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Smoking status and quit behaviors among health center patients with substance use disorders: A national study

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ABSTRACT

Background: Despite a high prevalence of smoking among individuals with substance use disorders, tobacco dependence in this vulnerable population is undertreated.
Methods: We analyzed data from 5592 adult (≥18 years old) respondents to the 2014 Health Center Patient Survey, a nationally representative cross-sectional survey of individuals who receive care at U.S. Federally Qualified Health Centers. We evaluated self-reported smoking status, smoking-related quit behaviors (having quit, wanting or attempting to quit in the past year, and planning to quit in the next 6 months), and receipt of advice to quit smoking among participants with and without alcohol use disorder (AUD) and drug use disorder (DUD).
Results: Current smoking was common among individuals with AUD (64.3%) and DUD (55.0%). Few patients with AUD or DUD had quit smoking (16.7% and 24.0%, respectively). Smokers with AUD had higher odds of wanting to quit smoking in the past year (adjusted odds ratio = 2.88; 95% confidence interval = 1.19, 7.05), but were not more likely to have made a past-year quit attempt. DUD was not significantly associated with smoking-related quit behaviors. Smokers with AUD or DUD, as well as those who engaged in treatment for AUD or DUD, did not differ significantly from other smokers in receipt of advice to quit smoking.
Conclusions: Smokers with AUD and DUD were unlikely to have quit smoking despite interest in quitting. Our findings suggest a need for individualized tobacco treatment approaches in patients with AUD and DUD and missed opportunities to provide tobacco cessation counseling during addiction treatment.

1. Introduction

The prevalence of smoking is substantially higher among individuals with substance use disorders (SUDs) compared to the general population (Richter et al., 2002; Grant et al., 2004; Kalman et al., 2005; Guydish et al., 2011; Weinberger et al., 2018). In line with the staggering health risks associated with smoking worldwide, harms from tobacco-related complications account for the majority of the morbidity and mortality among patients with SUDs (Hser et al., 1994; Hurt et al., 1996; Baca and Yahne, 2009). Though many patients with SUDs have a desire to quit smoking (Bobo et al., 1996; Clarke et al., 2001; Richter et al., 2001), quit rates remain about half that of the general population (Lasser et al., 2000; Richter et al., 2001, 2002).

Low rates of smoking cessation in this population have been attributed in part to several perceived barriers specific to this group of smokers. One of these barriers includes the concern that smoking cessation might jeopardize SUD treatment outcomes (Asher et al., 2003; Twyman et al., 2014; Martin et al., 2016; Kathuria et al., 2019), however, tobacco cessation may actually improve SUD treatment outcomes (Joseph et al., 1993; Prochaska et al., 2004; Reid et al., 2008; Tsoh et al., 2011). Studies specifically assessing the effect of smoking cessation on alcohol use disorder (AUD) and drug use disorder (DUD) treatment have found that tobacco use treatment can improve alcohol abstinence and may be associated with decreased drug use (Frosch et al., 2000; Shoptaw et al., 2002; Lemon et al., 2003; Friend and Pagano, 2005a,b; Kalman et al., 2006).

Clinical practice guidelines recommend treatment of tobacco dependence in patients with SUDs (Clinical Practice Guideline Treating Tobacco Use and Dependence Update Panel et al., 2008; Fiore et al., 2008), yet tobacco use treatment is only provided as part of addiction

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care in 10–53% of SUD treatment centers (Currie et al., 2003; Fuller et al., 2007; Friedmann et al., 2008; Knudsen et al., 2012). Even when treatment is offered, it may not be effective. A meta-analysis of smoking cessation interventions among individuals in SUD treatment or recovery found that long-term effects on smoking cessation were minimal (Prochaska et al., 2004). Recent studies focused on evaluating innovative and enhanced tobacco treatment programs for patients with SUDs, such as contingency management, cognitive behavioral therapy, and individualized intensive programs, have shown an increase in motivation to quit smoking and quit rates (Burling et al., 2001; Cooney et al., 2017; Hall et al., 2018).

To our knowledge, there have been few studies evaluating smoking status and quit behaviors in patients with SUDs at Health Services and Resources Administration (HRSA)-funded Federally Qualified Health Centers. These health centers care for vulnerable patient populations, including racial and ethnic minorities as well as people experiencing homelessness, who are all disproportionately impacted by tobacco and substance use, undertreated for tobacco dependence, and often underrepresented in research (Baggett and Rigotti, 2010; Trinidad et al., 2011; Baggett et al., 2015; Trinidad et al., 2015). HRSA has made the treatment of SUDs an administrative priority, recently awarding hundreds of millions of dollars to improve access to SUD treatment across the country (U.S. Dept. Health and Human Services, 2017, 2018). Evaluation of smoking-related behaviors among patients with SUDs in these health centers can help improve tobacco use treatment among the most vulnerable populations in our country.

The objectives of this study were to (1) describe smoking status in patients with and without AUD and DUD at U.S. safety net health centers, (2) assess the association between AUD and DUD and smoking-related quit behaviors, and (3) evaluate the association between AUD and DUD, as well as addiction treatment, and receipt of advice to quit smoking. We hypothesized that patients with AUD and DUD were less likely to quit smoking than patients without AUD or DUD. Among current smokers, we hypothesized that patients with AUD and DUD received similar amounts of advice to quit smoking compared to individuals without AUD or DUD. Additionally, we hypothesized that smokers with AUD or DUD who underwent addiction treatment were more likely to receive advice to quit smoking than those who did not undergo addiction treatment.

2. Material and methods

2.1. Study sample

We analyzed data from 5592 adult (≥ 18 years old) respondents to the 2014 Health Center Patient Survey (HCPS), a nationally representative cross-sectional survey of individuals who received care at HRSA-funded Federally Qualified Health Centers within the U.S. HCPS applied a three-stage sampling design to target individuals who received care from an eligible health center at least once within 12 months of the survey. First, health center grantees were chosen, then eligible clinics within each grantee were selected, and finally eligible patients within each clinic site were approached to participate. Surveys were administered via one-on-one interviews with a 91.4% response rate. Weighting procedures allowed for estimates to be representative of the 21.2 million patients cared for by these safety-net health centers at the time of the survey (Health Resources and Services Administration, 2016).

2.2. Measures

2.2.1. Exposures

There were four main exposures of interest: evidence of AUD in the past 3 months, evidence of DUD in the past 3 months, self-reported receipt of AUD treatment within the past twelve months, and self-reported receipt of DUD treatment within the past twelve months. Diagnoses of AUD and DUD were based on self-reported responses to the World Health Organization (WHO) Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), a validated test to detect unhealthy alcohol or drug use (Humeniuk et al., 2008). ASSIST includes questions that map closely to 5 of 11 Diagnostic and Statistical Manual of Mental Disorders (DSM-5) SUD criteria. See the supplemental material for specific survey questions. We defined individuals as having AUD or DUD if they endorsed ≥ 2 current symptoms relating to alcohol or drug use, consistent with DSM-5 diagnostic criteria (Hasin et al., 2013). DUD was a composite variable including individuals with evidence of amphetamine-type stimulant disorder, cannabis use disorder, cocaine use disorder, hallucinogen use disorder, inhalant use disorder, or opioid use disorder. We evaluated AUD and DUD separately based on clinical knowledge regarding differences in patient characteristics as well as differences in smoking and quit rates in these two populations from prior studies (Budney et al., 1993; Clemmey et al., 1997; Mackowick et al., 2012; Shu and Cook, 2015; Evans et al., 2017; Weinberger et al., 2017; Kathuria et al., 2019). We created a subgroup of patients with a combined use disorder in order to know who met criteria for both AUD and DUD. While some elements of HCPS are available publicly, we requested permission from HRSA to analyze a restricted use file, which included information regarding participants' drug use.

2.2.2. Outcomes

Outcomes included self-reported smoking status, smoking-related quit behaviors, and receipt of advice to quit smoking.

Smoking status included being a current smoker and former smoker. Being a current smoker was defined as smoking at least 100 cigarettes in one's lifetime and currently smoking every day or some days (Babb et al., 2017). Being a former smoker was defined as smoking at least 100 cigarettes in one's lifetime and currently not smoking at all (Babb et al., 2017).

Smoking-related quit behaviors included each of the following dichotomous measures: having had a desire to quit smoking in the past year, attempting to quit smoking in the past year, and planning to quit smoking in the next 6 months, all evaluated among current smokers. An additional smoking-related quit measure was having quit smoking, defined as being a former smoker among those who smoked at least 100 cigarettes in their lifetime.

Past-year receipt of advice to quit smoking was evaluated among current smokers. Please see the supplemental material for the specific survey questions used to define the outcomes.

2.2.3. Covariates

Other covariates were selected *a priori* based on the demographic, socioeconomic, and clinical characteristics known to be associated with AUD and DUD and smoking-related quit behaviors (Mackowick et al., 2012; Shu and Cook, 2015). Demographic factors included age (18–44 vs ≥ 45), sex (male vs female), and race/ethnicity (categorized as non-Hispanic White, non-Hispanic Black, Hispanic, and other). Socioeconomic factors included educational attainment (less than high school vs at least high school diploma), employment status (unemployed vs employed), income level (≤ 100% vs > 100% of the federal poverty level [FPL]), and insurance status (insured vs uninsured). Clinical characteristics included serious mental illness (SMI; defined as having a diagnosis of either bipolar disorder or schizophrenia, or a score ≥ 13 on the Kessler 6-item [K6] scale of psychological distress (Kessler et al., 2003, 2010)), self-reported medical comorbidities (0–1 vs 2 or more), and health center type (community health center [CHC], public housing primary care [PHPC], migrant health center [MHC], and health care for the homeless [HCH]). Medical comorbidities included coronary artery disease, congestive heart failure, stroke, chronic obstructive pulmonary disease, asthma, liver disease, renal disease, hypertension, and diabetes mellitus.

2.3. Statistical analysis

We first examined the unweighted counts and weighted percentages of participants' demographic, socioeconomic, and clinical characteristics by substance use disorder type. We then estimated the weighted percentages of current and former smoking among those with and without AUD and DUD. Next, we estimated the weighted percentages of smokers with and without AUD and DUD who engaged in each of the smoking-related quit behaviors described above. We used χ^2 tests to determine the unadjusted relationships between the exposure and outcome variables. We then performed multivariable logistic regression to assess the relationship between AUD and DUD and smoking-related quit behaviors. We performed multivariable logistic regression to assess the relationship between AUD and DUD and receipt of advice to quit smoking among all current smokers, and to assess the relationship between AUD and DUD treatment and receipt of advice to quit smoking among all current smokers with AUD or DUD. In each model, AUD was compared to no AUD and DUD was compared to no DUD. Each model included all the covariates described above.

To evaluate whether individuals with a combined use disorder differed from individuals with AUD or DUD alone with regards to the various smoking-related quit behaviors, we created an interaction term between AUD and DUD. This interaction term was not significant for any of the outcomes, indicating that there was no effect measure modification by having both AUD and DUD, and was removed from the analysis (beta coefficients and p values are displayed in Supplemental Table 1).

Additionally, we hypothesized that different types of health centers may be better equipped to care for patients with SUDs, modifying the effect of the exposures on the outcomes. To evaluate this, we created interaction terms between health center type and each SUD; however, there was no evidence of effect measure modification by health center type, so the interaction terms were removed from the final models.

We conducted all analyses in 2018 and 2019 using SAS (SAS institute), version 9.4, using strata, cluster, and weight variables to account for the complex sampling design and produce estimates representative of adult U.S. health center patients. Results were considered significant at $p < 0.05$. The Partners Human Research Committee exempted this study.

3. Results

3.1. Participant characteristics

The demographic, socioeconomic, and clinical characteristics of patients with and without AUD and DUD, as well as those with a combined use disorder, are shown in Table 1. Of 5592 adult respondents, 559 (7.3%) met criteria for AUD, 375 (4.4%) met criteria for DUD, and 163 (1.7%) met criteria for a combined use disorder. The majority of individuals with DUD were less than 45 years old (70.2%). There was a lower proportion of Hispanic individuals among those with vs without AUD (16.0% vs 24.8%) and a higher proportion of non-Hispanic Black individuals among those with vs without DUD (30.9% vs 18.7%). There was also a high proportion of non-Hispanic Black individuals among patients with a combined use disorder (40.8%).

Respondents with DUD had lower income than individuals without DUD, with 71.8% of those with DUD reporting an income ≤ 100% of the FPL. Respondents with a combined use disorder also had low income levels, with 82.1% reporting an income ≤ 100% of the FPL. The majority of respondents received care at CHCs, though more individuals with AUD and DUD received care at HCH compared to those without AUD or DUD. Individuals with AUD and DUD had a higher burden of SMI compared to those without AUD or DUD.

3.2. Smoking status

Approximately three quarters of respondents with AUD and DUD were current or former smokers (Fig. 1). A higher proportion of individuals with AUD were current smokers compared to those without AUD (64.3% vs 25.2%, $p < 0.001$), and the same was true for individuals with DUD as compared to those without DUD (55.0% vs 26.8%, $p < 0.001$), as shown in Fig. 1.

3.3. Smoking-related quit behaviors

3.3.1. Quit smoking

Respondents with AUD were less likely to have quit smoking than those without AUD (16.7% vs 43.8% $p < 0.001$; Fig. 2). This difference remained significant in the multivariable analysis (adjusted odds ratio [aOR] = 0.30; 95% confidence interval [CI] = 0.14, 0.65; Table 2). Respondents with DUD did not have a significantly different likelihood of having quit smoking in unadjusted (24.0% vs 41.8%, $p = 0.07$) or multivariable adjusted (aOR = 0.95, 95% CI = 0.30, 2.96) analyses compared to respondents without DUD.

3.3.2. Past-year desire to quit

Smokers with AUD were more likely than those without AUD to report a past-year desire to quit smoking in unadjusted (89.8% vs. 76.5%; $p < 0.001$; Fig. 2) and adjusted (aOR = 2.88; 95% CI = 1.19, 7.05; Table 2) analyses. DUD was not significantly associated with past-year desire to quit.

3.3.3. Past-year quit attempt

More than half of all current smokers with AUD (57.9%) and DUD (62.8%) reported a past-year quit attempt. There were no significant differences in past-year quit attempt between smokers with and without AUD or with and without DUD in both unadjusted (Fig. 2) and adjusted (Table 2) analyses.

3.3.4. Planning to quit in the next 6 months

Fewer than one third of current smokers with AUD (31.4%) and DUD (22.8%) reported a plan to quit smoking in the next 6 months. There were no significant differences in planning to quit smoking between smokers with and without AUD or with and without DUD in both unadjusted (Fig. 2) and adjusted (Table 2) analyses.

3.4. Receipt of advice to quit smoking

Overall, the majority of all health center smokers received advice to quit smoking (77.6% among individuals with AUD, 78.9% among individuals without AUD, 71.5% among individuals with DUD, and 79.4% among individuals without DUD; Supplemental Fig. 1). Receipt of quit advice among smokers with AUD (aOR = 0.89; 95% CI = 0.39, 2.02) and DUD (aOR = 0.59; 95% CI = 0.21, 1.61) did not differ significantly from those without AUD or DUD, respectively. Additionally, smokers with AUD or DUD who engaged in AUD treatment (aOR = 0.31; 95% CI = 0.05, 2.01) or DUD treatment (aOR = 0.97; 95% CI = 0.21, 4.44) in the past year did not differ significantly from those who did not engage in AUD or DUD treatment with respect to receipt of advice to quit smoking (Table 3).

4. Discussion

This nationally-representative sample of HRSA-funded Federally Qualified Health Center patients with AUD and DUD demonstrates an ongoing need to address tobacco use in this vulnerable population. Consistent with prior research, individuals with AUD and DUD were likely to be current smokers and unlikely to have quit smoking (Richter et al., 2002; Grant et al., 2004; Kalman et al., 2005). While the majority of patients with AUD received advice to quit smoking and reported

Table 1
Characteristics of adult patients at U.S. health centers with and without substance use disorders.

	Alcohol use disorder (n = 559) n (%)	No Alcohol use disorder (n = 5033) n (%)	Drug use disorder (n = 375) n (%)	No drug use disorder (n = 5217) n (%)	Combined use disorder[a] (n = 163) n (%)
Age					
18-44	215 (56.7)	2083 (53.2)	**183 (70.2)**	**2115(52.6)**	66 (66.4)
≥ 45	344 (43.3)	2950 (46.8)	**192 (29.8)**	**3102(47.4)**	97 (33.5)
Female	201 (63.0)	3319 (64.2)	161 (61.7)	3359 (64.2)	56 (65.3)
Race/ethnicity					
Non-Hispanic White	147 (49.9)	1227 (50.5)	104 (42.5)	1270 (50.8)	34 (29.6)
Non-Hispanic Black	200 (28.3)	1103 (18.5)	**150 (30.9)**	**1153(18.7)**	76 (40.8)
Hispanic	**117 (16.0)**	**1786(24.8)**	65 (18.2)	1838 (24.5)	– (15.1)
Other	95 (5.8)	917 (6.1)	56 (8.3)	956 (6.0)	– (14.6)
Education level					
Less than high school	242 (42.0)	2202 (33.6)	156 (41.0)	2288 (33.9)	70 (47.4)
At least high school	317 (58.0)	2814 (65.9)	219 (59.0)	2912 (65.6)	93 (52.6)
Currently employed	136 (35.2)	1649 (37.5)	73 (32.4)	1712 (37.5)	– (30.9)
Federal poverty level income					
> 100%	151 (37.0)	1814 (45.0)	**77 (28.2)**	**1888(45.2)**	– (17.9)
≤ 100%	408 (63.0)	3217 (55.0)	**298 (71.8)**	**3327(54.8)**	136 (82.1)
Health insurance status					
Insurance	406 (67.8)	3819 (73.9)	313 (76.8)	3912 (73.3)	137 (81.8)
No insurance	153 (32.2)	1214 (26.1)	62 (23.2)	1305 (26.7)	– (18.2)
Health center type					
Community health center	**212 (86.3)**	**2960(93.3)**	**120 (83.1)**	**3052(93.2)**	49 (81.5)
Public housing primary care	42 (1.0)	410 (0.9)	**40 (1.8)**	**412 (0.9)**	– (1.23)
Migrant health center	52 (2.8)	751 (3.1)	**14 (1.0)**	**789 (3.1)**	– (1.9)
Healthcare for the homeless	**253 (9.8)**	**912 (2.7)**	**201 (14.1)**	**964 (2.7)**	90 (15.3)
Fair or poor general health	301 (50.8)	2451 (40.9)	187 (49.6)	2565 (41.3)	77 (47.3)
Serious mental illness[b]	**231 (40.0)**	**1154(21.3)**	**194 (47.2)**	**1191(21.5)**	47 (28.7)
Multiple chronic illnesses[c]	199 (33.0)	1577 (30.0)	127 (21.5)	1649 (30.7)	57 (18.6)

All n's are unweighted and all percentages are population-weighted.
Boldface indicates statistical significance ($p < 0.05$).
n < 30 suppressed to maintain confidentiality per data use agreement.
[a] A diagnosis of both AUD and DUD.
[b] Defined as a diagnosis of bipolar disorder or schizophrenia, or having a Kessler 6 score ≥ 13.
[c] ≥ 2 of the following medical illnesses: coronary artery disease, congestive heart failure, stroke, COPD, asthma, liver disease, renal disease, hypertension, diabetes mellitus.

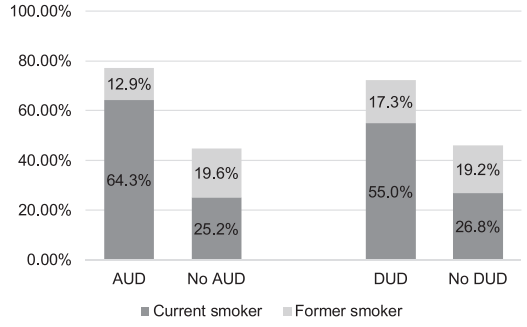

Fig. 1. Smoking status among patients with and without substance use disorders. The proportion of current smokers among individuals with AUD is significantly higher than the proportion of current smokers among individuals with no AUD ($p < 0.001$), as well as among individuals with DUD compared to no DUD ($p < 0.001$).

higher past-year desire to quit smoking compared to patients without AUD, they were not more likely to have made a past-year quit attempt or to have plans to quit smoking in the future. The majority of patients with DUD also received advice to quit smoking, yet did not appear to take measurable steps towards quitting. These findings highlight a discrepancy between receiving advice to quit smoking, having a desire to quit smoking, and taking action to quit, adding to a body of existing research that has found that patients with SUDs often have a difficult time quitting smoking (Prochaska et al., 2004).

While our study was not designed to evaluate the underlying cause of these discrepancies, one possibility may be due to inadequate treatment of tobacco dependence in this population. Prior research has demonstrated disparities in tobacco dependence treatment among racial and ethnic minorities, who make up a relatively large portion of this study population (Trinidad et al., 2015). Another possibility may be due to the relative ineffectiveness of traditional tobacco cessation approaches in patients with SUDs, supporting the emerging literature that innovative and enhanced treatment approaches are needed (Burling et al., 2001; Prochaska et al., 2004; Cooney et al., 2017; Hall et al., 2018).

Furthermore, we noted differences in smoking-related quit behaviors between those with AUD and DUD, suggesting that the treatment needs for these two groups may be different. While patients with AUD were unlikely to have quit smoking, they reported a high desire to quit compared to those without AUD. Patients with DUD were not more likely to endorse any of the smoking-related quit behaviors compared to those without DUD. Further research is needed to evaluate why these differences may exist and determine whether individualized treatment programs based on substances used may improve the likelihood of quitting.

Our study also provides reassuring information regarding tobacco cessation counseling at Federally Qualified Health Centers among smokers with SUDs. There was no association between the presence of AUD or DUD and the likelihood of receiving advice to quit smoking, indicating that clinical providers at U.S. health centers are offering advice to quit smoking to patients at high rates regardless of the

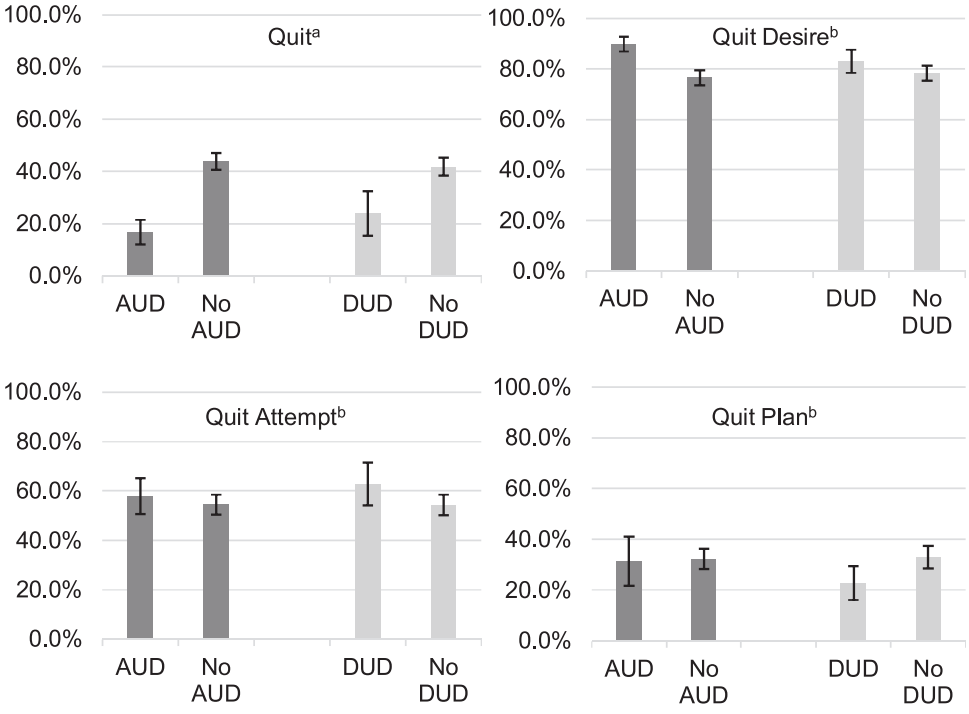

Fig. 2. Quit behaviors among patients with and without substance use disorders. [a]Being a former smoker among individuals who smoked at least 100 cigarettes in their lifetime. [b]Past-year desire to quit, past-year quit attempt, and plans to quit smoking in the next 6 months among current smokers. Respondents with AUD quit smoking less than those without AUD ($p < 0.001$). Respondents with AUD had higher past-year desire to quit smoking than those without AUD ($p < 0.001$).

Table 2
Association between substance use disorders (SUDs) and smoking-related quit behaviors.

	Quit[a] aOR (95% CI)	Desire to quit[b] aOR (95% CI)	Quit attempt[b] aOR (95% CI)	Plan to quit[b] aOR (95% CI)
Type of SUD				
AUD[c]	**0.30 (0.14, 0.65)**	**2.88 (1.19, 7.05)**	1.09 (0.49, 2.42)	1.09 (0.49, 2.42)
DUD[d]	0.95 (0.30, 2.96)	0.74 (0.31, 1.74)	0.63 (0.25, 1.58)	0.63 (0.25, 1.58)

Boldface indicates statistical significance ($p < 0.05$).
Results presented in each column are from a single model containing AUD, DUD, as well as age, gender, race/ethnicity, educational attainment, employment status, federal poverty level income, health insurance status, serious mental illness, medical comorbidities, and health center type.
[a] Being a former smoker among ever smokers (ever smoker n = 2712).
[b] Past-year desire to quit, past-year quit attempt, and plans to quit smoking in the next 6 months among current smokers (current smoker n = 1735).
[c] Reference group was no AUD.
[d] Reference group was no DUD.

Table 3
Association between substance use disorders (SUDs) and their treatment and receipt of advice to quit smoking.

	Receipt of advice to quit smoking among current smokers (n = 1735) aOR (95% CI)	Receipt of advice to quit among current smokers with AUD and/or DUD (n = 494) aOR (95% CI)
Type of SUD		
AUD[a]	0.89 (0.39, 2.02)	–
DUD[b]	0.59 (0.21, 1.61)	–
Type of SUD Treatment		
AUD Treatment	–	0.31 (0.05, 2.01)
DUD treatment	–	0.97 (0.21, 4.44)

Boldface indicates statistical significance ($p < 0.05$).
Results presented in each column are from a single model containing AUD and DUD (column 1) or AUD treatment and DUD treatment (column 2), as well as age, gender, race/ethnicity, educational attainment, employment status, federal poverty level income, health insurance status serious mental illness, medical comorbidities, and health center type.
[a] Reference group was no AUD.
[b] Reference group was no DUD.

presence of SUDs. These findings suggest that providers are practicing in accordance with current clinical guidelines recommending tobacco cessation in patients with SUDs (Clinical Practice Guideline Treating Tobacco Use and Dependence Update Panel et al., 2008; Fiore et al., 2008) and providing appropriate preventive health care within this safety net health system.

Our findings also suggest missed opportunities to address tobacco use in smokers undergoing treatment for addiction who were not more likely to have received advice to quit smoking than individuals who did not engage in addiction treatment. Despite research supporting the simultaneous treatment of tobacco and substance use disorders (Sussman, 2002; Clinical Practice Guideline Treating Tobacco Use and Dependence Update Panel et al., 2008; Baca and Yahne, 2009) and evidence-based practice guidelines for tobacco cessation that can be integrated into SUD treatment programs (i.e. ask, advice, assess, assist, and arrange (Fiore et al., 2008)), adoption and implementation in these settings remains low (Currie et al., 2003; Friedmann et al., 2008; Knudsen et al., 2012; Knudsen, 2017). Barriers to implementation include federal, state, and organizational policies, leadership authority, and financial resources (Hunt et al., 2013; Knudsen, 2017). However, HRSA recently lowered many of these barriers by making SUD treatment an administrative priority and granting significant funding for SUD treatment. Our findings suggest the need to develop tobacco treatment programs in these health centers that address the unique treatment needs of smokers with AUD and DUD, as well as ongoing efforts to integrate tobacco treatment into addiction programs.

4.1. Limitations

There are several limitations to our study. All measures were based on self-report and therefore subject to recall and social desirability biases. The WHO ASSIST includes only 5 of 11 criteria for AUD and DUD and focuses only on the past 3 months, introducing the possibility of misclassification of AUD or DUD status for some participants. To the

extent that individuals with AUD or DUD may have been included in the non-AUD or DUD groups, any misclassification should bias our results towards the null.

As mentioned in the methods section, we evaluated AUD and DUD separately due to *a priori* knowledge that individuals with AUD are distinct from those with DUD. This was supported in our data with respect to age, income, insurance status, medical and mental health comorbidities, site of care, and various smoking-related characteristics.

However, there was overlap in the exposure groups as some patients had both AUD and DUD. We accounted for this by controlling for both AUD and DUD in the multivariable models and by creating an interaction term between AUD and DUD to evaluate for effect measure modification. Finally, although our multivariable analyses controlled for a wide range of characteristics potentially associated with AUD and DUD and smoking-related behaviors, the observational nature of the study introduces the possibility of unmeasured confounding.

5. Conclusion

In a large nationally representative survey of U.S. safety-net health center patients, participants with AUD and DUD were likely to be current smokers and unlikely to have quit smoking, consistent with prior research. While smokers with AUD were more likely to want to quit, they were not more likely to take measurable steps towards quitting and were less likely to have successfully quit than those without AUD. DUD was not significantly associated with any of the smoking-related quit behaviors. These findings support the need for new approaches to tobacco cessation in patients with AUD and DUD, which may differ depending on the substances used. Additionally, we identified missed opportunities to provide tobacco use treatment to patients receiving addiction treatment, as recommended by current clinical practice guidelines. Improving access to tobacco treatment for individuals with SUDs in safety-net health centers is critical to prevent tobacco-related morbidity and mortality in some of our country's most vulnerable populations.

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Contributors

Dr. Fine made substantial contributions to the conception and design of the study, the acquisition, analysis, and interpretation of the data, and the drafting of the manuscript. Dr. Bearnot made substantial contributions to the analysis of the data and made critical revisions to the manuscript for important intellectual content. Dr. Rigotti made substantial contributions to the design of the study and made critical revisions to the manuscript for important intellectual content. Dr. Baggett made substantial contributions to the conception and design of the study, the analysis and interpretation of the data, and made critical revisions to the manuscript for important intellectual content. All authors approved the final version of this manuscript and agree to be accountable for all aspects of the work.

Appendix A. Supplementary data

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