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Racial disparities and factors associated with prescription for smoking cessation medications among smokers receiving routine clinical care for HIV

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ABSTRACT

Factors associated with prescription of smoking cessation medication (SCM), including the impact of race, have not been well described among a large population of people living with HIV (PLWH) engaged in routine clinical care. Our study investigated whether there are racial differences between African-American and White PLWH regarding SCM prescription and sought to identify other factors associated with these prescriptions at a large HIV clinic in the Southeastern United States. Among 1899 smokers, 38.8% of those prescribed SCMs were African-American and 61.2% were White. Factors associated with lower odds of SCM prescription included African-American race (AOR, 0.63 [95% CI: 0.47, 0.84]) or transferring care from another HIV provider during the study period (AOR, 0.63 [95% CI: 0.43, 0.91]). Whereas major depression (AOR, 1.54 [95% CI: 1.10, 2.15]), anxiety symptoms (AOR, 1.43 [95% CI: 1.05, 1.94]), and heavy smoking (>20 cigarettes/day) (OR, 3.50 [95% CI: 2.11, 5.98]) were associated with increased likelihood of SCM prescription. There were racial disparities in the prescription of SCM in African Americans with HIV. These findings underscore the need to increase pharmacotherapy use among African Americans to improve smoking cessation outcomes across racial groups among PLWH.

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KEYWORDS
HIV; smoking cessation medication; racial disparities; psychological factors

Introduction

Cigarette smoking cessation among people living with HIV (PLWH) represents an urgent public health priority. Existing evidence indicates that compared to the general population, PLWH are two to three times more likely to be current smokers and significantly less likely to quit (Mdodo et al., 2015; Cooperman, 2016; Zyambo et al., 2015). Since the introduction of combination antiretroviral therapy (cART), life expectancy among PLWH has increased substantially (Katz & Maughan-Brown, 2017; Samji et al., 2013; Teeraananchai et al., 2017); however, there has been an increase in tobacco-related illnesses (Palella et al., 2006; Reddy et al., 2017). PLWH who are smokers have increased risk of cardiovascular diseases, pulmonary diseases, and non-AIDS-related malignancies (Helleberg et al., 2013; Helleberg et al., 2015; Shirley et al., 2013), a shorter lifespan by 6–15 years (Helleberg et al., 2013; Reddy et al., 2016), and are more likely to have an unsuppressed HIV viral load and lower CD4 counts (Hile et al., 2016; Valiathan et al., 2014; Wojna et al., 2007) than PLWH who are non-smokers.

African Americans account for a higher proportion of new HIV diagnoses (44% in 2016) and a higher proportion of those ever diagnosed with AIDS compared to Whites (CDC, 2018). Despite African-American adults in the general population having a lower prevalence of smoking (CDC; Mdodo et al., 2015), they experience a disproportionate burden of tobacco-related illnesses compared to Whites (Jemal et al., 2008; U.S. Department of Health and Human Services, 1998) and are less likely to quit (King et al., 2004; Lawrence et al., 2003; Trinidad et al., 2005). Although studies support the effectiveness of smoking cessation medications (SCMs; i.e., bupropion sustained-release [SR], varenicline, and nicotine replacement therapy [NRT]) (Ebbert et al., 2010; Hurt et al., 2009; Robles et al., 2008), there is substantial evidence showing African Americans underutilize SCMs compared to Whites (Nollen et al., 2013; Shiffman et al., 2008; Trinidad et al., 2011).

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Factors associated with prescription of SCMs in PLWH and in the general population, including racial differences are well documented (Nollen et al., 2013; Robles et al., 2008; Shiffman et al., 2008; Tesoriero et al., 2010; Trinidad et al., 2011; Vijayaraghavan et al., 2017), but are based on small observational studies, clinical trials and systematic review of the literature and not on experience in routine clinical care settings. Thus, the current study investigated whether there are differences in SCM prescription between African Americans and Whites and sought to identify factors associated with these prescriptions as part of routine clinical care in a large HIV clinic cohort in the Southeastern United States (US). The findings from this study may provide insight into the optimal design of targeted smoking cessation interventions among PLWH.

Methods

Study design and setting

This cross-sectional study was conducted within the University of Alabama at Birmingham (UAB) 1917 HIV/AIDS Clinic cohort, a longitudinal HIV observational cohort established in 1992. The cohort database contains detailed sociodemographic, clinical, and psychological information on >6000 PLWH who have received primary HIV care and subspecialty care at the UAB 1917 HIV Clinic. The clinic formerly used a locally developed electronic medical record (EMR), but since 2011 has used a commercial (Cerner Impact®) EMR for care provision. Patients receive care from a team comprised of an attending infectious diseases (ID) physician working with an ID fellow or nurse practitioner (NP). Currently, there are 18 ID physicians, 6 NPs, and 8 ID fellows serving as HIV providers at the clinic. Both the UAB 1917 Clinic and the previous local EMR have been described in detail elsewhere (Burkholder et al., 2012; Chen et al., 2003). The UAB institutional review board approved this study.

Eligibility criteria

All PLWH aged ≥19 years who ever smoked, attended the outpatient HIV clinic between April 2008 and April 2017, and completed at least one self-administered survey on tobacco use during the study period were eligible. The index visit in this study was defined as the most recent patient visit between April 2008 and April 2017. We excluded 2.1% (39) people of a race other than White or African-American due to low sample size. A total of 1, 899 PLWH who ever smoked during the study period were included in the final analyses.

Data sources

Sociodemographic data, medications, comorbidities, laboratory results, and visit information were obtained by query of the EMR and administrative databases using MS SQL Server 2008. The UAB 1917 HIV Clinic uses a patient-reported outcome (PRO) system to capture behavioral and psychological information from PLWH receiving care (Kozak et al., 2012). The system employs standardized, validated questionnaires that are self-administered every 4–6 months during patient visits via a touch screen computer. Smoking status is assessed with a tobacco use questionnaire. The PRO system also assesses patients for depression with the Patient Health Questionnaire-9 (PHQ-9), alcohol risk through the Alcohol Use Disorder Identification Test (AUDIT-C), anxiety through the PHQ-Anxiety test, substance abuse through the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST), and ART adherence through the Adult AIDS Clinical Trials Group (AACTG) adherence instrument (Kozak et al., 2012).

Primary outcome

The primary outcome was SCM prescription, defined as the presence of bupropion, varenicline, or NRT on a patient's medication list at the index visit.

Independent variables

Sociodemographic variables included age, gender/sexual orientation (men who have sex with men [MSM], heterosexual men, and women), and race/ethnicity (White and African-American). Clinical variables included duration of care at the HIV clinic, health insurance status (private, public and uninsured), care status (transferring care from another clinic, re-engaging in care after an absence of >12 months, newly diagnosed with HIV/new to HIV care and established in care at the clinic), ART adherence (non-adherence was defined as missing ≥1 dose over the previous 7 days), history of respiratory diseases (asthma, chronic obstructive pulmonary disease [COPD], and bacterial pneumonia), history of metabolic diseases (diabetes and dyslipidemia), history of cardiovascular diseases (stroke, myocardial infarction, coronary heart disease [CHD], and hypertension), history of any cancers and laboratory values (most recent CD4 count and plasma HIV-1 RNA [viral load; VL]). A history of comorbidity was defined as ever being diagnosed with the particular comorbidity on or prior to the index visit. Psychological factors included anxiety (symptoms of anxiety or panic syndrome based on PHQ-Anxiety score) and major depression (major depressive symptoms defined as PHQ-9 ≥ 10). Behavioral variables

included alcohol use (at risk use was defined as an AUDIT-C score ≥5 in men and ≥ 4 in women), substance use per the ASSIST (defined as current use of street opioids, prescription opioids, marijuana, crack/cocaine, amphetamines, sedatives, inhalants, and hallucinogens) and cigarette consumption categorized as light (<10/day), moderate (10-20/day) or heavy (>20/day). For time varying co-variates, the value closest to the index visit was used.

Statistical analyses

Characteristics of smokers were calculated for the overall population and stratified by prescription of SCM or not. Among smokers prescribed SCMs, the proportion prescribed each type of SCM was calculated, overall and stratified by race. Continuous variables were reported as means (standard deviation [SD]), and categorical variables were reported as frequencies with percentages.

Using logistic regression, univariate and multivariable analyses were conducted to calculate unadjusted and adjusted odds ratios (ORs) and corresponding 95% confidence intervals (CIs) for the association between the independent variables and the outcome of prescription of SCM. Clinically relevant variables were predetermined and included in the full model regardless of the univariate statistical significance (age, CD4 count (cells/μL) and plasma HIV-1 RNA), (copies/mL) with additional variables included based on univariate statistical significance ($p < 0.05$) (gender/sexual orientation, race/ethnicity, duration of care, non-adherent to ART, health insurance, care status, comorbidities, major depression, anxiety symptoms, substance use and cigarette consumption). We performed an additional analysis to investigate the interaction between race and depression and anxiety respectively. Statistical significance was set at $p < 0.05$ (two-tailed test). Analyses were performed using IBM SPSS Statistics for Windows, version 24.0 (IBM Corp., Armonk, N.Y., USA).

Results

Descriptive statistics

Among 1899 PLWH who were smokers included in the study, the mean age (SD) was 47.3 (11.5) years. The overall population was 52.1% African-American and predominantly men (81.2%) (Table 1). Most of the patients were insured (public insurance 34.8%, private insurance 41.9%, and uninsured 21.1%). Plasma HIV-1 RNA was suppressed (<200 copies/mL) in 80.5% of the patients, and CD4 cell count was ≥200 cells/μL in 88.9% of the patients. In terms of comorbidities, 13.0% had history of cardiovascular diseases, 18.3% respiratory diseases, 12.4% metabolic diseases, and 5.3% any type of cancer. Major depressive symptoms and anxiety symptoms were present in 24.7% and 29.4% of patients, respectively. At risk alcohol use (32.4%) and current substance use (43.7%) were common. A majority of patients (80%) were heavy smokers (>20/day).

SCMs were prescribed to 31.4% of PLWH; of these, 38.8% were African-American and 61.2% were White. When SCMs were stratified by type of medication, 56.2% were prescribed bupropion, 31.0% varenicline, and 12.8% NRT. A lower proportion of African Americans were prescribed each type of SCM than Whites (Figure 1).

Factors associated with smoking cessation prescription

In univariate analysis, age, MSM, a longer duration of care, suppressed plasma HIV-1 RNA (<200 copies/mL), CD4 cell count ≥200 cells/μL, health insurance, major depression, anxiety symptoms and heavy smoking (>20/day) were associated significantly with increased odds of SCM prescription, whereas heterosexual male status, African-American race, newly diagnosed/new to care, transferring care, having a history of cardiovascular, respiratory or metabolic diseases and prior substance abuse were associated with decreased odds of SCM prescription (Table 2).

In multivariable analysis, factors associated with lower odds of SCM prescription included African-American race (OR, 0.63 [95% CI: 0.47, 0.84]) or transferring care from another HIV provider during the study period (OR, 0.63 [95% CI: 0.43, 0.91]). Whereas major depression (OR, 1.54 [95% CI: 1.10, 2.15]), anxiety symptoms (OR, 1.43 [95% CI: 1.05, 1.94]), and heavy smoking (>20 cigarettes/day) (OR, 3.50 [95% CI: 2.11, 5.98]) were associated with increased likelihood of SCM prescription. There was no interaction between race and depression or anxiety (p-value 0.84 and 0.69 respectively).

Discussion

In the current study of PLWH receiving routine clinical care only 31.2% of smokers were prescribed SCMs despite strong evidence for their effectiveness (Houston et al., 2005; Tesoriero et al., 2010; Vijayaraghavan et al., 2017) and smoking being a major risk for morbidity and mortality among PLWH (Helleberg et al., 2013; Helleberg et al., 2015; Shirley et al., 2013). African Americans were less likely to be prescribed SCMs compared to Whites, even after adjustment for a number of

Table 1. The characteristics of HIV-positive smokers receiving care at the UAB 1917 HIV/AIDS Clinic between April 2008 and April 2017 according to prescriptions for smoking cessation medications.

	Overall *N* (1899)	Smoking medication (Yes = 596)	Smoking medication (No = 1303)
Socio-demographic	***N* (%)[a]**	***n* (%)[a]**	***n* (%)[a]**
Age (years), mean (SD)	47.3 (11.5)	47.9 (10.6)	47.4 (11.9)
Gender/sexual orientation			
Women	345 (18.8)	102 (17.4)	243 (19.4)
Men (heterosexual)	333 (18.1)	75 (12.8)	258 (20.6)
MSM	1162 (63.2)	410 (69.8)	752 (60.0)
Race/ethnicity			
White	892 (47.9)	359 (61.2)	533 (41.9)
African-American	968 (52.1)	228 (38.8)	740 (58.1)
Clinical/medical			
Duration of care, years, mean (SD)	7.92 (5.08)	8.91 (5.11)	7.47 (5.0)
Non-adherent to ART	270 (16.2)	69 (12.5)	201 (18.0)
Health insurance			
Uninsured	400 (21.1)	104 (17.4)	336 (25.9)
Public	658 (34.8)	201 (33.7)	457 (35.3)
Private	794 (41.9)	291 (48.8)	503 (38.8)
Care status			
Established in care	1285 (67.7)	456 (76.5)	829 (63.6)
Newly diagnosed/new to care	87 (4.6)	15 (2.5)	72 (5.5)
Re-engaging in care	69 (3.6)	17 (2.9)	52 (4.0)
Transferring care	458 (24.1)	108 (18.1)	350 (26.9)
Comorbidities‡			
Cardiovascular	247 (13.0)	94 (15.8)	153 (11.7)
Respiratory	347 (18.3)	138 (23.2)	209 (16.0)
Metabolic	235 (12.4)	99 (16.6)	136 (10.4)
Cancer	101(5.32)	42 (7.0)	59 (4.5)
Laboratory parameters*			
Plasma HIV-1 RNA <200 copies/mL	1527 (80.5)	494 (88.2)	925 (77.0)
CD4 count (cells/μL)			
<200	210 (11.1)	38 (6.4)	172 (13.2)
≥200	1686 (88.9)	557 (93.6)	1129 (86.8)
Behavioral and psychological variables			
Major depression	462 (24.7)	176 (29.8)	286 (22.3)
Anxiety symptoms	544 (29.4)	204 (35.2)	340 (26.7)
Substance abuse§			
Never	590 (41.4)	200 (41.1)	390 (41.6)
Prior	212 (14.9)	52 (10.7)	160 (17.1)
Current	622 (43.7)	235 (48.3)	387 (41.3)
Alcohol abuse			
Not at risk	1225 (67.6)	382 (66.7)	843 (68.1)
At risk	586 (32.4)	191(33.3)	395 (31.9)
Cigarette consumption			
Light smoker (<10/day)	182 (9.90)	30 (5.1)	152 (12.2)
Moderate smoker (10–20/day)	185 (10.1)	25 (4.3)	160 (12.8)
Heavy smoker (>20/day)	1468 (80.0)	530 (90.6)	938 (75.0)

Abbreviations: ART, antiretroviral therapy; HIV, human immunodeficiency virus;MSM, men who have sex with men; SD, standard deviation, UAB; University of Alabama at Birmingham.

‡Comorbidities: respiratory (asthma, chronic obstructive pulmonary disease, and bacterial pneumonia); metabolic (diabetes and dyslipidemia); cardiovascular (stroke, myocardial infarction, coronary artery disease, and hypertension).Missing data: Race, 2.1%; gender/sexual orientation, 3.1%; insurance, 0.4%; adherence, 0.6%; viral load, 0.1%; CD4 count, 0.2%; depression (PHQ-9), 1.9%; anxiety (PHQ-A), 2.4%; substance abuse (ASSIST), 25%; alcohol abuse, 4.6%

[a]Column percentages; ‡Yes to history of comorbidities; *Most recent lab value at the time of the index visit; §Substance abuse includes street opioids, prescription opioids, marijuana, crack/cocaine, amphetamines, sedatives, inhalants, and hallucinogens.

All variables were significant at the $p<0.05$ level except for alcohol abuse and age.

sociodemographic, clinical, psychological, and behavioral factors, consistent with studies in the general population (King et al., 2004; Lawrence et al., 2003; Trinidad et al., 2011). These results emphasize the need to increase pharmacotherapy use among African-American PLWH to improve smoking cessation rates. Efforts to reduce smoking-related complications among African-American PLWH are especially important given their excess all-cause mortality compared to Whites.

The proportion of smokers prescribed SCMs in our study was lower than that reported by Tesoriero et al. (41.2% of 631 HIV-positive smokers in care in New York recommended or receiving SCMs) (Tesoriero et al., 2010) but higher than reported by Vijayaraghavan et al (6.5% of 462 HIV-positive smokers in San Francisco, California prescribed SCMs at their last clinic visit). (Vijayaraghavan et al., 2017). Vijayaraghavan et al. reported that compared to the general population, PLWH receiving routine clinical care for HIV were less likely to report being asked, advised, or assessed for smoking cessation (Vijayaraghavan et al., 2017), as providers may have less time to address smoking

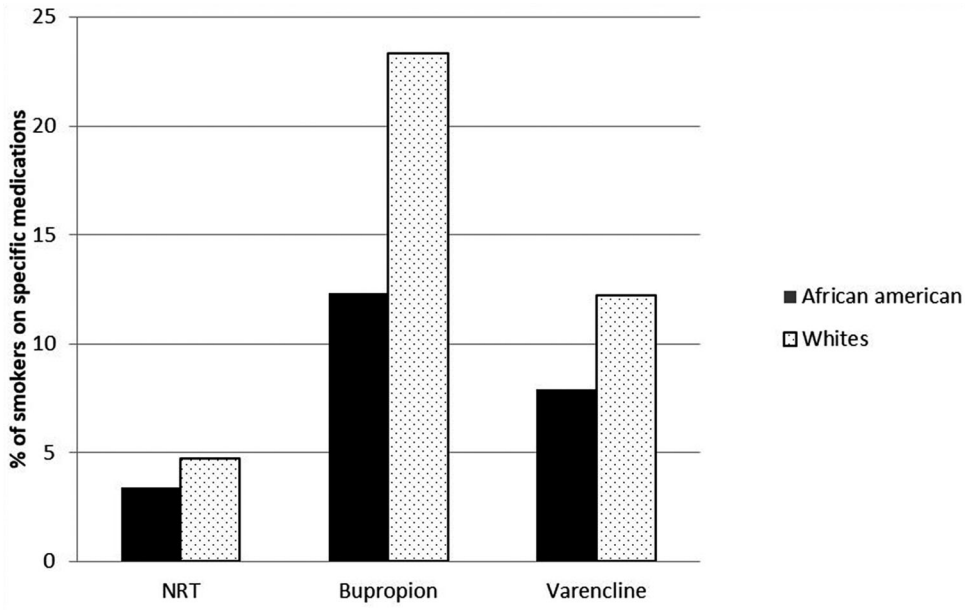

Figure 1. Racial differences in prescriptions for smoking cessation medications in PLWH ($N = 596$) receiving routine clinical care at the 1917 HIV Clinic at the University of Alabama at Birmingham.

cessation due to the high burden of comorbidities and mental illness among PLWH. There is a paucity of information on SCMs prescribed to PLWH on a national level. However, a previous study (Shiffman et al., 2008) reported that 32.2% of smokers in the general US population had ever been prescribed SCMs, which is not substantially different from the 31.2% found in our study. In the current study, only 12.8% of patients prescribed SCMs received NRT, which may be due to patients purchasing these drugs over the counter as NRT is often not covered by insurance.

Although 52.1% of smokers in our study were African-American, they only composed 38.8% of patients prescribed SCMs. When we stratified the SCM by type of medication (NRT, bupropion, and varenicline), the proportions of African Americans who were prescribed each of these medications were lower than those of Whites.

The racial disparity in SCM prescription we observed needs to be interpreted with the qualification that we were unable to control for socioeconomic status (SES) and hence unable to comment on how much of the racial disparity is driven by differences in SES. A higher percentage of African Americans live below the federal poverty level (26% versus 10% of Whites) and a lower proportion complete high school (22% versus 36% of Whites) (DeNavas-Walt C, 2015; Division, US. C.B.P). Such differences may lead to socioeconomic barriers to healthcare and reduced access to preventive care services and medications. High poverty and lower literacy levels may also contribute to higher rates of comorbidities, polysubstance abuse, and psychological illness compared to Whites (Burkhalter, Springer, Chhabra, Ostroff, & Rapkin, 2005; Daza et al., 2006), which may affect patient-physician relationships and the ability of the healthcare provider to focus on preventive care such as smoking cessation.

The racial disparity in SCM prescription is analogous to racial disparities in both HIV and co-morbidity care among PLWH (Richardson et al., 2016). The factors resulting in lower prescription of SCMs among African-American PLWH and in the general population are not well-studied. SCM may be less acceptable to these individuals or there may be unique barriers to accessing these drugs. Another factor which bears investigation is cultural competency, which refers to how effectively a provider can interact with a patient of another cultural background. A study conducted by Paez et al in Baltimore, Maryland demonstrated that patients of providers with greater cultural competencies are more likely to seek and share information with their providers (Paez, Allen, Beach, Carson, & Cooper, 2009). Currently approximately 70% of our HIV providers are non-Hispanic Whites. Thus, many of our African-American patients receive care from a provider of discordant race; this could potentially impact the patient-provider relationship and likelihood of SCM prescription. The fact that around 80% of our patients had some type of insurance; means that more have access to coverage for SCMs than are being prescribed these medications. When we controlled for insurance status in our multivariable model, the racial disparity remained

Table 2. Factors associated with prescription of smoking cessation medications among HIV-positive smokers receiving care at the UAB 1917 HIV/AIDS Clinic from April 2008 to April 2017

	Smoking cessation medication			
	Unadjusted[a]	*p*-value	Adjusted[a]	*p*-value
Socio-demographic	**OR (95% CI)**		**OR (95% CI)**	
Age (per 10 years)	**2.4 (1.02, 5.78)**	**0.04**	0.28 (0.65, 1.23)	0.08
Gender/sexual orientation				
Women	REF		REF	
Men (heterosexual)	**0.69 (0.49, 0.98)**	**0.04**	0.65 (0.41, 1.04)	0.08
MSM	**1.29 (1.00, 1.69)**	**0.05**	1.17 (0.81, 1.69)	0.42
Race/ethnicity				
White	REF		REF	
African American	**0.46 (0.38, 0.56)**	**<0.001**	**0.63 (0.47, 0.84)**	**<0.001**
Clinical/medical				
Duration of care (per year)	**1.10 (1.04, 1.08)**	**<0.001**	0.99 (0.96, 1.03)	0.81
Non-adherent to ART	**0.64(1.15, 2.07)**	**<0.001**	0.74 (0.93, 1.99)	0.11
Health insurance				
Uninsured	REF		REF	
Public	**1.86 (1.44, 2.43)**	**<0.001**	1.23 (0.84, 1.79)	0.29
Private	**1.42 (1.08,1.87)**	**0.01**	1.26 (0.85, 1.91)	0.25
Care status				
Established in care	REF		REF	
Newly diagnosed/new to care	**0.38(0.22, 0.69)**	**<0.001**	0.49(0.19, 1.28)	0.15
Re-engaging in care	0.59(0.34, 1.04)	0.06	1.08 (0.49, 2.34)	0.89
Transferring care	**0.55(0.44, 0.72)**	**<0.001**	**0.63(0.44, 0.91)**	**0.01**
Comorbidities[b]				
Cardiovascular	**0.71 (0.54, 0.94)**	**0.02**	1.05 (0.72, 1.55)	0.79
Respiratory	**0.63 (0.49, 0.81)**	**<0.001**	0.79 (0.57, 1.11)	0.18
Metabolic	**0.59 (0.44, 0.77)**	**<0.001**	0.89 (0.58, 1.36)	0.59
Cancer	**0.63(0.42, 0.94)**	**0.02**	1.08 (0.67, 1.78)	0.76
Laboratory parameters[c]				
Plasma HIV-1 RNA <200 copies/mL	**2.25 (1.69, 2.97)**	**<0.001**	1.38 (0.87, 2.17)	0.17
CD4 count (cells/μL)				
<200	REF		REF	
≥200	**2.23 (1.55, 3.21)**	**<0.001**	1.72 (0.99, 3.03)	0.06
Behavioral and psychological variables				
Major depression	**1.48 (1.19, 1.84)**	**<0.001**	**1.54 (1.10, 2.15)**	**0.01**
Anxiety symptoms	**1.49 (1.21, 1.84)**	**<0.001**	**1.43 (1.05, 1.94)**	**0.02**
Substance abuse[d]				
Never	REF		REF	
Prior	**0.63 (0.44, 0.91)**	**0.01**	0.72 (0.46, 1.11)	0.13
Current	1.18 (0.94, 1.49)	0.16	1.06 (0.79, 1.40)	0.70
Alcohol abuse				
No risk	REF		REF	
At risk	1.06(0.86, 1.32)	0.55	-	-
Cigarette consumption				
Light smoker (<10/day)	REF		REF	
Moderate smoker (10–20/day)	0.79 (0.44, 1.41)	0.43	0.86 (0.38, 1.77)	0.60
Heavy smoker (>20/day)	**2.86 (1.91, 4.29)**	**<0.001**	**3.55 (2.11, 5.98)**	**<0.001**

Abbreviations: ART, antiretroviral therapy; CI, confidence interval; HIV, human immunodeficiency virus; MSM, men who have sex with men; OR, odds ratio; SD, standard deviation, UAB; University of Alabama at Birmingham.
Boldface indicates statistical significance at the 0.05 level.
[a]Logistic regression model.
[b]Comorbidities: respiratory (asthma, chronic obstructive pulmonary disease, and bacterial pneumonia); metabolic (diabetes and dyslipidemia); cardiovascular (stroke, myocardial infarction, coronary artery disease, and hypertension);
[c]Most recent lab value closest on or prior to the index visit.
[d]Substance abuse (street opioids, prescription opioids, marijuana, crack/cocaine, amphetamines, sedatives, inhalants, and hallucinogens).

strong, indicating factors other than coverage for SCM is contributing to the disparity. While interventions to reduce racial disparities across a number of health conditions have been studied (Chin, Walters, Cook, & Huang, 2007), more studies focused specifically on improving smoking cessation outcomes across racial groups, including increasing rates of SCM prescription, need to be conducted.

The current study showed that depression, anxiety, and cigarette consumption were associated with increased odds of receiving an SCM prescription. The relationship between mental disorders, especially depression and anxiety, and increased risk for cigarette smoking is well established (Benard et al., 2007; Kodl et al., 2008). Twenty-four percent of our population had major depressive symptoms, which is 2–3 times the prevalence of depression in the general population (Ferrando & Freyberg, 2008; Stewart, Jones, & Minor, 2011). The interpretation of the association between mental health disorders and prescription of SCMs should

be made carefully, as bupropion is prescribed for both depression and smoking cessation. Our EMR data did not allow us to determine the reason for bupropion prescription (i.e., depression, smoking cessation, or both). The high rate of depression in our population may in part explain why a much higher proportion of patients were prescribed bupropion than NRT. Smoking cessation may confer a mental health benefit. A meta-analysis of 26 longitudinal studies by Gemma *et al.* assessing mental health before and after smoking cessation showed that smoking cessation was associated with reduced depression and anxiety compared to smoking continuation (Taylor et al., 2014).

After multivariable adjustment, patients who had CD4 cell counts ≥200 cells/μL and viral loads <200 copies/mL were more likely to be prescribed SCMs, although these findings were not statistically significant. This could perhaps be related to sample size given the relatively low numbers of patients with low CD4 counts and uncontrolled HIV. It is possible that providers have more time to focus on preventive care such as smoking cessation in patients with well-controlled HIV. In the univariate model, both newly diagnosed/new to care patients and those transferring care were significantly less likely to be prescribed SCMs than established patients. However, in the multivariable analysis, only the assocation with transferring care remained stastically signifcant, possibly related to sample size considerations as only a small percentage of our popuation was newly diagnosed/new to care. One possible explanation for these results is that there is competing demand for management of HIV as well as other medical and psychological comorbidities early in care, and therefore, physicians have limited time for smoking cessation counseling (Jaen et al., 2001; Vijayaraghavan et al., 2017; Yarnall, Pollak, Ostbye, Krause, & Michener, 2003).

Our study has limitations. The cross-sectional nature of the data permitted us to evaluate associations but not to demonstrate causality. We were unable to examine changes in the factors associated with SCM prescriptions over time. In addition, we did not have access to information regarding over the counter NRT use. However, we do not expect that African Americans were more likely to purchase NRT over the counter than Whites and thus do not think the absence of this data biased our major finding of lower odds for SCMs prescription among African-American PLWH. We only assessed SCM prescription at index visit and did not control for the previous use of SCMs. Some of the smokers prescribed bupropion could have received it for depression and not for smoking cessation, resulting in misclassification. In addition, we only controlled for major depression and not depressive symptoms. Our EMR captures SCM prescription, but information on whether patients picked up these medications or were adherent to them is unknown. Although we adjusted for known confounders, the observational design has inherent residual confounders that might skew the interpretation of the results. Furthermore, we analyzed data only from individuals who completed PROs and our findings may not be relevant to those who refused to do PROs. However, > 90% of our HIV patients consented to completing the PROs. Some of the effect sizes were modest and may potentially be statistically significant without any clinical significance. However, we note that our association of race, depression, and anxiety with SCMs was consistent with previous studies. Lastly, our single-center study may not be generalizable to other national and international settings.

One of the strengths of our study that is the large sample size of PLWH who smoke receiving routine clinical care. Moreover, data from routine clinical care often represent a more diverse population due to the absence of enforcement of any enrollment criteria. We also note the robust sociodemographic, clinical, and behavioral/psychological data captured on our population. Unlike prior studies, our study includes medical comorbidities. We also used PRO data in our analyses, which is known to be more accurate in many domains (Kissinger et al., 1999; Sanders et al., 1994); however, this may also have led to misclassification due to self-reporting bias. Although self-reporting may underestimate the prevalence of tobacco use (Connor Gorber, Schofield-Hurwitz, Hardt, Levasseur, & Tremblay, 2009; Patrick et al., 1994), other studies have shown that computer-administered questionnaires have comparable validity with clinical interviews (Bryant et al., 2011; Studts et al., 2006).

Conclusion

Our study found that African-American PLWH had lower odds of being prescribed SCMs. This finding underscores the need to increase use of SCMs among African-American PLWH to improve the rate of successful smoking cessation and decrease risk for smoking-related morbidity and mortality. Such improvements in racial disparities in healthcare are crucial to closing the gap in mortality between African-American and White PLWH. Future research is needed to assess the reasons for the low rate of SCM prescription among African Americans; such research may lead to an increase in SCM prescription and eventually to improvement of smoking cessation outcomes across racial groups.

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