse treatment facilities (SAMHSA, 2006, 2012, 2014a), and previous evidence from national surveys suggests that the prevalence of multiple SUDs among U.S. adults with prescription drug use disorders increased significantly from 1991–1992 to 2001–2002 (McCabe et al., 2008). At least two prior studies examined the prevalence of multiple SUDs associated with drug-specific use disorders involving prescription drug classes and found that the majority of individuals with lifetime and past-year DSM-IV prescription opioid, sedative, stimulant, and tranquilizer use disorders also met DSM-IV criteria for an additional lifetime and past-year SUD, respectively

TABLE 3 Adjusted odds ratios of multiple DSM-5 substance use disorders (weighted and unweighted estimates)

Sociodemographic characteristics and other psychiatric disorders	Lifetime AOR [95% CI]	Prior to past year AOR [95% CI]	Past year AOR [95% CI]
Sex			
Female	Ref	Ref	Ref
Male	2.17 [1.96, 2.40]*** *2.28 [2.08, 2.49]****	2.04 [1.81, 2.29]*** *2.06 [1.85, 2.27]****	2.16 [1.76, 2.64]*** *2.33 [2.00, 2.72]****
Age			
65 or more years	Ref	Ref	Ref
45–64 years	5.35 [3.67, 7.81]*** *5.44 [4.14, 7.16]****	5.80 [3.69, 9.13]*** *6.28 [4.48, 8.83]****	7.27 [3.28, 16.12]*** *7.40 [3.62, 15.11]****
30–44 years	7.46 [5.18, 10.74]*** *7.22 [5.59, 9.34]****	7.52 [4.90, 11.53]*** *7.73 [5.65, 10.57]****	13.47 [6.01, 30.16]*** *12.83 [6.31, 26.08]****
18–29 years	9.03 [6.22, 13.12]*** *8.73 [6.68, 11.41]****	7.16 [4.56, 11.24]*** *7.36 [5.27, 10.29]****	35.01 [15.60, 78.55]*** *30.08 [14.87, 60.85]****
Race			
Hispanic	Ref	Ref	Ref
Black	1.34 [1.11, 1.62] *1.32 [1.10, 1.59]*	1.16 [0.92, 1.46] *1.20 [0.96, 1.50]*	1.80 [1.37, 2.35]*** *1.76 [1.40, 2.22]****
Native American	2.42 [1.65, 3.54]*** *2.13 [1.63, 2.77]****	2.48 [1.56, 3.95]*** *2.23 [1.58, 3.14]****	1.48 [0.78, 2.79] *1.29 [0.73, 2.30]*
Asian/Pacific Islander	0.67 [0.45, 1.00] *0.64 [0.45, 0.92]*	0.74 [0.48, 1.16] *0.72 [0.49, 1.06]*	0.44 [0.27, 0.72] *0.52 [0.33, 0.81]*
White	1.91 [1.62, 2.24]*** *1.84 [1.60, 2.12]****	2.12 [1.73, 2.60]*** *2.03 [1.69, 2.44]****	1.21 [0.97, 1.49] *1.16 [0.98, 1.38]*
Anxiety disorder			
No	Ref	Ref	Ref
Yes	1.42 [1.23, 1.63]*** *1.43 [1.27, 1.61]****	1.45 [1.26, 1.67]*** *1.45 [1.28, 1.63]****	1.16 [0.93, 1.46] *1.24 [1.02, 1.51]*
Mood disorder			
No	Ref	Ref	Ref
Yes	1.90 [1.68, 2.16]*** *2.00 [1.80, 2.21]****	1.99 [1.71, 2.31]*** *2.10 [1.86, 2.38]****	1.96 [1.59, 2.40]*** *1.93 [1.65, 2.25]****
Personality disorder			
No	Ref	Ref	Ref
Yes	4.08 [3.63, 4.60]*** *4.12 [3.74, 4.55]****	3.99 [3.49, 4.58]*** *3.90 [3.50, 4.36]****	4.59 [3.66, 5.75]*** *4.68 [3.93, 5.57]****
Eating disorder			
No	Ref	Ref	Ref
Yes	1.08 [0.83, 1.40] *1.26 [1.01, 1.56]*	1.17 [0.89, 1.53] *1.34 [1.06, 1.70]*	1.21 [0.83, 1.77] *1.38 [0.97, 1.97]*
Posttraumatic stress disorder			
No	Ref	Ref	Ref
Yes	1.71 [1.43, 2.04]*** *1.68 [1.46, 1.95]****	1.68 [1.37, 2.06]*** *1.71 [1.46, 2.00]****	1.56 [1.20, 2.03]*** *1.55 [1.28, 1.88]****

Note. Anxiety disorders refer to agoraphobia, generalized anxiety disorder, panic, and social and specific phobias; mood disorders refer to bipolar, dysthymia, and major depressive disorder; personality disorders refer to antisocial, borderline, and schizotypal personality disorders; eating disorders refer to anorexia nervosa, binge-eating disorder, and bulimia nervosa. Unweighted results are in italics. Source: National Epidemiologic Survey on Alcohol and Related Conditions III.

***$p < .001$.

(Blanco, Secades-Villa, García-Rodríquez, et al., 2013; McCabe et al., 2008). Taken together, the findings from the present study and the two prior studies provide evidence from three independent nationally representative samples over the past two decades that the majority of adults with drug-specific past-year prescription drug use disorders involving opioids, sedatives or tranquilizers, and stimulants also met criteria for another SUD (Blanco et al., 2013; McCabe et al., 2008).

This study found that multiple SUDs were more prevalent among males, African Americans, Native Americans, Whites, and younger adults. These findings extend prior work that has found that polysubstance use behaviors are generally more prevalent among males, Whites, and younger age groups such as adolescents and young adults (Connor et al., 2014; Garnier et al., 2009; McCabe et al., 2006). For example, previous work found that the majority of adolescents and young adults who engage in nonmedical use of prescription drugs

TABLE 4 Prevalence and sex differences in past-year SUD as a function of PPY SUD status

PPY number of disorders	Past year Any SUD % (*SE*)	Past year Single SUD % (*SE*)	Past year Multiple SUD % (*SE*)
No PPY SUD			
Overall (*n* = 27,681)	8.2 (0.2)	7.7 (0.2)	0.5 (0.1)
Female (*n* = 16,583)	6.0 (0.3)	5.7 (0.3)	0.3 (0.1)
Male (*n* = 11,098)	11.1 (0.4)***	10.3 (0.4)***	0.7 (0.1)***
PPY alcohol use disorder only			
Overall (*n* = 5,773)	32.9 (0.9)	29.8 (0.8)	3.0 (0.3)
Female (*n* = 2,596)	30.4 (1.2)	27.9 (1.2)	2.5 (0.4)
Male (*n* = 3,177)	34.6 (1.0)**	31.2 (1.0)*	3.4 (0.4)
PPY alcohol + other drug use disorder(s)			
Overall (*n* = 2,012)	49.9 (1.4)	30.6 (1.2)	19.3 (1.1)
Female (*n* = 882)	49.6 (2.1)	30.3 (1.8)	19.3 (1.5)
Male (*n* = 1,130)	50.2 (1.8)	30.8 (1.5)	19.3 (1.4)
PPY other drug use disorder only			
Overall (*n* = 843)	40.5 (2.1)	29.6 (1.9)	10.8 (1.1)
Female (*n* = 386)	39.6 (3.0)	30.5 (2.7)	9.1 (1.7)
Male (*n* = 457)	41.2 (2.6)	29.0 (2.5)	12.2 (1.7)

Note. All percentages weighted using AUDWEIGHT. Male versus female differences (based on Rao–Scott chi-square tests). SUD = substance use disorder; PPY = prior to past year. Source: National Epidemiologic Survey on Alcohol and Related Conditions III.

*$p < .05$.

**$p < .01$.

***$p < .001$.

coingest other substances at the same time when they use prescription drugs (Barrett, Darredeau, & Pihl, 2006; Garnier et al., 2009; McCabe et al., 2006, 2015). There is a need to distinguish between simultaneous and concurrent polysubstance use behaviors among individuals with multiple SUDs because the longitudinal trajectories and related adverse substance-related consequences may differ between these two types of polysubstance use behaviors (Abé et al., 2013; Garnier et al., 2009; McCabe et al., 2006; SAMHSA, 2014b).

We found that multiple SUDs were more prevalent among adults with other DSM-5 psychiatric disorders, especially mood, personality, and posttraumatic stress disorders. Notably, adults with multiple lifetime psychiatric disorders had more than 9 times greater odds of having past-year multiple SUDs relative to those with no lifetime psychiatric disorders, which is consistent with earlier work suggesting a small subset of U.S. adults with extremely high rates of psychiatric comorbidity based on previous versions of the DSM (Kessler et al., 2005). Previous studies have found high rates of psychiatric comorbidity associated with nonalcohol drug use disorders, including other SUDs (Blanco et al., 2013; Compton et al., 2007, 2013; Fenton et al., 2012; Hasin et al., 2016; McCabe et al., 2008). At least one national study found that psychiatric comorbidity was greater among U.S. adults with a nonalcohol drug use disorder who had sought substance abuse treatment or help seeking as compared to others in the general population with a drug use disorder (Compton et al., 2007). A more recent study found that majority of individuals with multiple past-year SUDs had a lifetime personality disorder and did not utilize substance abuse treatment or other help seeking (McCabe & West, 2017). Future work is needed to examine the associations between DSM-5 tobacco use disorders and other DSM-5 SUDs.

This study and the NESARC-III had several strengths and limitations that should be taken into account while considering implications of these findings. The NESARC-III represents the first nationally representative study to assess substance-specific SUDs and other psychiatric comorbidity based on DSM-5 criteria. The limitations of the NESARC-III included the cross-sectional design of the study, which prevents assessment and testing of causal relationships. The response rate was lower than previous administrations of the NESARC (Grant & Kaplan, 2005; Grant, Kaplan, Shepard, & Moore, 2003), and despite the fact that nonresponse adjustments were applied to the base sampling weights (Grant, Chu, Sigman, et al., 2015), the higher rate of nonresponse may have biased survey estimates. Although more research is needed to determine the characteristics of nonrespondents in national substance use studies such as the NESARC-III, recent studies have found that attrition was higher among individuals with no SUDs in prior longitudinal versions

TABLE 5 Prevalence of past-year substance-specific versus any SUD as a function of PPY SUD status across 10 drug classes

PPY substance-specific use disorders	Past year Any SUD % (*SE*)	Past year Substance-specific SUD % (*SE*)	Past year Different SUD % (*SE*)
PPY alcohol use disorder (*n* = 7,785)	37.2 (0.8)	34.2 (0.8)	3.0 (0.2)
PPY cannabis use disorder (*n* = 1,748)	47.9 (1.5)	25.6 (1.3)	22.3 (1.2)
PPY cocaine use disorder (*n* = 809)	42.5 (2.1)	9.2 (1.2)	33.3 (2.3)
PPY heroin use disorder (*n* = 145)	44.7 (4.8)	20.3 (4.5)	24.4 (4.1)
PPY hallucinogen use disorder (*n* = 172)	34.1 (3.7)	1.5 (0.8)	32.6 (3.7)
PPY inhalant use disorder (*n* = 43)	44.0 (9.3)	13.0 (7.5)	31.0 (8.3)
PPY prescription opioid use disorder (*n* = 505)	53.5 (2.6)	25.6 (2.1)	27.8 (2.3)
PPY prescription sedative use disorder (*n* = 286)	52.4 (3.9)	19.4 (2.7)	33.0 (3.4)
PPY prescription stimulant use disorder (*n* = 514)	38.9 (2.8)	10.2 (1.5)	28.7 (2.4)
PPY other drug use disorder (*n* = 159)	48.3 (4.4)	10.4 (2.6)	37.9 (4.5)

Note. All percentages weighted using AUDWEIGHT. SUD = substance use disorder; PPY = prior to past year. Source: National Epidemiologic Survey on Alcohol and Related Conditions III.

of the NESARC (Dawson, Goldstein, Pickering, & Grant, 2014; McCabe & West, 2016). In addition, the NESARC-III was interviewer administered, so caution should be exercised when comparing results from these studies and other sources of data based on different modes of data collection; the survey methodology literature suggests that our estimates may be biased low, given the ability of self-administered modes to generate more frequent reports of sensitive behaviors such as drug use (Turner, 2005). Furthermore, the AUDADIS-5/PRISM-5 concordance was fair on some binary SUD diagnoses (e.g., past-year opioids). Finally, the exclusion of some institutionalized subpopulations with higher rates of SUDs, including inmate populations currently in jails and prisons, may have led to underestimation of SUD prevalence in the NESARC-III (Compton, Dawson, Duffy, & Grant, 2010).

The majority of U.S. adults with a DSM-5 SUD involving cannabis, cocaine, heroin, hallucinogens, inhalants, prescription opioids, sedatives or tranquilizers, stimulants, or other drugs had at least one other SUD. The prevalence rates of multiple SUDs associated with DSM-5 alcohol use disorders were significantly lower than other nonalcohol drug use disorders. Past-year multiple SUDs had greater odds among males, young adults aged 18–29, and those with a history of DSM-5 anxiety, mood, personality, posttraumatic stress disorder, or multiple psychiatric disorders. Individuals with prior-to-past-year multiple SUDs were significantly more likely than those with a single (nonmultiple) SUD to report past-year SUDs. The findings of this study indicate that the majority of adults with a nonalcohol drug use disorder also meet criteria for at least one other SUD and that such cases are less likely to remit, which has important implications for treating DSM-5 nonalcohol drug use disorders.

In conclusion, the findings of the current study indicate that clinical assessment and diagnosis should screen for multiple SUDs, especially when working with patients with a history of nonalcohol drug use disorders. The current study identified several subgroups that are at increased risk for multiple SUDs including males, African Americans, Native Americans, Whites, young adults, and those with other DSM-5 psychiatric disorders (e.g., mood, personality, and posttraumatic stress disorders) that can be considered in clinical practice. The long-term drug use trajectories of individuals with multiple SUDs as compared with single SUDs may be indicative of distinct causal mechanisms contributing to multiple SUDs. For instance, prior-to-past-year multiple SUDs may produce robust, long-term changes in neurobiological pathways and circuits that lead to persistent multiple SUDs and relapse. In addition, multiple SUDs may be initiated by or exaggerated by preexisting aberrant neurobiology, as suggested by a history of psychiatric disorders. The contributing mechanisms are likely not mutually exclusive and together may amplify disease status. On the basis of the higher rates of psychiatric comorbidity among those with multiple DSM-5 SUDs and the more persistent course of multiple SUDs, a greater emphasis toward treating multiple SUDs and comorbid psychiatric disorders is warranted. Future research is needed to determine whether treating multiple SUDs and comorbid psychiatric disorders at the same time is more effective than treating each disorder individually and sequentially according to severity. The distinct characteristics and causal mechanisms of multiple SUDs as compared with single SUDs should be further investigated to better understand vulnerability to multiple SUDs and potential points of intervention and to improve treatment outcomes. Future work should include prospective studies and preclinical studies in which neurobiological changes can be thoroughly examined and contributing factors are readily controlled.

CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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