

# Comorbid Substance Use Disorder Profiles and Receipt of Substance Use Disorder Treatment Services: A National Study

CURTIS D. VON GUNTEN, PH.D.,<sup>a,\*</sup> & LI-TZY WU, SC.D., R.N., M.A.<sup>a,b,c,\*</sup>

<sup>a</sup>*Department of Psychiatry and Behavioral Sciences, School of Medicine, Duke University, Durham, North Carolina*

<sup>b</sup>*Department of Medicine, Division of General Internal Medicine, School of Medicine, Duke University, Durham, North Carolina*

<sup>c</sup>*Center for Child and Family Policy, Sanford School of Public Policy, Duke University, Durham, North Carolina*

**ABSTRACT. Objective:** Those with comorbid substance use disorders (SUDs) are a particularly vulnerable group. Information regarding the nature of these comorbidities and how they relate to receipt of substance use treatment could reduce the treatment gap that exists among those with comorbid SUDs. **Method:** Public-use data from the 2015–2017 National Surveys on Drug Use and Health was used to analyze past-year SUD comorbidity combinations among 12 substances and the relationship between these combinations with past-year treatment in adults ( $N = 128,740$ ). **Results:** In all, 7.9% of adults had at least one SUD in the past year (6.7% had one SUD, 0.9% had two SUDs, and 0.3% had three or more). Conditioning on specific SUDs, the prevalence of having additional SUDs ranged from 14.9% (alcohol) to 85.1% (hallucinogens). The four most common SUD combinations all included alcohol use disorder.

Alcohol and marijuana use disorder was the most common comorbidity combination and had the lowest receipt of treatment. Compared to those with one SUD, adjusted odds of receiving treatment were almost two times greater for those with two SUDs, and more than four times greater for those with three or more SUDs. Treatment prevalence was lower for those who had higher family income and education, were not employed full time, were married, were younger than age 26 years or older than age 50 years, and were Asian. **Conclusions:** Even though the treatment gap is reduced among those with multiple SUDs, it remains large. The most common and undertreated comorbid SUD combinations, in conjunction with the most underserved groups, could be targeted to facilitate treatment uptake. (*J. Stud. Alcohol Drugs*, 82, 246–256, 2021)

**S**UBSTANCE USE AND substance use disorders (SUDs) are associated with elevated risks of developing heterotypic (cross grouping) comorbid psychiatric conditions such as major depression (Kessler et al., 1996; Swendsen et al., 2010). Numerous studies have also documented that a large portion of adults with an SUD for an illicit drug also have at least one additional co-occurring SUD (homotypic comorbidity; John et al., 2018; McCabe et al., 2017). For instance, a recent study using the 2012–2013 National Epidemiological Survey on Alcohol and Related Conditions reported a multiple SUD prevalence range of 56.8% for adults with prescription opioid use disorder to 97.5% for inhalant use disorder (McCabe et al., 2017). In addition, relative to the use of a single substance or the presence of a single SUD, polysubstance use and the co-occurrence of multiple SUDs are associated with elevated risk of developing comorbid psychiatric and physical health problems (Connor et al., 2014; Kandel et al., 2001; McCabe et al., 2017; Stinson et al., 2005). Thus, individuals with comorbid SUD are a par-

ticularly vulnerable group, making them high priority targets for treatment.

Given their high need for treatment, it is important to determine the characteristics of this group, along with the current prevalence of treatment uptake. The need for this information is more pressing because the 2017 National Survey on Drug Use and Health (NSDUH) found that only 12% of people age 12 years or older who needed substance use treatment received specialty treatment in the past year. To this end, the first aim of the present article is to provide an updated and thorough analysis of comorbid SUD. There are a surprising number of ways to present information on SUD comorbidity, and it is not uncommon in existing research for important information to go unreported. For instance, although conditional prevalence is a common method for SUD comorbidity reporting, studies often condition on specific substances without reporting the conditional prevalence of having at least one other SUD among those with any SUD (Grant & Pickering, 1996; John et al., 2018; McCabe et al., 2017; Stinson et al., 2005). This is an important distinction because it can be the case that the majority of individuals with each specific SUD (e.g., opioids) have an additional SUD (McCabe et al., 2017) and that only a minority of individuals with any SUD have an additional SUD.

Moreover, the prevalence of any comorbidity for each substance class (e.g., the percentage of individuals in the population that have a specific SUD and at least one other of any type) provides additional information beyond condi-

Received: August 30, 2019. Revision: October 6, 2020.

This study was made possible by the U.S. National Institutes of Health Grant Numbers UG1DA040317 and R01MD007658 to principal investigator Li-Tzy Wu. The sponsoring agency had no further role in the study design and analysis, the writing of the report, or the decision to submit the article for publication.

\*Correspondence may be sent to Curtis Von Gunten via email at: Curt-VonGunten@gmail.com. Correspondence may also be sent to Li-Tzy Wu via email at: litzy.wu@duke.edu.

tional prevalence that is relevant to intervention, screening, and treatment. For instance, research has found that alcohol use disorder (AUD) is the most prevalent comorbid SUD; however, at the same time, it also possesses the lowest conditional probability of being accompanied by another SUD (John et al., 2018; McCabe et al., 2017). From a screening perspective, when concerned with not missing any additional substance use problems a patient might have, those with AUD will have the lowest probability of having another SUD. However, from a broad resource allocation and planning perspective, because the majority of SUD comorbidities involve AUD, a case could be made for implementing more programs directed at alcohol SUD comorbidity relative to other comorbidity combinations.

Last, this information is distinct from the ranked prevalence of specific SUD combinations (Chen et al., 2011). For example, opioids have received a lot of recent national attention (Gostin et al., 2017; Skolnick, 2018). What are the most common use disorders that co-occur with opioid use disorder and how do opioids and co-occurring substances rank relative to other combinations? If some co-occurring use disorders are particularly common, this may imply a need for specialized intervention programs and treatment facilities targeting those combinations.

The second aim of the present study is to examine all of these aspects of SUD comorbidity in the context of receipt of treatment. An understanding of polysubstance use disorder is important in its own right; however, previous research has noted that polysubstance use disorder findings have important implications for intervention and treatment (McCabe et al., 2017). Yet, a majority of studies that examine comorbid SUD do not do so in conjunction with an examination of treatment participation (Chen et al., 2011). The studies that do have used primary care and inpatient samples (Chen et al., 2011; John et al., 2018), limiting their ability to generalize to the general population.

### *Present study*

Given the need for updated and thorough information on comorbid SUD and how it, along with sociodemographic characteristics, relates to treatment, the present study uses recent data from a representative national data set to (a) provide information on past-year SUD (DSM-IV) comorbidity prevalence at several distinct levels of analysis; (b) assess past-year treatment prevalence at various levels of comorbidity analysis, including treatment for specific substances within co-occurring SUD pairs, and the association between the number of SUDs an individual has and any SUD treatment; and (c) test associations between sociodemographic variables and treatment. This information provides a better understanding of the prevalence, patterns, and correlates of multiple past-year SUDs, as well as a better understanding of how this information relates to the prevalence of treatment.

Information on the current unmet treatment need as a function of SUD combinations and sociodemographic characteristics can aid in screening and assessment strategies, thereby facilitating connection with proper care.

## **Method**

### *Data source and study sample*

Data for this study came from the public use files of the 2015–2017 NSDUH (Substance Abuse and Mental Health Services Administration). The annual NSDUH is a cross-sectional survey of alcohol, tobacco, and illicit drug use and other health-related behaviors of the U.S. civilian, noninstitutionalized population. It uses a stratified, multistage area probability sampling design to select a representative sample of the U.S. population age 12 years or greater (Substance Abuse and Mental Health Services Administration, 2018). Survey respondents were interviewed in private at their residence using a combination of methods (audio computer-assisted self-interview, computer-assisted self-interview, and computer-assisted personal interview) to increase the validity of their reports of substance use and illegal activity. The three most recent years of data (NSDUH from 2015 to 2017) were combined, all of which used a similar design. The weighted response rates for household screening and for interviewing in each survey year were 79.7% and 69.3% (in 2015), 77.9% and 68.4% (in 2016), and 75.1% and 67.1% (in 2017) (Substance Abuse and Mental Health Services Administration, 2016, 2017, 2018). The numbers of respondents contained in the public-use data files for each year were 57,146 (2015), 56,897 (2016), and 56,276 (2017). The domain of interest for the current study consisted of adults age 18 years and older ( $n = 128,740$ ).

### *Measures*

*Sociodemographic variables.* Respondents' self-reported sex, age, race/ethnicity, education, employment status, annual family income, marital status, urbanity (e.g., metropolitan vs. nonmetropolitan), health insurance status, and nicotine use disorder status were included as covariates (Brown et al., 2017; Havens et al., 2009; Oh et al., 2017). A survey year variable was also included as a categorical variable to examine yearly variations in substance use prevalence. See Table 2 for the categories used for each of these variables.

*Past-year substance use disorder.* Past-year SUD was assessed for the following substance classes: alcohol, marijuana, opioids (which includes heroin and prescription pain relievers), hallucinogens, cocaine, inhalants, methamphetamines, prescription tranquilizers, prescription sedatives, and prescription stimulants. SUD classification was based on questions that were designed to measure illicit drug or

alcohol dependence or abuse based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM IV; American Psychiatric Association, 1994). Thus, SUD classification includes both dependence and abuse.

*Receipt of treatment.* NSDUH collects information on the past-year receipt of any substance use treatment and on the past-year receipt of treatment at a specialty facility. Receipt of substance use treatment at a specialty facility is defined as substance use treatment that a respondent received at a hospital (only as an inpatient), a drug or alcohol rehabilitation facility (as an inpatient or outpatient), or a mental health center. Receipt of any substance use treatment includes all of the above, as well as additional categories, including treatment received at a hospital (outpatient), emergency department, private doctor's office, prison, jail, or a self-help group (e.g., Alcoholics Anonymous or Narcotics Anonymous). Respondents could report receiving treatment at more than one location. In the current study, we opted to be inclusive and use any past-year substance use treatment service as our treatment variable. In doing so, we avoid any controversial positions on the empirical effectiveness of certain treatments and provide a nonrestrictive upper-bound estimate of treatment receipt.

Respondents were asked generally whether they had ever received treatment for alcohol or an illicit drug. In addition, if respondents reported use of a specific substance, they were also queried about treatment for that substance. Unless otherwise noted, receipt of treatment services includes treatment services for any of the 10 substance categories examined. This variable includes logical assignment by NSDUH to having received treatment. For instance, it includes those who originally did not report having received alcohol or illicit substance treatment but who later reported having received treatment for specific substances.

#### *Analytic plan*

First, the prevalence of SUD for each of the 10 substance classes was examined. These prevalences were then decomposed into single and multiple SUDs, as well as into conditional probabilities of having another SUD given an SUD for each of the 10 substance classes. Second, the associations between the number of SUDs and sociodemographic characteristics with past-year treatment were analyzed. Third, the 12 most prevalent SUD combinations and their accompanying treatment prevalence were analyzed. Fourth, the treatment combination prevalences for SUDs comorbid with AUD were examined. The treatment combinations included alcohol-only treatment, illicit drug-only treatment, and treatment for both alcohol and illicit drugs. Fifth, adjusted logistic regression was conducted to examine the association between treatment and having an SUD comorbid with AUD (because AUD featured in a majority of the most common SUD combinations), after sociode-

mographic variables were controlled for. All analyses took into account NSDUH's complex survey design. Results are weighted estimates except for sample size. Analyses were conducted using SAS software, Version 9.4 (SAS Institute Inc., Cary, NC), except for the most prevalent SUD combination analysis, which used the UpSetR package from the R statistical language.

## **Results**

### *Prevalence and conditional probabilities of past-year SUD comorbidity (Table 1)*

Of the entire sample, 7.9% had at least one DSM-IV SUD in the past year. Of this group, 6.7% had one SUD, 0.9% had two SUDs, and 0.3% had three or more SUDs. AUD was the most prevalent SUD (6.0%), followed by marijuana use disorder (0.8%) and opioid use disorder (0.9%). Judging by the conditional probability of each substance class, the majority of those with a past-year SUD for an illicit drug also had at least one other SUD. More specifically, the conditional probabilities of having any other SUD given each illicit SUD ranged from 85.1% for hallucinogen use disorder to 45.2% for marijuana use disorder. AUD had a smaller conditional probability of 14.9%. Nevertheless, AUD was the most prevalent comorbid SUD (0.9%), followed by marijuana use disorder (0.6%).

Ignoring substance class, the conditional probability of respondents with at least one SUD having at least one other SUD was 15.4%. This might seem low when compared with the large conditional probabilities above. For this reason, we broke down the analyses at a finer level of detail. Conditioning on respondents with at least one illicit substance SUD (which includes all substance classes but alcohol), 20.2% had at least one additional illicit SUD, 32.5% had AUD, and 44.0% had any additional SUD (including AUD).

### *Most prevalent past-year substance use disorder combinations*

Of all the possible combinations of SUDs among the 10 substance types examined, the 12 most common combinations were determined (Table 2). Single SUDs were treated as "combinations" in order to compare their prevalence with combinations comprising multiple SUDs. Of the 12, five combinations comprised two SUDs. Four of these five included AUD as one of the co-occurring SUDs, consistent with the results of Table 1 indicating that alcohol is the most prevalent comorbid SUD. The most prevalent multiple SUD combination comprised AUD and marijuana use disorder (0.4%). This pattern was the third most prevalent combination overall, having a higher prevalence than all other single SUDs besides AUD and marijuana use disorder. The next most prevalent multiple SUD combinations were AUD and

TABLE 1. Prevalence of single and multiple substance use disorders in the past year, NSDUH 2015–2017 (*n* = 128,740)

Variable	Single or multiple SUDs <sup>a</sup> for substance in row			Single SUD for substance in row		Multiple SUDs, including substance in row		% with multiple SUDs among those with SUD for substance in row <sup>b</sup>	
	<i>n</i> <sup>c</sup>	%	[95% CI]	%	[95% CI]	%	[95% CI]	%	[95% CI]
<b>Substances</b>									
Alcohol	9,923	6.01	[5.85, 6.16]	5.11	[4.97, 5.25]	0.90	[0.85, 0.95]	14.9	[14.17, 15.71]
Marijuana	3,001	1.39	[1.31, 1.46]	0.76	[0.71, 0.81]	0.63	[0.58, 0.68]	45.2	[42.67, 47.76]
Opioids <sup>d</sup>	1,470	0.87	[0.81, 0.93]	0.42	[0.38, 0.47]	0.45	[0.40, 0.49]	51.3	[47.65, 55.03]
Cocaine	585	0.36	[0.31, 0.41]	0.08	[0.06, 0.10]	0.28	[0.24, 0.32]	78.0	[73.02, 82.96]
Methamphetamines	563	0.33	[0.29, 0.37]	0.14	[0.12, 0.17]	0.19	[0.16, 0.21]	56.6	[51.64, 61.50]
Prescription tranquilizer	443	0.25	[0.22, 0.29]	0.06	[0.04, 0.07]	0.20	[0.17, 0.22]	78.0	[73.20, 82.79]
Prescription stimulant	390	0.20	[0.17, 0.22]	0.05	[0.03, 0.06]	0.15	[0.13, 0.17]	76.4	[69.87, 82.86]
Hallucinogens	235	0.10	[0.08, 0.12]	0.02	[0.01, 0.02]	0.09	[0.07, 0.11]	85.1	[79.37, 90.92]
Prescription sedative	98	0.06	[0.05, 0.08]	0.01	[0.00, 0.02]	0.05	[0.04, 0.06]	77.4	[64.71, 90.19]
Inhalants	55	0.03	[0.02, 0.04]	0.01	[0.00, 0.02]	0.02	[0.01, 0.02]	60.1	[39.25, 80.99]
<b>Number of SUDs</b>									
0	115,311	92.13	[91.95, 92.31]	–	–	–	–	–	–
1	11,096	6.66	[6.50, 6.81]	–	–	–	–	–	–
2	1,706	0.90	[0.85, 0.96]	–	–	–	–	–	–
3 or more	627	0.31	[0.28, 0.35]	–	–	–	–	–	–

Notes: All sample sizes are unweighted numbers, and results are weighted estimates. NSDUH = National Survey on Drug Use and Health; SUD = substance use disorder; CI = confidence interval. <sup>a</sup>SUD includes abuse and dependence; <sup>b</sup>these values are conditional probabilities of having any other SUD given the SUD; <sup>c</sup>unweighted number of participants meeting criteria for each SUD; <sup>d</sup>includes heroin use disorder and prescription pain reliever use disorder.

TABLE 2. Twelve most common SUD combinations (exclusive) and past-year treatment use

SUD patterns	Sample size <i>n</i> <sup>b</sup>	Column percentage		Treatment <sup>a</sup>	
		%	[95% CI]	%	[95% CI]
1. Alcohol only	8,129	5.11	[4.97, 5.25]	6.34	[5.49, 7.18]
2. Marijuana only	1,701	0.76	[0.71, 0.81]	4.77	[3.48, 6.05]
3. Alcohol and marijuana	764	0.36	[0.33, 0.39]	9.66	[6.67, 12.64]
4. Opioids only <sup>c</sup>	681	0.42	[0.38, 0.47]	29.81	[25.61, 34.01]
5. Methamphetamine only	216	0.14	[0.12, 0.17]	27.68	[15.39, 39.97]
6. Alcohol and opioids	169	0.09	[0.07, 0.11]	20.91	[11.93, 29.89]
7. Alcohol and cocaine	144	0.09	[0.07, 0.11]	21.40	[9.02, 33.78]
8. Tranquilizer only	102	0.06	[0.04, 0.07]	16.62	[4.77, 28.47]
9. Cocaine only	112	0.08	[0.06, 0.10]	16.06	[8.22, 23.90]
10. Stimulant only	84	0.05	[0.03, 0.06]	8.09	[0.04, 16.13]
11. Alcohol and stimulants	88	0.04	[0.03, 0.06]	6.88	[1.04, 12.73]
12. Marijuana and opioids	68	0.04	[0.03, 0.06]	24.04	[11.40, 36.69]

Notes: All sample sizes are unweighted numbers, and results are weighted estimates. SUD = substance use disorder; CI = confidence interval. <sup>a</sup>Includes treatment at any location, such as a hospital, rehabilitation facility, mental health center, emergency department, private doctor's office, prison or jail, or a self-help group; <sup>b</sup>unweighted number of participants meeting criteria for each SUD pattern; <sup>c</sup>includes heroin use disorder and prescription pain reliever use disorder.

opioids (0.1%), and AUD and cocaine (0.1%). Both multiple SUD combinations were more prevalent than single SUDs for 6 of the 10 classes examined in the study.

*Treatment prevalence*

Receipt of treatment across the 12 combinations ranged from 29.1% for opioid use disorder to 4.77% for marijuana use disorder (Table 2). The second and third most treated combinations were methamphetamine use disorder (27.7%), followed by the combinations of opioid use disorder and marijuana use disorder (24%; although the precision of this estimate is weak). The second and third least-treated combinations were AUD (6.3%, which also happens to be

the most prevalent) and the combination of AUD and stimulant use disorder (6.9%).

Given that the four most prevalent multiple SUD combinations included AUD, receipt of treatment was examined in more detail (Table 3). In particular, treatment was decomposed into three exclusive categories for each combination: treatment for only alcohol, treatment for only the specific illicit drug, and treatment for both. As shown in Figure 1, treatment for both alcohol and the illicit drug was the most common treatment pattern (63.7% for marijuana; 31.4% for opioids; 78.0% for cocaine; 86.2% for stimulants). Treatment for only alcohol was the next most common (19.8% marijuana; 36.6% opioids; 18.2% cocaine; 13.8% stimulants), and treatment for only the illicit drug was the least

TABLE 3. Past-year treatment use among persons with common patterns of comorbid alcohol and drug use disorders

SUD categories	Any treatment <sup>a</sup>		Alcohol-only treatment		Illicit drug-only treatment		Both treatments	
	%	[95% CI]	%	[95% CI]	%	[95% CI]	%	[95% CI]
Alcohol and marijuana	9.7	[6.7, 12.6]	1.8	[0.6, 3.0]	1.5	[0.5, 2.6]	5.8	[3.3, 8.4]
Alcohol and opioids	20.9	[11.9, 29.9]	6.4	[0.4, 12.4]	5.6	[0.5, 10.7]	5.5	[1.9, 9.1]
Alcohol and cocaine	21.4	[9.0, 33.8]	3.9	[0.4, 7.4]	0.8	[0.0, 2.1]	16.7	[5.2, 28.2]
Alcohol and stimulants	6.9	[1.0, 12.7]	0.9	[0.0, 2.3]	0.0	–	5.6	[0.0, 11.3]

Notes: All sample sizes are unweighted numbers, and results are weighted estimates. SUD = substance use disorder; CI = confidence interval. Opioid use disorder includes heroin use disorder and prescription pain reliever use disorder. "Any treatment" % is greater than the sum of the three exclusive categories because misreporting was present. The final column was calculated based on the total treatment percentage calculated from the three exclusive columns rather than from the "Any treatment" column. <sup>a</sup>Includes treatment at any location, such as a hospital, rehabilitation facility, mental health center, emergency department, private doctor's office, prison or jail, or a self-help group.

common (16.5% marijuana; 32.0% opioids; 3.7% cocaine; 0.0% stimulants). Note that the opioid and AUD combination deviates from the other three combinations in that the three treatment patterns are roughly equal.

#### *Association between number of SUDs and past-year treatment*

Table 4 includes only participants with at least one past-year SUD. It shows the associations between number of SUDs and past-year treatment. Number of SUDs was positively associated with receiving treatment before and after the remaining variables were controlled for. In particular, the adjusted odds ratio (OR) was almost two times greater among adults with two past-year SUDs (adjusted OR = 2.17, 95% CI [1.74, 2.71]) and more than four times greater for those with at least three past-year SUDs (adjusted OR = 4.43, 95% CI [3.35, 5.85]) compared with those with one past-year SUD. The adjusted odds of receiving treatment service for those with at least three past-year SUDs compared with two SUDs was 2.03 (95% CI [1.53, 2.69]).

#### *Association between sociodemographic characteristics and past-year treatment*

Table 4 also shows the associations between several sociodemographic variables and past-year treatment. Treatment was lower among those without nicotine use disorder, with higher family income and education, who were not employed full time, who were married, who were younger than age 26 years and older than age 50 years, and who were Asian (vs. White), after the remaining variables were controlled for.

#### *Associations between most common combinations and receipt of treatment*

Table 5 includes tests of whether having a marijuana, opioid, cocaine, or stimulant use disorder in addition to an AUD (the four most common combinations reported above) is associated with greater probability of receiving treatment,

after the variables found in Table 2 were controlled for. Three of the four combinations were associated with increase in treatment. This was not the case for the combination of stimulant use disorder and AUD, which was also the least prevalent and had the lowest precision. The greatest increase in treatment was found for the combination of opioid use disorder and AUD (adjusted OR = 3.11, 95% CI [1.72, 5.62]), followed by cocaine use disorder and AUD (adjusted OR = 2.86, 95% CI [1.38, 5.91]), and marijuana use disorder and AUD (adjusted OR = 1.51, 95% CI [1.08, 2.11]).

## Discussion

Individuals with comorbid SUDs are a particularly vulnerable group, having increased risk for developing additional comorbid psychiatric and physical health problems (Connor et al., 2014; Kandel et al., 2001; McCabe et al., 2017; Stinson et al., 2005). To ameliorate the large treatment gap among those with SUD, and to develop effective screening and interventions, it is important to determine common SUD profiles, as well as the existing treatment gap for those profiles. The current study provides a detailed analysis of SUD profiles and the associated prevalence of treatment in a recent nationally representative data set.

Regarding treatment, the present study found that, compared with those with one past-year SUD, adults with two past-year SUDs were almost two times more likely to have received some form of substance use treatment in the past year after other relevant characteristics were controlled for (Table 2). Adults with at least three SUDs were four times more likely. These results are consistent with previous findings using the NSDUH showing that heterotypic comorbidity between SUD and major depressive episodes results in increased treatment service utilization, compared to those with only SUD (Chen et al., 2013). Nevertheless, even though there was a greater prevalence of treatment among those with the most severe SUD comorbidity (three diagnoses or more), treatment prevalence was only 35%, relative to 8% of those with one SUD. A better understanding of the barriers to accessing SUD treatment services could increase treatment participation.

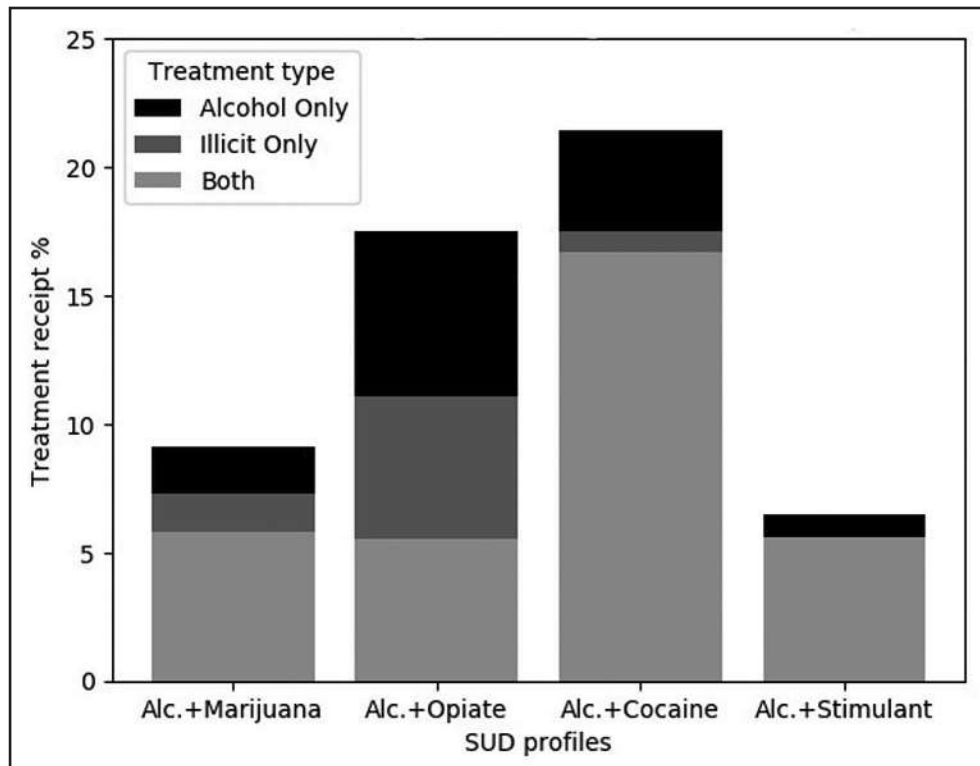


FIGURE 1. Treatment percentage by substance use disorder (SUD) profile and treatment type. The x-axis contains the four most common comorbid SUD profiles. The legend signifies treatment type partitioned into three mutually exclusive possibilities. *Illicit* refers to the substance other than alcohol contained in each bar. Treatment and SUD are measured at a past-year interval. Alc. = alcohol.

To this end, the current study identified a number of additional characteristics that were related to treatment. Those not nicotine dependent were half as likely to have received treatment relative to those who were dependent. Treatment was also less common among those below age 26 years and over age 50 years as well as those who had higher family income and higher education, were not employed full time, were married, and were Asian (vs. White), after we controlled for the remaining variables. Given that racial minorities and those with low socioeconomic status are considered medically underserved groups (Devine et al., 2017; Priester et al., 2016), it is perhaps surprising that Hispanic and Black individuals did not receive less treatment than White individuals. In addition, it is unexpected that those with lower income and lower education were more likely to have participated in treatment, and that the insured were not more likely to have received treatment. This is unanticipated given findings that the second-most reported reason for not receiving treatment is not being able to afford the cost (Ali et al., 2017), and that lack of health insurance is a major deterrent to treatment among low-income individuals (Mojtabai et al., 2014; Priester et al., 2016).

One possible explanation for these findings involves Medicaid's expansion in financing SUD treatment. The Affordable Care Act extended Medicaid eligibility to 12

million previously uninsured Americans and required state Medicaid plans to cover SUD treatment (Andrews et al., 2019; Olfson et al., 2018). As a result, Medicaid's role in financing SUD treatment has greatly expanded (Abraham et al., 2017), and it is now the largest funding source for SUD treatment services in the nation (Mark et al., 2011). This has resulted in significant gains in Medicaid coverage (Sommers et al., 2016) and reductions in uninsurance rates among low-income people (Buck, 2011). Given that the present study's data come from 2015–2017, it is possible that this explains the current study's findings that those with relatively lower levels of income and education demonstrated greater treatment use and that there was no treatment difference between White, Black, and Hispanic individuals. However, the NS-DUH data do not allow exploring the quality of substance use treatment care received.

Despite the increase in coverage that has resulted from Medicaid expansion, research has not found a coinciding increase in overall SUD treatment (Andrews et al., 2019; Capoccia et al., 2012; Olfson et al., 2018). This is consistent with the present study's finding that insurance was not associated with treatment use; however, the present study collapses private and public health insurance. It is therefore possible that either private or public insurance coverage does influence treatment use, whereas the other does not, and

TABLE 4. Odds ratios (ORs) for past-year treatment use among persons with at least one past-year substance use disorder (SUD), by number of substance use disorders and other characteristics ( $n = 13,429$ )

Variable	No treatment %	Treatment <sup>a</sup> %	Treatment vs. no treatment (ref.)			
			Crude OR	[95% CI]	AOR <sup>b</sup>	[95% CI]
Number of alcohol/drug SUDs						
1 SUD	91.7	8.3	ref.	ref.	ref.	ref.
2 SUDs	80.7	19.3	<b>2.64</b>	<b>[2.15, 3.23]</b>	<b>2.17</b>	<b>[1.74, 2.71]</b>
≥3 SUDs	64.9	35.1	<b>5.97</b>	<b>[4.62, 7.72]</b>	<b>4.43</b>	<b>[3.35, 5.85]</b>
2 SUD (ref.) vs. > 2 SUDs <sup>c</sup>	–	–	<b>2.26</b>	<b>[1.73, 2.97]</b>	<b>2.03</b>	<b>[1.53, 2.69]</b>
Nicotine dependence						
No	92.7	7.3	ref.	ref.	ref.	ref.
Yes	80.5	19.5	<b>3.08</b>	<b>[2.53, 3.76]</b>	<b>2.05</b>	<b>[1.65, 2.55]</b>
Sex						
Male	89.9	10.1	ref.	ref.	ref.	ref.
Female	89.1	10.9	1.09	[0.95, 1.25]	1.12	[0.95, 1.31]
Age, in years						
18–25	91.6	8.4	ref.	ref.	ref.	ref.
26–34	88.4	11.6	<b>1.42</b>	<b>[1.18, 1.71]</b>	<b>1.83</b>	<b>[1.52, 2.21]</b>
35–49	86.8	13.2	<b>1.65</b>	<b>[1.41, 1.95]</b>	<b>2.18</b>	<b>[1.75, 2.73]</b>
≥50	90.5	9.5	1.14	[0.90, 1.44]	1.28	[0.93, 1.77]
Race/ethnicity						
White, non-Hispanic	89.2	10.8	ref.	ref.	ref.	ref.
Hispanic	90.3	9.7	0.89	[0.71, 1.12]	0.91	[0.71, 1.17]
Black, non-Hispanic	89.5	10.5	0.97	[0.77, 1.22]	0.71	[0.56, 0.91]
Asian, non-Hispanic	96.9	3.1	<b>0.27</b>	<b>[0.11, 0.64]</b>	<b>0.31</b>	<b>[0.13, 0.77]</b>
Other <sup>d</sup>	80.9	19.1	<b>1.96</b>	<b>[1.44, 2.65]</b>	<b>1.52</b>	<b>[1.11, 2.09]</b>
Education						
Less than high school	85.4	14.6	ref.	ref.	ref.	ref.
High school grad	87.0	13.0	0.87	[0.70, 1.10]	1.05	[0.81, 1.36]
Some college/associates	88.8	11.2	<b>0.73</b>	<b>[0.57, 0.94]</b>	1.07	[0.83, 1.39]
College graduate	94.0	6.0	<b>0.37</b>	<b>[0.28, 0.50]</b>	0.75	[0.55, 1.03]
Family income						
<\$50,000	86.2	13.8	ref.	ref.	ref.	ref.
\$50,000–\$74,999	90.8	9.2	<b>0.64</b>	<b>[0.51, 0.80]</b>	0.82	[0.64, 1.05]
≥\$75,000	93.5	6.5	<b>0.44</b>	<b>[0.36, 0.53]</b>	<b>0.75</b>	<b>[0.61, 0.91]</b>
Employment						
Full time	83.6	16.4	ref.	ref.	ref.	ref.
Part time	90.8	9.2	<b>0.52</b>	<b>[0.39, 0.68]</b>	<b>0.71</b>	<b>[0.53, 0.94]</b>
Unemployed	92.2	7.8	<b>0.43</b>	<b>[0.32, 0.59]</b>	<b>0.61</b>	<b>[0.46, 0.82]</b>
Other/not in labor force	83.8	16.2	0.98	[0.73, 1.32]	1.12	[0.80, 1.56]
Health insurance						
Uninsured	88.2	11.8	ref.	ref.	ref.	ref.
Insured	89.6	10.4	0.87	[0.70, 1.09]	1.24	[0.97, 1.58]
Marital status						
Married	92.6	7.4	ref.	ref.	ref.	ref.
Divorced/separated/widowed	85.7	14.3	<b>2.09</b>	<b>[1.58, 2.75]</b>	<b>1.44</b>	<b>[1.06, 1.95]</b>
Never been married	88.7	11.3	<b>1.59</b>	<b>[1.30, 1.95]</b>	<b>1.39</b>	<b>[1.10, 1.75]</b>
Urbanity						
Large metro	90.3	9.7	ref.	ref.	ref.	ref.
Small metro	88.0	12.0	<b>1.26</b>	<b>[1.08, 1.48]</b>	1.08	[0.91, 1.28]
Non metro	88.2	11.8	<b>1.25</b>	<b>[1.02, 1.53]</b>	0.85	[0.68, 1.07]
Survey year						
2015	89.7	10.3	ref.	ref.	ref.	ref.
2016	89.3	10.7	1.05	[0.85, 1.29]	1.08	[0.86, 1.35]
2017	89.0	11.0	1.08	[0.88, 1.32]	1.09	[0.88, 1.36]

Notes: All sample sizes are unweighted numbers, and results are weighted estimates. AOR = odds ratios for each variable after adjusting for all other variables in the left column; CI = confidence interval; ref. = reference. **Bold** indicates  $p < .05$ . <sup>a</sup>Includes treatment at any location, such as a hospital (inpatient), rehabilitation facility (outpatient or inpatient), mental health center, emergency department, private doctor's office, prison or jail, or a self-help group (e.g., such as Alcoholics Anonymous or Narcotics Anonymous); <sup>b</sup>odds ratios after all other independent variables were controlled for; the adjusted model did not include the variable coding 2 SUD vs. >2 SUDs; <sup>c</sup>this test involved a different sample: those with at least two SUDs ( $n = 2,860$ ); <sup>d</sup>other includes Native American, Alaskan Native, Hawaiian, Pacific Islander, and those identifying as more than one race.

that one is obfuscating the effect of the other. It should also be acknowledged that our lowest income bracket was less than \$50,000, which does not adequately capture the most socioeconomically deprived individuals. Yet, this does not

explain why those with more relative financial resources are not more likely to receive treatment.

Besides cost, other barriers to treatment include not being ready to stop using substances (the most commonly

TABLE 5. Odds ratios (ORs) for past-year treatment by comorbid substance use disorders (SUDs) after other characteristics were controlled for. The analyses include only those with alcohol use disorder (AUD) only or any of the four AUD + SUD combinations in Table 4 ( $n = 9,294$ ).

Comorbid SUDs	No treatment %	Treatment %	Treatment vs. no treatment (ref.)			
			Crude OR	[95% CI]	AOR <sup>a</sup>	[95% CI]
AUD only ref.	93.7	6.3	ref.	ref.	ref.	ref.
Marijuana UD vs. AUD only	90.3	9.7	<b>1.58</b>	<b>[1.12, 2.23]</b>	<b>1.51</b>	<b>[1.08, 2.11]</b>
Opioid UD vs. AUD only	79.1	20.9	<b>3.91</b>	<b>[2.22, 6.88]</b>	<b>3.11</b>	<b>[1.72, 5.62]</b>
Cocaine UD vs. AUD only	78.6	21.4	<b>4.02</b>	<b>[1.94, 8.37]</b>	<b>2.86</b>	<b>[1.38, 5.91]</b>
Stimulant UD vs. AUD only	93.1	6.9	1.09	[0.43, 2.79]	1.02	[0.37, 2.80]

Notes: The sample size is unweighted, and results are weighted estimates. Ref. = reference; UD = use disorder; AOR = odds ratios for each variable after adjusting for all other variables in the left column; CI = confidence interval. **Bold** indicates  $p < .05$ . <sup>a</sup>Odds ratios after all other independent variables found in Table 2 were controlled for.

reported reason), perceived negative influence on work (Ali et al., 2017), social stigma (Barry et al., 2014; Masson et al., 2013; Pedersen & Paves, 2014), not knowing where to go for treatment, and not finding a program that offers the type of treatment desired (Ali et al., 2017). Understanding how these barriers relate to different segments of the population will be important for expanding treatment. In particular, Americans age 65 years and older constitute the fastest growing segment of the population, and the aging baby-boom cohort is placing increasing demands on the SUD treatment system (Chhatre et al., 2017; Gfroerer et al., 2003). Given the finding in the present study that older individuals are less likely to receive treatment, a focus on the special needs of this population of substance users, along with their substance use profiles, is important. Regarding race/ethnicity, Asian individuals had the lowest treatment prevalence (3%) of any category examined in the study. Further research could examine this possibly underserved group with more precision (there were only 153 Asian individuals reporting at least one past-year SUD in the sample) and investigate any culturally specific barriers this group may face (Masson et al., 2013).

The four most common comorbid SUD patterns all involved AUD: alcohol and marijuana, alcohol and opioid (which includes heroin and prescription pain relievers), alcohol and cocaine, and alcohol and stimulants. This is unsurprising considering that AUD is the most prevalent SUD with the exception of nicotine dependence (Supplemental Table 1; John et al., 2018; McCabe et al., 2017), although this result is discrepant with Chen and colleagues (2011), who found that alcohol plus cocaine was the most common SUD pattern by a wide margin, and that the second most common pattern did not include alcohol. (Supplemental material appears as an online-only addendum to this article on the journal’s website.) Nonetheless, the current study used a representative sample of the general population, whereas Chen et al. used an impatient sample from an SUD treatment facility, as well as data from 2006–2009.

Similar to the associations between the number of SUDs a person has and their likelihood of treatment, having a marijuana, opioid, or cocaine use disorder were all associated

with greater prevalence of (any) treatment, relative to having only AUD. In addition, treatment for both alcohol and the co-occurring substance was the most common treatment pattern. These data suggest that of the minority of those with SUDs who receive treatment, a majority receive treatment for all their SUD problems, if they have more than one. However, there was one notable exception to this. For the opioid and alcohol SUD combination, treatment prevalence for alcohol and for opioids was only 31%, whereas treatment for “both SUDs” ranged from 64% to 86% for the other three combinations. Further efforts could be made to foster more comprehensive SUD treatment for this group. It is possible that the recent attention given to opioid use disorder (Gostin et al., 2017; Skolnick, 2018) has unintentionally resulted in less emphasis on co-occurring SUDs.

By far, the most commonly treated SUDs were opioid use disorder (30%) and methamphetamine use disorder (28%). Confirming past research, AUD was very common (6%) but remains undertreated (e.g., Edlund et al., 2012) relative to other SUDs. With treatment use at 6%, it was the second lowest, just on the tails of marijuana use disorder (5%). It is important to note, however, that these values reflect only the cases where a person has only these use disorders. As noted above, having a co-occurring SUD increases treatment use. The data imply that AUD is more likely to be treated when it occurs alongside another SUD, and that this treatment involves treatment for both alcohol and the co-occurring substance. This suggests that AUD is screened and targeted when individuals enter or receive treatment for other SUDs. It is also possible that the increased stress on an individual, and the corresponding increased clinical severity, when struggling with multiple SUDs drives their motivation for seeking treatment. Given that the most commonly reported treatment barrier is not being ready to stop using substances (Ali et al., 2017), this is likely part of the story. Having multiple SUDs may also increase the probability of their detection by providers during healthcare contacts for other medical or mental health concerns.

Although treatment generally increases as number of SUDs increases, and treatment for AUD specifically increas-

es when it is paired with opioid use disorder or cocaine use disorder, it can be seen from Tables 2 and 3 that the reverse pattern occurs for opioid use disorder. When it occurs on its own, at 30% it has the highest treatment prevalence of any SUD and SUD combination. Yet, when it co-occurs with AUD, treatment prevalence is 11.1% (combining treatment for opioid use disorder only and for opioid use disorder and AUD). It is possible that some individuals who lack common risk factors for developing an SUD may have prescription opioid use disorder because of inappropriate prescribing or pain related issues. These individuals may be unlikely to develop a comorbid SUD and may be more likely to seek treatment or be targeted by treatment interventions stemming from the recent attention given to opioid use disorder and improper prescribing. Speculation aside, when considered alongside the earlier finding that when paired with AUD, treatment for both opioid use disorder and AUD is relatively lower than other AUD + SUD combinations, opioid use disorder appears to be an outlier in its relationship with comorbid comorbidity and treatment.

### *Limitations*

There are several limitations to the current study that warrant mentioning. First, the NSDUH uses DSM-IV criteria to determine SUDs. It is therefore possible that the current results would diverge from diagnoses based on DSM-5 (American Psychiatric Association, 2013) criteria. Nevertheless, research suggests that DSM-5 changes have minimal impact on the prevalence of SUDs (Peer et al., 2013). In addition, all results are based on self-reported data that could be influenced by recall or reporting bias/errors. The NSDUH variables also do not capture the quality of substance use treatment received by survey participants.

The current study includes any form of treatment services for SUD. The specialty treatment variable found in NSDUH includes receipt of substance use treatment at a hospital (only as an inpatient), a drug or alcohol rehabilitation facility (as an inpatient or outpatient), or a mental health center. The “any treatment” variable expands treatment to include treatment received at a hospital (outpatient), emergency department, private doctor’s office, prison, jail, or self-help group (e.g., such as Alcoholics Anonymous or Narcotics Anonymous). By using the more inclusive treatment variable, we avoid commitments concerning the empirical effectiveness of certain treatments. However, it should be noted that because of the variable’s inclusive nature, the estimates provide an upper bound on any treatment service receipt and do not reflect specialized treatment receipt. In addition, the majority of the analyses did not stratify treatment in terms of treatment for specific SUDs; however, this procedure was performed for the four most prevalent comorbidity patterns.

Furthermore, NSDUH only includes the civilian, non-institutionalized population. It excludes people with no fixed

address (e.g., homeless people not in shelters), military personnel on active duty, and residents of institutional group quarters, such as jails, nursing homes, mental institutions, and long-term care hospitals. Whether our results under- or overestimate the population depends on the direction and extent to which these subpopulations deviate from the general population in SUD prevalence and treatment.

Next, although not exactly a limitation, NSDUH does not include information on treatment for nicotine use, and past-year nicotine use disorder data are not collected by NSDUH. For this reason, nicotine was not included in the primary SUD analyses. The rank order of SUD comorbidity patterns, as well as the class-specific and class-general conditional probabilities of SUD prevalence, would change if nicotine was included as an SUD (see Supplemental Table 1). To alleviate some concerns surrounding nicotine use disorder, the present study controlled for nicotine use disorder when testing for the association between number of SUDs and receipt of treatment. Last, the current study restricts itself to past-year SUD and past-year treatment. Additional research can probe longer time intervals (McCabe et al., 2017) and trace longitudinal trends. On that note, because the data are cross-sectional, causal interpretations of the positive association between number of SUDs and receipt of treatment cannot be made.

### *Conclusions*

The present study provides a detailed analysis of SUD comorbidity patterns and the treatment prevalence of these patterns in a recent nationally representative sample of adults. These results provide a granular view on the prevalence of types of co-occurring SUDs and how such co-occurrences, or lack thereof, are related to the likelihood of treatment. Most generally, the study finds that even though treatment prevalence greatly increases as the number of co-occurring SUDs increases, the treatment gap remains large.

To reduce this gap, emphasis has been placed on incorporating SUD treatment services into primary care and general medical settings (Ducharme et al., 2016; Ghitza & Tai, 2014; Harris et al., 2017; Hemsing et al., 2017; Olfson et al., 2018). Health care professionals in primary care settings in particular are in a unique position to perform screening, referral to treatment, and brief intervention for SUD (Ghitza & Tai, 2014). This has the potential to detect early those with SUDs as they engage in routine medical care. Primary care physicians in medical settings already implementing SUD services would benefit from knowing how different SUDs may co-occur with others as well as factors that decrease the likelihood of treatment use, including high family income and education, lack of employment, being married, and young and old age. Of all groups analyzed in the study, Asian individuals had the lowest treatment levels, potentially making this group a high priority for targeted interventions

(Wu & Blazer, 2015). A focus on the special needs and barriers of these populations of substance users will aid in facilitating treatment participation. In addition, even though much emphasis has been placed on expanding screening, assessment, and treatment in primary care settings, it is important for specialty addiction treatment programs to become more aware of the specific treatment needs of their populations with SUD.

Furthermore, accessibility of SUD treatment could potentially be improved by ensuring that individuals already receiving mental health care are screened for SUDs and are properly referred (Edlund et al., 2012). The current study suggests that this may take place when a patient is being examined or treated for a different SUD, given that some SUDs are more likely to be treated when accompanied by others. However, given the higher treatment receipt for those with multiple SUDs, the data also suggest that further steps should be taken to capture those with a single SUD, particularly for alcohol and marijuana.

## References

- Abraham, A. J., Andrews, C. M., Grogan, C. M., D'Aunno, T., Humphreys, K. N., Pollack, H. A., & Friedmann, P. D. (2017). The Affordable Care Act transformation of substance use disorder treatment. *American Journal of Public Health, 107*, 31–32. doi:10.2105/AJPH.2016.303558
- Ali, M. M., Teich, J. L., & Mutter, R. (2017). Reasons for not seeking substance use disorder treatment: Variations by health insurance coverage. *Journal of Behavioral Health Services & Research, 44*, 63–74. doi:10.1007/s11414-016-9538-3
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.
- Andrews, C. M., Pollack, H. A., Abraham, A. J., Grogan, C. M., Bersamira, C. S., D'Aunno, T., & Friedmann, P. D. (2019). Medicaid coverage in substance use disorder treatment after the Affordable Care Act. *Journal of Substance Abuse Treatment, 102*, 1–7. doi:10.1016/j.jsat.2019.04.002
- Barry, C. L., McGinty, E. E., Pescosolido, B. A., & Goldman, H. H. (2014). Stigma, discrimination, treatment effectiveness, and policy: Public views about drug addiction and mental illness. *Psychiatric Services, 65*, 1269–1272. doi:10.1176/appi.ps.201400140
- Brown, Q. L., Sarvet, A. L., Shmulewitz, D., Martins, S. S., Wall, M. M., & Hasin, D. S. (2017). Trends in marijuana use among pregnant and non-pregnant reproductive-aged women, 2002–2014. *JAMA, 317*, 207–209. doi:10.1001/jama.2016.17383
- Buck, J. A. (2011). The looming expansion and transformation of public substance abuse treatment under the Affordable Care Act. *Health Affairs, 30*, 1402–1410. doi:10.1377/hlthaff.2011.0480
- Capoccia, V. A., Grazier, K. L., Toal, C., Ford, J. H., II, & Gustafson, D. H. (2012). Massachusetts's experience suggests coverage alone is insufficient to increase addiction disorders treatment. *Health Affairs, 31*, 1000–1008. doi:10.1377/hlthaff.2011.0326
- Chen, K. W., Banducci, A. N., Guller, L., Macatee, R. J., Lavelle, A., Daughters, S. B., & Lejuez, C. W. (2011). An examination of psychiatric comorbidities as a function of gender and substance type within an inpatient substance use treatment program. *Drug and Alcohol Dependence, 118*, 92–99. doi:10.1016/j.drugalcdep.2011.03.003
- Chen, L. Y., Strain, E. C., Crum, R. M., & Mojtabai, R. (2013). Gender differences in substance abuse treatment and barriers to care among persons with substance use disorders with and without comorbid major depression. *Journal of Addiction Medicine, 7*, 325–334. doi:10.1097/ADM.0b013e31829b7afe
- Chhatre, S., Cook, R., Mallik, E., & Jayadevappa, R. (2017). Trends in substance use admissions among older adults. *BMC Health Services Research, 17*, 584. doi:10.1186/s12913-017-2538-z
- Connor, J. P., Gullo, M. J., White, A., & Kelly, A. B. (2014). Polysubstance use: Diagnostic challenges, patterns of use and health. *Current Opinion in Psychiatry, 27*, 269–275. doi:10.1097/YCO.0000000000000069
- Devine, M., DeCaporale-Ryan, L., Lim, M., & Berenyi, J. (2017). Psychological issues in medically underserved patients. *Primary Care: Clinics in Office Practice, 44*, 99–112. doi:10.1016/j.pop.2016.09.012
- Ducharme, L. J., Chandler, R. K., & Harris, A. H. (2016). Implementing effective substance abuse treatments in general medical settings: Mapping the research terrain. *Journal of Substance Abuse Treatment, 60*, 110–118. doi:10.1016/j.jsat.2015.06.020
- Edlund, M. J., Booth, B. M., & Han, X. (2012). Who seeks care where? Utilization of mental health and substance use disorder treatment in two national samples of individuals with alcohol use disorders. *Journal of Studies on Alcohol and Drugs, 73*, 635–646. doi:10.15288/jsad.2012.73.635
- Gfroerer, J., Penne, M., Pemberton, M., & Folsom, R. (2003). Substance abuse treatment need among older adults in 2020: The impact of the aging baby-boom cohort. *Drug and Alcohol Dependence, 69*, 127–135. doi:10.1016/S0376-8716(02)00307-1
- Ghitza, U. E., & Tai, B. (2014). Challenges and opportunities for integrating preventive substance-use-care services in primary care through the Affordable Care Act. *Journal of Health Care for the Poor and Underserved, 25*, 36–45. doi:10.1353/hpu.2014.0067
- Gostin, L. O., Hodge, J. G., Jr., & Noe, S. A. (2017). Reframing the opioid epidemic as a national emergency. *JAMA, 318*, 1539–1540. doi:10.1001/jama.2017.13358
- Grant, B. F., & Pickering, R. P. (1996). Comorbidity between DSM-IV alcohol and drug use disorders. *Alcohol Health and Research World, 20*, 67–72.
- Harris, A. H. S., Brown, R., Dawes, M., Dieperink, E., Myrick, D. H., Gerould, H., . . . Hagedorn, H. J. (2017). Effects of a multifaceted implementation intervention to increase utilization of pharmacological treatments for alcohol use disorders in the US Veterans Health Administration. *Journal of Substance Abuse Treatment, 82*, 107–112. doi:10.1016/j.jsat.2017.09.002
- Havens, J. R., Simmons, L. A., Shannon, L. M., & Hansen, W. F. (2009). Factors associated with substance use during pregnancy: Results from a national sample. *Drug and Alcohol Dependence, 99*, 89–95. doi:10.1016/j.drugalcdep.2008.07.010
- Hemsing, N., Greaves, L., & Poole, N. (2017). Preconception health care interventions: A scoping review. *Sexual & Reproductive Healthcare: Official Journal of the Swedish Association of Midwives, 14*, 24–32. doi:10.1016/j.srhc.2017.08.004
- John, W. S., Zhu, H., Mannelli, P., Schwartz, R. P., Subramaniam, G. A., & Wu, L.-T. (2018). Prevalence, patterns, and correlates of multiple substance use disorders among adult primary care patients. *Drug and Alcohol Dependence, 187*, 79–87. doi:10.1016/j.drugalcdep.2018.01.035
- Kandel, D. B., Huang, F.-Y., & Davies, M. (2001). Comorbidity between patterns of substance use dependence and psychiatric syndromes. *Drug and Alcohol Dependence, 64*, 233–241. doi:10.1016/S0376-8716(01)00126-0
- Kessler, R. C., Nelson, C. B., McGonagle, K. A., Edlund, M. J., Frank, R. G., & Leaf, P. J. (1996). The epidemiology of co-occurring addictive and mental disorders: Implications for prevention and service utilization. *American Journal of Orthopsychiatry, 66*, 17–31. doi:10.1037/h0080151
- Mark, T. L., Levit, K. R., Vandivort-Warren, R., Buck, J. A., & Coffey, R. M. (2011). Changes in US spending on mental health and substance

- abuse treatment, 1986–2005, and implications for policy. *Health Affairs*, *30*, 284–292. doi:10.1377/hlthaff.2010.0765
- Masson, C. L., Shopshire, M. S., Sen, S., Hoffman, K. A., Hengl, N. S., Bartolome, J., . . . Iguchi, M. Y. (2013). Possible barriers to enrollment in substance abuse treatment among a diverse sample of Asian Americans and Pacific Islanders: Opinions of treatment clients. *Journal of Substance Abuse Treatment*, *44*, 309–315. doi:10.1016/j.jsat.2012.08.005
- McCabe, S. E., West, B. T., Jutkiewicz, E. M., & Boyd, C. J. (2017). Multiple DSM-5 substance use disorders: A national study of US adults. *Human Psychopharmacology*, *32*, e2625. doi:10.1002/hup.2625
- Mojtabai, R., Chen, L.-Y., Kaufmann, C. N., & Crum, R. M. (2014). Comparing barriers to mental health treatment and substance use disorder treatment among individuals with comorbid major depression and substance use disorders. *Journal of Substance Abuse Treatment*, *46*, 268–273. doi:10.1016/j.jsat.2013.07.012
- Oh, S., Reingle Gonzalez, J. M., Salas-Wright, C. P., Vaughn, M. G., & DiNitto, D. M. (2017). Prevalence and correlates of alcohol and tobacco use among pregnant women in the United States: Evidence from the NSDUH 2005–2014. *Preventive Medicine*, *97*, 93–99. doi:10.1016/j.ypmed.2017.01.006
- Olfson, M., Wall, M., Barry, C. L., Mauro, C., & Mojtabai, R. (2018). Impact of Medicaid expansion on coverage and treatment of low-income adults with substance use disorders. *Health Affairs*, *37*, 1208–1215. doi:10.1377/hlthaff.2018.0124
- Pedersen, E. R., & Paves, A. P. (2014). Comparing perceived public stigma and personal stigma of mental health treatment seeking in a young adult sample. *Psychiatry Research*, *219*, 143–150. doi:10.1016/j.psychres.2014.05.017
- Peer, K., Rennert, L., Lynch, K. G., Farrer, L., Gelernter, J., & Kranzler, H. R. (2013). Prevalence of DSM-IV and DSM-5 alcohol, cocaine, opioid, and cannabis use disorders in a largely substance dependent sample. *Drug and Alcohol Dependence*, *127*, 215–219. doi:10.1016/j.drugalcdep.2012.07.009
- Priester, M. A., Browne, T., Iachini, A., Clone, S., DeHart, D., & Seay, K. D. (2016). Treatment access barriers and disparities among individuals with co-occurring mental health and substance use disorders: An integrative literature review. *Journal of Substance Abuse Treatment*, *61*, 47–59. doi:10.1016/j.jsat.2015.09.006
- Skolnick, P. (2018). The opioid epidemic: Crisis and solutions. *Annual Review of Pharmacology and Toxicology*, *58*, 143–159. doi:10.1146/annurev-pharmtox-010617-052534
- Sommers, B. D., Blendon, R. J., & Orav, E. J. (2016). Both the ‘private option’ and traditional Medicaid expansions improved access to care for low-income adults. *Health Affairs*, *35*, 96–105. doi:10.1377/hlthaff.2015.0917
- Stinson, F. S., Grant, B. F., Dawson, D. A., Ruan, W. J., Huang, B., & Saha, T. (2005). Comorbidity between DSM-IV alcohol and specific drug use disorders in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence*, *80*, 105–116. doi:10.1016/j.drugalcdep.2005.03.009
- Substance Abuse and Mental Health Services Administration. (2016). *Key substance use and mental health indicators in the United States: Results from the 2015 National Survey on Drug Use and Health*. HHS Publication No. SMA 16-4984, NSDUH Series H-51. Rockville, MD: Center for Behavioral Health Statistics and Quality.
- Substance Abuse and Mental Health Services Administration. (2017). *Key substance use and mental health indicators in the United States: Results from the 2016 National Survey on Drug Use and Health*. HHS Publication No. SMA 17-5044, NSDUH Series H-52. Rockville, MD: Center for Behavioral Health Statistics and Quality.
- Substance Abuse and Mental Health Services Administration. (2018). *Key substance use and mental health indicators in the United States: Results from the 2017 National Survey on Drug Use and Health*. HHS Publication No. SMA 18-5068, NSDUH Series H-53. Rockville, MD: Center for Behavioral Health Statistics and Quality.
- Swendsen, J., Conway, K. P., Degenhardt, L., Glantz, M., Jin, R., Merikangas, K. R., . . . Kessler, R. C. (2010). Mental disorders as risk factors for substance use, abuse and dependence: Results from the 10-year follow-up of the National Comorbidity Survey. *Addiction*, *105*, 1117–1128. doi:10.1111/j.1360-0443.2010.02902.x
- Wu, L.-T., & Blazer, D. G. (2015). Substance use disorders and co-morbidities among Asian Americans and Native Hawaiians/Pacific Islanders. *Psychological Medicine*, *45*, 481–494. doi:10.1017/S0033291714001330