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Tobacco Smoking, Substance Use, and Mental Health Symptoms in People with HIV in an Urban HIV Clinic

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Abstract

The prevalence of tobacco smoking among people with HIV (PWH) ranges from 40% to 70%. Additionally, tobacco smoking is higher among low-income individuals, yet few studies have examined tobacco smoking in low socioeconomic status PWH. Using data from a cohort of PWH receiving care in an urban HIV clinic, we characterized factors associated with current and former smoking and with initiation/re-initiation and cessation of tobacco use. Among a study sample of 1,607 PWH, the prevalence of current smoking was 46.6% among men and 46.0% among women. Current smoking in men and women was associated with Medicaid insurance status, substance use, and panic symptoms. In women, but not men, hazardous alcohol use decreased the likelihood of quitting smoking and increased the risk of initiation/re-initiation. Smoking interventions for low-income, urban PWH may need to be tailored to address mental health and substance use comorbidities.

Keywords

Tobacco smoking; urban health; mental health; substance-related disorders; HIV; vulnerable populations

INTRODUCTION

The prevalence of tobacco smoking among people with HIV (PWH) ranges from 40% to 70% in the U.S., compared with a prevalence in the U.S. general population of around

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15.5%.^{1–8} Despite this increased rate of smoking, PWH are about 20% less likely to quit smoking than other U.S. adults.¹ With antiretroviral therapy (ART) resulting in durable viral suppression and improved long-term survival, smoking-related illnesses account for a significant proportion of the excess morbidity and mortality among PWH. There is a higher prevalence of chronic obstructive pulmonary disease (COPD) and respiratory symptoms among PWH compared with other individuals matched by age and sex.⁹ Smoking also significantly increases the risk of developing non-AIDS-defining malignancies in PWH on antiretroviral therapy (ART).^{10,11} For example, the risk of developing lung cancer is two- to four-times higher in PWH than in the general population, even when adjusting for smoking intensity and duration, and after cessation of tobacco use, lung cancer incidence remains elevated for up to five years.^{12,13} Among individuals engaged in care in Europe and North America, PWH who smoke tobacco lost more life-years to smoking than to HIV.^{14–16}

In the U.S. general population and among PWH, smoking prevalence is higher among low-income and socially disadvantaged groups than others.^{1,5,7,17,18} Tobacco smoking among PWH is significantly associated with less education, homelessness, incarceration, and poverty.¹ Substance use and mental health comorbidities also contribute to these differences in smoking prevalence among PWH.¹⁹

While these associations have been found in general PWH populations, few studies have examined correlates of smoking in low-income or minority PWH.^{7,20–22} Both HIV and tobacco use disproportionately affect vulnerable populations, so studies investigating tobacco use in these groups are needed.^{18,23} Additionally, in contrast to the U.S. general population—in which tobacco smoking is higher among men—the prevalence is similar among men and women with HIV.²⁴

In addition to the need to focus on correlates of smoking among low-income or minority PWH, potential sex differences should be studied. For example, tobacco marketing has increasingly focused on women.^{25,26} Previous research has identified other sex differences in tobacco smoking cessation related to factors such as pregnancy, fear of weight gain, and depression.²⁵ However, to date, sex-specific associations of tobacco use in female PWH have not been examined thoroughly.²⁷

The co-occurrence of HIV infection, substance use, and smoking is consistent with the theory of syndemics, in which it is hypothesized that health conditions co-occur due to shared social factors.²⁸ The co-occurrence of these factors in a low-income population presents an additional challenge because they may interact in ways that worsen the health status of an already overburdened population.

Due to the high prevalence of tobacco smoking, the relatively low rates of cessation among low-income PWH, and the association of tobacco smoking with excess morbidity and mortality among PWH, it is essential to develop cessation interventions that are tailored for low-income and minority PWH.^{17,29} Ideally, these interventions would also account for sex differences in initiation/re-initiation and cessation of tobacco use. In order for these interventions to be developed, a better understanding of associations with current and former tobacco smoking in low-income and minority PWH must be identified and stratified by sex.

We sought to determine among men and women separately: 1) factors associated with current and former tobacco smoking among PWH in an urban clinic providing care to primarily low-socioeconomic status (SES) individuals; and 2) characteristics associated with tobacco smoking cessation and initiation/re-initiation of tobacco use. We hypothesized that smoking prevalence would be associated with a higher prevalence of other substance use and mental health symptoms. In addition, we hypothesized that these co-morbid conditions would be associated with decreased likelihood of tobacco smoking cessation, and increased likelihood of initiation/re-initiation of tobacco use.

METHODS

Study design.

This is a prospective cohort study from the Johns Hopkins HIV Clinical Cohort (JHHCC), a longitudinal cohort of adult patients (≥ 18 years old) receiving care from the Johns Hopkins HIV Clinic in Baltimore, Maryland. All individuals entering into care in the clinic are eligible to participate in the cohort. Demographic, clinical, laboratory, and pharmacy data are abstracted electronically from the medical record and from laboratory data at six-month intervals by trained staff. A detailed description of the data collection procedures of the JHHCC is available elsewhere.³⁰ In addition to medical and laboratory data collection, the JHHCC also collects patient-reported behaviors and symptoms at approximately six-month intervals using a tablet-based computer-assisted self-interview (CASI). Items captured on CASI include self-reported tobacco cigarette use; alcohol, opioid, cocaine, marijuana, and other drug use; symptoms of depression and anxiety; and medication adherence. The survey takes approximately 15 minutes to complete. Written informed consent is obtained from the participants.

Study population.

In this study, we included all individuals enrolled in the JHHCC who completed a CASI between September 2013 and June 2016. While there were no exclusion criteria for participants, we included only observations where there was complete data. During this time period, 1,607 PWH participated in 4,609 CASI assessments. There was complete data for 1,413 individuals who completed 3,726 CASIs (median number of records contributed per individual = 2). There was no significant difference between included and excluded participants with respect to age, sex, race, insurance status, or smoking status.

Outcome description.

Our primary independent outcome of interest was tobacco smoking status. This was assessed by the CASI with the two following questions: (1) have you smoked more than 20 cigarettes in your lifetime? and (2) do you currently smoke cigarettes? We classified individuals' smoking status as *never* if they reported having never smoked at least 20 cigarettes in their lifetime. Individuals that reported having smoked at least 20 cigarettes in their lifetime were subsequently classified as *current* if they reported currently smoking cigarettes. We classified individuals as *former* if they reported having ever smoked more than 20 cigarettes but were not smoking them currently. We classified 176 individuals who reported never smoking but reported smoking on a previous CASI as *former*. For the longitudinal analysis,

we defined cessation of tobacco use when an individual reported formerly smoking after having reported currently smoking in a previous assessment. We defined initiation/re-initiation of tobacco smoking if an individual reported current smoking, but had reported never or former smoking in a previous assessment.

Independent variables.

Demographic variables.—Age, sex, race, and insurance were obtained from clinical records. Age was categorized as 30 years old or younger, 31–40, 41–50 and 51 years old or older. Race was categorized as Black or other (given low sample size of all other racial categories). Insurance was categorized as Medicaid, Medicare, privately insured, or uninsured.

Clinical variables.—Antiretroviral therapy (ART) was determined from clinical records, and adherence was determined using a visual analog scale.³¹ Individuals were categorized as: not on ART, on ART but not adherent (visual analog scale <90), on ART and adherent (visual analog scale ≥ 90).³¹ The CD4 cell counts, previously measured by flow cytometry from study participants' blood samples, were obtained from laboratory files and categorized as less than 350 cells/ml, 350–500 cells/ml and above 500 cells/ml.

Substance use variables.—Marijuana use and other drug use (any of heroin/cocaine/amphetamines/prescription opioids for non-medical use) were assessed via the CASI using the National Institute on Drug Abuse Modified ASSIST (NIDA ASSIST).³² We classified individuals as having *never*, *current*, or *former* (past use, but no use in the prior three months) use of marijuana or heroin/cocaine/amphetamine/prescription opioids. We pooled all other illicit drugs to avoid sample size concerns. We assessed alcohol use using Alcohol Use Disorders Identification Test (AUDIT-C), and created the categories of *none* (score of 0), *moderate* (score of 1 to 3 in women and 1 to 4 in men), and *hazardous* (score above 3 for women and above 4 for men) based on their AUDIT-C score and sex.^{33,34}

Mental health variables.—We classified individuals' mental health symptoms as follows: *depressive* if they scored 10 or more on the Patient Health Questionnaire-8,³⁵ *generalized anxiety* if they scored 10 or more on the Generalized Anxiety Disorders Screen,³⁶ and *panic* if the individual answered yes to the first and fifth questions ("Over the last two weeks, how often have you been bothered by the following problems? 1. Feeling nervous, anxious, or on edge. 5. Being so restless that it is hard to sit still") and had an affirmative response to at least one of the remaining three questions on the panic module of the Patient Health Questionnaire.^{37,38}

Medical disease variables.—Diagnoses of asthma, COPD, cardiovascular diseases, and cardiovascular risk factors (dyslipidemia, hypertension, and diabetes) were abstracted from medical records if they occurred prior to the initial date of the first included CASI.

Statistical methods.

Descriptive statistics were calculated for the entire cohort and by category of smoking, stratified by sex. We then examined the association between clinical and sociodemographic

covariates and the prevalence of current or former smoking with three sets of logistic regression models: 1) current smoking vs. never smoking (excluding former use); 2) former smoking vs. never smoking (excluding current use); and 3) current smoking vs. former smoking (excluding never use).

We assessed the association between clinical and sociodemographic covariates and the incidence of tobacco smoking initiation/re-initiation or cessation using Poisson regression. For initiation/re-initiation, we started with all individuals with never or former smoking and modelled the incidence rate of current smoking with the natural logarithm of the follow-up time in years (from first CASI) as the offset. For cessation, we started with individuals with current smoking and modelled the incidence rate of former smoking with the natural logarithm of the follow-up time in years (from first CASI) as the offset.

All models were adjusted by age, race, and insurance status; stratified by sex; and included (in separate models) each of the other clinical and sociodemographic covariates. We also ran fully adjusted multivariate models (see Appendix, available from the authors upon request). Because patients could contribute more than one CASI to the analysis, we used generalized estimating equations (GEE) with an exchangeable correlation structure and robust standard errors to account for multiple measurements on participants.³⁹

We do not report p-values in order to prevent “p-hacking” and as our goal is not to test hypotheses but rather to report point estimates and levels of precision by the confidence interval.⁴⁰ The data were analyzed using R Environment for Statistical Computing v3.3,⁴¹ with package “geepack” for the GEE analysis.⁴²

The Johns Hopkins University School of Medicine’s Institutional Review Board reviewed and approved this study.

RESULTS

Study sample.

Lifetime prevalence of smoking was 65.2% for men and 59.6% for women. The prevalence of current smoking was 46.6% among men and was 46.0% among women. Table 1 describes demographic, behavioral, and psychosocial characteristics and medical comorbidities by category of smoking status at first CASI, stratified by sex. Among both men and women, insurance status and the prevalence of marijuana and other drug use differed by smoking status, with those with current smoking more likely to have Medicaid and less likely to have private insurance and more likely to have other drug use, including alcohol and marijuana. The prevalence of mental health symptoms generally and COPD was also higher among those with current smoking.

Factors associated with smoking status.

Table 2 shows clinical and sociodemographic factors associated with smoking status over the duration of the study, adjusted for age, race, and insurance status.

In both men and women, current and former drug use, marijuana use, and hazardous alcohol use were positively correlated with current smoking. Panic symptoms were also positively associated with current smoking in men and women, while depressive and anxiety symptoms were positively associated with current smoking in men only. Men and women with private insurance had lower odds of currently smoking (versus both never and formerly smoking) compared with those with Medicaid. In both men and women, increasing age was associated with lower odds of current smoking compared to former smoking. Men with cardiovascular disease (CVD) risk factors also had lower odds of currently smoking compared to formerly smoking.

Factors associated with tobacco smoking cessation and initiation/re-initiation.

Table 3 shows the incidence rate ratio (IRR) of cessation in patients currently smoking and of initiation/re-initiation in individuals who never or formerly smoked. The incidence rate of tobacco smoking cessation was 68.0 and 80.2 per 1,000 person-years of follow-up in men and women, respectively. The incidence rate of initiation/re-initiation was 65.3 and 79.2 per 1,000 person-years of follow-up in men and women, respectively.

None of the sociodemographic or clinical characteristics measured in this study were associated with smoking cessation among men, after adjusting for age, sex, race and insurance status. However, substance use was weakly associated with a lower likelihood of cessation, while an increased number of CVD risk factors was associated with an increased likelihood of cessation. In the multivariate analysis, women with hazardous alcohol use had a lower likelihood of cessation, while those with a history of asthma had a higher likelihood of cessation.

Black women had decreased likelihood of smoking initiation/re-initiation compared with the other race category. There was an increase in the likelihood of initiation/re-initiation of tobacco use among uninsured men when compared with individuals with Medicaid in this model. Men with Medicare and men and women with private insurance had a lower risk of initiation/re-initiation compared with Medicaid patients. There was an increased risk of initiation/re-initiation among women with hazardous alcohol use, but this association was not present in the multivariate analysis. In men and women, current marijuana use and both current and former drug use had a higher risk of initiation/re-initiation. Men with asthma had an increased risk of smoking initiation/re-initiation, while women with COPD had a higher likelihood of initiation/re-initiation.

DISCUSSION

In this study of PWH from an urban, low SES clinic setting, the prevalence of current smoking was 46.4% with a lifetime prevalence of 63.2%, which is consistent with previously described data in comparable populations of PWH and is much higher than the prevalence of smoking in the U.S. general population.^{1,5,7} There was a similar prevalence of current smoking in both men and women PWH (46.6% and 46.0%, respectively). Current smoking was associated with Medicaid insurance status, current substance use, and comorbid panic symptoms in both men and women, while depressive symptoms were associated with current smoking only in men. Among men, none of the measured factors were associated with

cessation of tobacco use, but drug use and Medicaid insurance status increased the risk of initiation/re-initiation. Among women, alcohol use decreased the likelihood of quitting, and alcohol use, drug use, and Medicaid insurance status increased the risk of initiation/re-initiation of tobacco use.

The increased prevalence of smoking in PWH of this study sample may in part be explained by the fact that risk factors for HIV and tobacco use, which include social determinants of health such as less education, incarceration, and homelessness, overlap in low-income and marginalized communities.^{1,7,43} Those with Medicaid insurance, a proxy for low SES, had the highest prevalence of current smoking, which is consistent with previous findings that current smoking was associated with low SES.⁷

Substance use is an established risk factor for tobacco use.^{19,22,44} Patients with substance use disorders have been shown to have tobacco use rates two to four times higher than those of the general population.²¹ A relationship between alcohol consumption and smoking has also been demonstrated in PWH and in the general population.^{7,19,22,45} Substance use, including marijuana, other drugs, and alcohol, was increased in both men and women with tobacco smoking in this study. The association between hazardous alcohol use and tobacco use among women in our study was not seen in a previous study comparing sex differences in a similar population (majority Black PWH in an urban setting).⁴⁶ In our study, hazardous alcohol use increased the odds of currently or formerly smoking compared to never smoking among both men and women. Notably, hazardous alcohol use was associated with a decreased risk of cessation of tobacco use and increased risk of initiation/re-initiation in women. Tobacco smoking and alcohol use frequently co-occur and can enhance one another's effects.⁴⁷ As a result, it is important to address alcohol use among PWH tobacco users who quit, since alcohol use could serve as a trigger for smoking.

Psychiatric comorbidities, including depression, anxiety, panic symptoms, and emotional distress, are often associated with tobacco smoking among low SES PWH.^{7,19,22,44,48–50} The association between mental health disorders and tobacco use is incompletely understood, but has been attributed to relief of negative symptoms, such as depression or anxiety, and improving concentration and cognition.^{51,52} Additionally, continuation of smoking in individuals with lung disease has been shown to trigger panic symptoms.⁵⁰ In this study, depression increased the odds of currently smoking in men but not in women. Among men and women in this study, panic symptoms also increased the odds of currently smoking. Since low SES is associated with more stressful living situations, and previous studies have suggested that people who smoke tobacco may use smoking as a coping mechanism, the association of smoking with depression and panic symptoms may reflect the living situation and co-morbid mental illness of individuals in this study.¹⁷

In the U.S. general population, more men (17.5%) than women (13.5%) smoke tobacco,² while among PWH, the proportion of men and women who smoke has been shown to be roughly equal in both the National Health Interview Survey and a statewide survey in New York.^{1,2,5} This study showed an equal prevalence of smoking in men and women as well. This similarity in proportion of men and women who smoke tobacco is likely multifactorial. It may be in part due to tobacco marketing targeting low SES women, including minority

women in cities, and the co-occurrence of risk factors for both tobacco use and HIV acquisition.^{26,53}

Overall, understanding factors associated with tobacco smoking in low SES and minority PWH will be important in designing cessation programs. In an effort to develop effective tobacco cessation strategies in PWH, several randomized controlled trials (RCTs) have been completed, and varenicline has been the only treatment that has shown promise for sustained abstinence.^{54–60} Strategies such as motivational interviewing, individual counseling, and stress management have not been shown to increase abstinence rates.^{17,56,58} However, combinations of nicotine replacement therapy or pharmacologic therapy with motivational interviewing show promise in decreasing tobacco use among PWH.^{54,55,60}

The aforementioned RCTs and the current study highlight the need not only to address tobacco, but to treat mental health and substance use disorders concurrently as well. A recent pilot intervention demonstrated the effectiveness of targeting depressive symptoms concurrently with tobacco cessation.⁶¹ Furthermore, meta-analyses of studies addressing mental health or substance use disorders and tobacco use disorder in PWH support the benefit of addressing these issues simultaneously.^{62,63} For example, smoking cessation therapy in women should specifically address hazardous alcohol use as it may decrease cessation and increase initiation/re-initiation based on the association seen in this study. Brief interventions have been shown to be efficacious in decreasing the amount of alcohol consumed by women with HIV.⁶⁴ These interventions could be performed in conjunction with tobacco counseling. Additionally, varenicline, which has been the most promising treatment to promote cessation of tobacco use among PWH, is safe to use in individuals with comorbid mental health disorders.^{54,59,65} As previous research has demonstrated, a complex interplay exists between socioeconomic status, mental health symptoms, substance use, and tobacco smoking, and these interactions perpetuate lower rates of smoking cessation in disadvantaged PWH.^{7,19,21,49} Thus, cessation interventions must integrate medical, behavioral health, and substance use treatment for an effective and tailored strategy.

This study has some limitations. Since the cohort is from an urban, low SES population, there may be limited generalizability to all PWH in the United States. Additionally, these data only represent those patients who have been diagnosed with HIV and are engaged in care. However, this group may be more receptive to cessation messages and interventions since they are already engaged in care. Smoking status was based on self-report, which may result in an underestimation of prevalence and measurement error of cessation and initiation/re-initiation. Only a small percentage of individuals quit or re-initiated smoking during the time period, so the study may have been underpowered to detect factors associated with risk of cessation and initiation/re-initiation. Last, our main analysis only presents the age-, race-, and insurance-adjusted associations. We believe that this analysis represents the clinical reality better than a multivariate model that adjusts for every other factor available, where associations may be harder to interpret. However, we included the fully adjusted multivariate model in an appendix (available from the authors upon request) for transparency.

This study is one of the few to characterize factors associated with tobacco smoking in an urban sample of PWH, and, to the best of our knowledge, one of the few to examine smoking stratified by sex in PWH.⁴⁶ This study supports the need to treat comorbid substance use disorders and mental health in order to promote cessation of tobacco use. In addition, policy changes such as limitations on point-of-sale marketing and display of tobacco products, should be enacted in order to limit marketing towards low SES individuals, and in particular low SES women. In summary, cessation of tobacco use in PWH is a public health priority, and in addition to addressing smoking cessation during clinical visits, novel and innovative methods should be incorporated to address the multiple factors that contribute to tobacco smoking and affect cessation and initiation/re-initiation in low-income PWH communities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Characteristics of participants at their first included visit, by smoking status and gender

	Men			Women		
	Never	Current	Former	Never	Current	Former
N	353	474	189	239	272	80
Median Age [IQR]	40 [33–49]	42 [34–48]	43 [36–50]	40 [32–46]	40 [34–46]	40 [33–48]
Race						
Black	76.5%	83.8%	71.4%	90.0%	87.9%	86.2%
Other	23.50%	16.20%	28.60%	10.00%	12.10%	13.80%
Insurance type						
Medicaid	30.7%	44.2%	28.7%	41.7%	65.7%	35.6%
Medicare	35.6%	41.1%	44.3%	26.9%	23.5%	41.1%
Private	28.2%	11.0%	24.1%	25.9%	7.2%	19.2%
Uninsured	5.5%	3.8%	2.9%	5.6%	3.6%	4.1%
Alcohol use						
None	54.8%	51.2%	55.1%	68.1%	63.0%	57.0%
Moderate	31.2%	30.7%	31.0%	24.4%	16.7%	22.8%
Hazardous	13.9%	18.1%	13.9%	7.6%	20.4%	20.3%
Marijuana use						
Never	63.2%	35.7%	31.7%	73.1%	40.9%	24.1%
Current	11.5%	31.2%	19.4%	9.2%	25.3%	19.0%
Former	25.3%	33.1%	48.9%	17.6%	33.8%	57.0%
Other drug use ^a						
Never	69.4%	30.8%	40.7%	76.1%	33.1%	23.8%
Current	5.4%	22.4%	9.5%	5.5%	22.8%	6.2%
Former	25.2%	46.8%	49.7%	18.5%	44.1%	70.0%
Mental health symptoms						
Depression	3.5%	10.6%	8.2%	9.4%	10.5%	5.1%
GAD	4.9%	9.5%	3.2%	4.7%	7.2%	7.6%
Panic	4.6%	10.6%	8.6%	6.4%	14.5%	8.8%
Medical comorbidities						

	Men			Women		
	Never	Current	Former	Never	Current	Former
Asthma	10.5%	9.5%	7.9%	18.0%	25.7%	25.0%
COPD	2.8%	11.8%	10.6%	3.3%	15.8%	8.8%
CVD	9.1%	11.0%	12.2%	13.8%	10.3%	15.0%
CVD Risk Factors ^b						
None	59.5%	62.9%	52.4%	56.5%	57.7%	60.0%
One	28.0%	27.2%	33.9%	30.1%	30.5%	30.0%
Two	3.4%	4.0%	4.2%	3.8%	5.1%	5.0%
Three	9.1%	5.9%	9.5%	9.6%	6.6%	5.0%

^a Other drugs include: cocaine, heroin, amphetamines, and prescription opioids

^b CVD risk factors defined as: hypertension, hyperlipidemia, and diabetes

GAD: generalized anxiety disorder

COPD: chronic obstructive lung disease

CVD: cardiovascular disease

Table 2.

Factors associated with current or former tobacco smoking^a

	Men			Women		
	Current (vs. Never)	Former (vs. Never)	Current (vs. Former)	Current (vs. Never)	Former (vs. Never)	Current (vs. Former)
Age range						
<=30	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
31-40	0.86 (0.54;1.36)	1.31 (0.76;2.25)	0.59 (0.35;1.00)	1.76 (1.04; 2.96)	1.90 (0.98; 3.71)	1.04 (0.54;2.02)
41-50	1.36 (0.87;2.14)	1.95 (1.13;3.34)	0.66 (0.40;1.08)	1.76 (1.04; 2.99)	1.76 (0.89; 3.46)	1.13 (0.58;2.23)
>=51	0.93 (0.56;1.55)	1.96 (1.09;3.51)	0.44 (0.26;0.76)	1.07 (0.57; 2.02)	2.03 (0.96; 4.32)	0.53 (0.25;1.12)
Black (vs. Other)	1.16 (0.79;1.70)	0.85 (0.57;1.27)	1.57 (1.07;2.30)	1.08 (0.61; 1.91)	1.05 (0.50; 2.21)	0.83 (0.43;1.63)
Insurance type						
Medicaid	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Medicare	0.80 (0.62;1.03)	1.32 (0.92;1.89)	0.70 (0.50;0.98)	0.76 (0.62; 0.93)	0.80 (0.51; 1.25)	0.70 (0.45;1.09)
Private	0.38 (0.26;0.56)	0.95 (0.61;1.47)	0.39 (0.24;0.63)	0.69 (0.57; 0.83)	0.62 (0.42; 0.92)	0.57 (0.31;1.04)
Uninsured	0.53 (0.27;1.04)	1.30 (0.76;2.23)	0.39 (0.17;0.85)	0.78 (0.63; 0.96)	0.69 (0.42; 1.11)	1.14 (0.48;2.72)
Alcohol use						
None	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Moderate	0.97 (0.88;1.06)	1.13 (0.91;1.41)	0.97 (0.80;1.18)	1.01 (0.92; 1.11)	1.22 (0.95; 1.55)	0.98 (0.72;1.34)
Hazardous	1.10 (0.99;1.22)	1.39 (1.00;1.92)	1.13 (0.86;1.48)	1.11 (1.03; 1.20)	1.78 (1.26; 2.52)	1.10 (0.82;1.49)
Marijuana use						
Never	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Current	1.40 (1.20;1.64)	2.08 (1.53;2.83)	1.69 (1.28;2.23)	1.52 (1.15; 2.01)	2.77 (1.87; 4.11)	0.95 (0.66;1.38)
Former	1.17 (1.04;1.31)	2.33 (1.78;3.05)	0.89 (0.75;1.07)	1.22 (1.08; 1.38)	3.29 (2.20; 4.92)	0.76 (0.55;1.06)
Other drug use ^b						
Never	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Current	1.79 (1.46;2.20)	2.87 (1.85;4.47)	1.73 (1.32;2.26)	1.26 (0.94; 1.71)	2.34 (1.14; 4.81)	1.00 (0.62;1.63)
Former	1.45 (1.26;1.68)	3.49 (2.53;4.81)	0.99 (0.82;1.19)	1.25 (0.96; 1.64)	3.02 (2.00; 4.54)	0.71 (0.49;1.05)
Mental Health symptoms ^c						
Depression	1.14 (1.00;1.29)	1.61 (0.99;2.61)	1.19 (0.87;1.63)	0.96 (0.88; 1.05)	1.07 (0.81; 1.43)	0.71 (0.49;1.03)
GAD	1.16 (0.98;1.38)	1.16 (0.56;2.42)	1.20 (0.77;1.88)	1.22 (0.87; 1.70)	1.67 (0.99; 2.83)	1.23 (0.64;2.36)

	Men			Women		
	Current (vs. Never)	Former (vs. Never)	Current (vs. Former)	Current (vs. Never)	Former (vs. Never)	Current (vs. Former)
Panic	1.23 (1.07;1.41)	1.36 (0.88;2.09)	1.17 (0.82;1.67)	1.02 (1.00; 1.05)	1.22 (0.95; 1.55)	1.08 (0.78;1.50)
Medical comorbidities ^c						
Asthma	0.78 (0.47;1.29)	0.93 (0.52;1.67)	0.93 (0.54;1.58)	1.29 (0.82; 2.03)	1.70 (1.02; 2.83)	0.67 (0.41;1.08)
COPD	4.01 (1.97;8.17)	4.41 (2.06;9.47)	1.24 (0.78;1.98)	6.31 (2.86;13.90)	4.49 (1.76;11.49)	1.71 (0.87;3.34)
CVD	0.99 (0.61;1.60)	1.23 (0.73;2.06)	0.91 (0.58;1.42)	0.80 (0.47; 1.37)	0.96 (0.51; 1.79)	0.82 (0.44;1.50)
+ 1 CVD Risk Factor ^d	0.85 (0.71;1.01)	1.11 (0.92;1.33)	0.76 (0.64;0.90)	0.94 (0.76; 1.17)	1.01 (0.78; 1.30)	0.97 (0.75;1.24)

Data represents odds ratio with 95% confidence interval in parentheses.

^aEach model is adjusted for age, race, insurance type, and the corresponding covariate

^bOther drugs include: cocaine, heroin, amphetamines, and prescription opioids

^cThe reference category in these models is the absence of each mental health symptom or medical comorbidities

^dCVD risk factors defined as: hypertension, hyperlipidemia, and diabetes

GAD: generalized anxiety disorder

COPD: chronic obstructive lung disease

CVD: cardiovascular disease

Table 3.Rates of tobacco smoking cessation and re-initiation^a

	Men		Women	
	Cessation	Re-initiation	Cessation	Re-initiation
Age range				
<=30	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
31-40	1.13 (0.46;2.76)	0.791 (0.35;1.78)	0.70 (0.26;1.86)	1.68 (0.69; 4.10)
41-50	1.04 (0.42;2.52)	1.03 (0.49;2.15)	0.58 (0.21;1.57)	1.20 (0.47; 3.04)
>=51	0.74 (0.24;2.06)	0.49 (0.18;1.36)	1.63 (0.56;4.70)	1.08 (0.35;3.30)
Black (vs. Other)	0.86 (0.43;1.73)	0.99 (0.53;1.84)	1.12 (0.33;3.79)	0.42 (0.19; 0.93)
Insurance type				
Medicaid	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Medicare	0.90 (0.52;1.54)	0.54 (0.29;0.96)	0.73 (0.32;1.63)	0.60 (0.31; 1.16)
Private	1.26 (0.42;3.74)	0.09 (0.02;0.38)	2.34 (0.82;6.62)	0.26 (0.09; 0.72)
Uninsured	0.74 (0.09;5.87)	2.56 (1.39;4.73)	0.69 (0.14;3.47)	0.22 (0.05; 1.12)
Alcohol use				
None	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Moderate	0.62 (0.32;1.19)	1.57 (0.95;2.60)	0.53 (0.22;1.30)	1.75 (0.91; 3.38)
Hazardous	0.86 (0.43;1.73)	0.64 (0.23;1.77)	0.24 (0.07;0.87)	2.19 (1.05; 4.58)
Marijuana use				
Never	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Current	0.77 (0.40;1.46)	2.80 (1.43;5.45)	0.45 (0.17;1.19)	4.01 (2.05; 7.87)
Former	0.79 (0.45;1.40)	1.70 (0.94;3.08)	0.79 (0.41;1.53)	2.68 (1.43; 5.03)
Other drug use ^b				
Never	1 (Ref.)	1 (Ref.)	1 (Ref.)	1 (Ref.)
Current	0.63 (0.32;1.24)	2.32 (1.04;5.18)	0.38 (0.11;1.32)	12.85 (5.98;27.64)
Former	0.57 (0.33;1.00)	2.06 (1.20;3.53)	0.65 (0.32;1.30)	5.05 (2.60; 9.83)
Mental Health symptoms ^c				
Depression	0.80 (0.27;2.32)	0.33 (0.05;2.40)	1.19 (0.50;2.83)	1.25 (0.63; 2.50)
GAD	0.54 (0.14;2.16)	1.35 (0.64;2.82)	2.13 (0.94;4.84)	1.65 (0.83; 3.30)
Panic	1.46 (0.61;6.347)	1.10 (0.36;3.43)	0.41 (0.15;1.16)	1.19 (0.61; 2.35)

	Men		Women	
	Cessation	Re-initiation	Cessation	Re-initiation
Medical comorbidities ^c				
Asthma	1.24 (0.55;2.77)	2.37 (1.16;4.81)	1.98 (1.05;3.71)	0.95 (0.50; 1.82)
COPD	1.36 (0.66;2.79)	2.19 (0.93;5.15)	0.87 (0.39;1.96)	3.10 (1.58; 6.09)
CVD	0.97 (0.48;1.97)	1.07 (0.53;2.15)	0.90 (0.39;2.08)	1.05 (0.43; 2.54)
+ 1 CVD Risk Factor ^d	1.26 (0.99;1.60)	1.03 (0.81;1.30)	1.10 (0.78;1.55)	0.83 (0.58; 1.18)

Data represents incident rate ratio with 95% confidence interval in parentheses.

^aEach model is adjusted for age, race, insurance type, and the corresponding covariate

^bOther drugs include: cocaine, heroin, amphetamines, and prescription opioids

^cThe reference category in these models is the absence of each mental health symptom or medical comorbidities

^dCVD risk factors defined as: hypertension, hyperlipidemia, and diabetes

GAD: generalized anxiety disorder

COPD: chronic obstructive lung disease

CVD: cardiovascular disease