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Cigarette Smokers are Less Likely to have Undetectable Viral Loads: Results from Four HIV Clinics

Karen L. Cropsey, Psy.D.[1], **James H. Willig, M.D.**[1], **Michael J. Mugavero, M.D., MHSc**[1], **Heidi M. Crane, M.D., MPH**[2], **Cheryl McCullumsmith, M.D., Ph.D.**[1], **Sarah Lawrence**[1], **James L. Raper, D.S.N., J.D.**[1], **W. Christopher Mathews, M.D., M.S.P.H.**[3], **Stephen Boswell, M.D.**[4], **Mari M. Kitahata, M.D., MPH**[2], **Joseph E. Schumacher, Ph.D.**[1], **Michael S. Saag, M.D.**[1], and **CFAR Network of Integrated Clinical Systems**

[1]University of Alabama at Birmingham

[2]University of Washington

[3]University of California, San Diego

[4]Fenway Community Health Center

Abstract

Background—The prevalence of smoking among HIV-infected individuals is 2–3 times that of the general population, increasing the risk of smoking-related morbidity and mortality. We examined characteristics associated with smoking behavior among a large cohort of HIV-infected individuals in care in the US.

Methods—A convenience sample of 2,952 HIV-infected patients in the Centers for AIDS Research (CFAR) Network of Integrated Clinical Systems (CNICS) were assessed during routine clinic visits was included. Multinomial logistic regression was used to examine the relationship between smoking status, depression/panic symptoms, alcohol/substance use, and demographic and clinical characteristics.

Results—Compared to never smokers, current smokers were more likely to have moderate to severe depression (OR: 1.37), endorse current substance use (OR: 14.09), and less likely to report low risk alcohol use on the AUDIT-C (OR: 0.73). Current smokers were less likely to have an undetectable viral load (OR: 0.75) and more likely to have current substance abuse (OR: 2.81) and moderate to severe depression (OR: 1.50) relative to smokers who had quit smoking.

Conclusions—HIV-infected smokers are less likely to have undetectable viral loads and frequently have psychosocial co-morbidities including depression and substance abuse that impact ART adherence and viral load suppression. To be effective, smoking cessation interventions need to address the complex underlying concurrent risks in this population.

Correspondence: Karen Cropsey, Psy.D., Associate Professor, 401 Beacon Parkway West, Birmingham, AL, 35209, (205) 917-3786 x205, (205) 943-0853 fax, kcropsey@uab.edu. Alternate: James Willig, M.D., Assistant Professor of Medicine-Infectious Diseases, 908 20th St. So. CCB 174, Birmingham, AL 35294-2050, Phone (205) 996-5753, Fax (205) 975-8273, jwillig@uab.edu.

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Keywords

HIV; smoking

Introduction

Smoking-related diseases remain the leading cause of death in the US and while an estimated 18% of all adults in the U.S. smoke cigarettes, estimates of smoking prevalence among people living with HIV/AIDS (PLHIV) are as high as 40–70% (CDC, 2013; Crothers et al., 2005; Demyttenaere et al., 2004; Elzi et al., 2006; Webb et al., 2007; Lifson at al., 2010). Medical advances in the treatment of HIV have resulted in substantial increases in life expectancy among PLHIV (Lifson et al, 2010; Palella et al., 2006; Ortblad et al., 2013; Helleberg et al., 2013) and as a consequence PLHIV smokers are now, more than ever, at heightened risk for tobacco-related illness. In fact, PLHIV smokers who are engaged in treatment for their HIV disease lose more years of life due to smoking now than to HIV disease (12.3 years lost to smoking vs. 5.1 years lost to HIV), highlighting the critical importance of smoking cessation for PLHIV smokers (Helleberg et al., 2013). In particular, pulmonary disease, bacterial pneumonia, and cardiovascular risk remains significantly elevated in PLHIV relative to the general population (Rahmanian, Wewers et al., 2011; Manilli, et al, 2011; De et al., 2013) and smoking appears to work synergistically with antiretroviral medication to promote cardiovascular disease (Rahmanian et al., 2011; Manili et al., 2011; De et al., 2013; Armah et al., 2012; Petrosillo et al., 2013). Furthermore, HIV treatment regimens that include protease inhibitors (PI) significantly increase the annual incidence of cardiovascular events over treatment regimens that do not include a PI (Bargaro et al., 2003). Thus, continued smoking among PLHIV has unique and specific risks that promote more rapid development of cardiovascular and pulmonary disease. Since smoking is one of the biggest modifiable risk factors for cardiovascular and pulmonary diseases specifically in PLHIV, cessation strategies targeting this population are particularly relevant (Fiore et al., 2008; The Antiretroviral Therapy Cohort Collaboration, 2008). PLHIV smokers face unique barriers to smoking cessation, such as high rates of comorbid drug and alcohol use and mental illness (Bing et al., 2001), unemployment and lower socioeconomic status, lower quality of life (Shirley et al., 2013), inadequate social support (Gostin & Weber, 1998), and reliance on cigarettes as a coping mechanism for the stress associated with their illness (Helleberg et al., 2013). The Guidelines for Treating Tobacco Use and Dependence (Fiore et al., 2008) noted that studies examining smoking cessation interventions among HIV-infected patients are limited and generally show low rates of smoking cessation (Cummins et al., 2005; Fingeret et al., 2007; Ingersoll et al., 2009; Lloyd-Richardson et al., 2009; Vidrine et al., 2006), although more recent studies have shown cessation rates in this population ranging from 15% to 29% at 3 month follow-ups (Humfleet et al., 2013; Gritz et al, 2013). A recent meta-analysis of smoking interventions with PLHIV noted that interventions that employ multiple strategies that are delivered across multiple sessions appear to increase abstinence (Moscou-Jackson et al., 2014).

While a couple of studies have examined PLHIV smokers from several clinics in the northeast (Lloyd-Richardson et al, 2008) or from two regions in Canada (Cui et al, 2012),

most previous studies of PLHIV smokers have been limited to smokers from one clinic or geographical area. Through the Centers for AIDS Research (CFAR) Network of Integrated Clinical Systems (CNICS) we were able to examine the characteristics of a large and diverse cohort of HIV-infected patients from four distinct regions of the US. It was expected that regional differences in smoking may be found among PLHIV smokers from these four clinics as smoking patterns change among the general populations of smokers from different areas of the US (McClure, Murphy, Roseman, Howard, Malarcher, 2011). This examination of socio-demographic and psychosocial characteristics of HIV-infected smokers was collected as a preliminary step in developing an effective smoking cessation interventions tailored to the needs of this population.

Methods

Study Setting

This cross-sectional study was conducted in the CNICS cohort, which includes HIV-infected individuals in care at eight clinical sites across the US (Kitahata et al., 2008). The goal of the network is to integrate a broad range of longitudinal clinical data collected through point-of-care electronic health record systems and other data sources to facilitate studies of treatment factors and long-term clinical outcomes among HIV-infected patients in the modern ART era (Kitahata et al., 2008). The assessment of patient reported outcomes (PRO), including smoking behavior, was integrated into routine clinical care between 2005 and 2008 at four CNICS sites (the University of Alabama at Birmingham (UAB) 1917 HIV/AIDS Clinic, the University of Washington (UW) Harborview Medical Center HIV Clinic, Fenway Community Health Center of Harvard University (Fenway), and University of California San Diego HIV Clinic (UCSD). PROs include a series of standardized, validated psychosocial instruments that are collected every four to six months (described below). The Institutional Review Board for Protection of Human Subjects at each site reviewed and approved this study.

Computerized Self-Reported PRO Assessment Software and Implementation

PROs were assessed using an open-source, web-based software application that incorporated instruments measuring a number of domains, using touch-screen desktop computers or touch-screen portable tablet computers (Crane et al., 2007; Lawrence et al., 2010). This method enables data collection from patients with limited prior computer experience, and for assessments to be completed during routine visits in high volume clinical settings as has been described in detail elsewhere (Crane et al., 2007; Lawrence et al., 2010).

Participants

A convenience sample included HIV-infected adults (N=2952) who attended a routine clinic visit during the study period and completed their first PRO between September 2005 and October 2009. Sites with a high percentage of Spanish-speaking patients (e.g., UW and UCSD) administered the assessment in English or Spanish and non-English speakers were excluded at the remaining sites. Research assistants aided participants with visual impairments, those who were unable to read, and patients who requested assistance. Patients who did not answer questions about their use of tobacco products were excluded from the

analysis (N=78) and there were no significant differences in demographic characteristics between these individuals and those who completed the computerized PRO assessment.

Instruments, scoring and categorization of PRO results

The assessment battery included valid and reliable measures to screen for depression (Patient Health Questionnaire-9 (PHQ-9), anxiety and panic symptoms (Patient Health Questionnaire Anxiety Module), alcohol risk (Alcohol Use Disorders Identification Test (AUDIT-C), and substance abuse (Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), and antiretroviral medication adherence (last missed dose item from the AACTG instrument). Most participants completed the assessment in 10–15 minutes. Participants were categorized according to their responses to instruments measuring depression (none, mild-moderate, or severe; Kroenke et al., 2001), anxiety (no panic symptoms or panic syndrome; Sptizer et al., 1999) alcohol abuse (no risk, low risk, or at-risk for abuse; Gual et al., 2002; Bradley et al., 1998), adherence (no missed doses or missed any doses in the past 3 months; Chesney et al., 2000), and individual substance use (current use defined as use in the last 3 months, prior use, or no use of marijuana, crack/cocaine, amphetamines, opioids). In addition, an overall composite measure of any illicit substance use categorized as current (defined as use in the past 3 months), prior, or never use was determined (Newcombe et al., 2005; WHO ASSIST Working Group). Finally, participants were asked about receiving substance abuse treatment in the past year (yes/no). Participants were assigned to one of three tobacco use categories: current smokers, ex-smokers, and non-smokers based on responses to smoking status questions. The number of years of smoking (0–5 years, 6–10 years, 11–15 years, 16–20 years, and 20+ years) and number of packs per day (ppd; < 1/2 ppd, 1/2-1 ppd, >1-2 ppd, or >2 ppd; Kiechl et al., 2002) were also collected.

Statistical Analyses

We performed univariate analyses comparing study participants characteristics to the overall CNICS cohort at the participating sites using chi-squared tests and *t*-tests. Among participants, we examined associations between smoking category (current smokers, ex-smokers, and non-smokers), demographic characteristics (age, sex, and race), clinical characteristics (current CD4 cell count, HIV viral load, and ART use), and psychosocial assessment results (depression, anxiety, alcohol abuse, and substance abuse, and ART adherence). To compare groups, we used Analysis of Variance (ANOVA) procedures and Chi-squared tests for continuous and categorical variables, respectively. For Chi-Square tests with more than 2x2 comparisons, we present the overall p-value, but do not examine all possible 2x2 comparisons for significance as these univariate analyses were performed primarily to determine if statistical threshold ($p<0.05$) for inclusion in the multivariate logistic regression model was met. We performed multinomial logistic regression analyses to evaluate factors associated with current or former smoking, using never smoking as the reference category. We conducted a binary logistic regression to compare smokers to former smokers to determine characteristics of individuals who had quit smoking. Final variables included in multivariate models were race, sex, age, depression, alcohol risk, substance abuse, ART adherence, viral load, and study site. To address co-linearity between moderate to severe depression and panic attacks (61.6% endorsed both), we excluded panic attacks from the final multivariate model. Inclusion of the “not on ART” group for the adherence

measure was done to avoid exclusion of these patients in multivariate models. All statistical analyses were performed using SPSS for Windows software (SPSS Inc., version 18).

Results

Demographics

Among participants (N=2,952) attending routine HIV clinical care visits at the study sites, 2,874 completed the PRO (97.4%; including smoking status) assessment. Table 1 presents the distribution of demographic and clinical characteristics, and psychosocial variables across the four sites. The majority of participants were middle-aged (M=43±10), White (64%), male (84%), with 41% of the sample identifying as current smokers. The prevalence of smoking was higher at UW and UAB (45% and 42%, respectively), followed by UCSD (37%) and Fenway (26%). Among smokers, 42% reported smoking for more than 20 years, 20% smoked for 16–20 years, and 17% smoked for 11–15 years. Further, 42% of smokers smoked between ½-1 ppd, while 38% reported smoking less than ½ ppd. Less than 1% of smokers reported smoking more than 2 ppd. Most were receiving ART (77%), the mean CD4 count was 472 cells/mm^3, and 50% of all participants had virologic suppression (<50 copies/mL) at the time of the assessment.

Univariate Comparisons among Smoking Status Groups

Table 2 presents comparison between current smokers, former smokers, and never smokers. Whites and males were more likely to be former smokers (76% and 87%, respectively) or current (67% and 84%, respectively) smokers while females and African-Americans were more likely to be never smokers (20% and 42%, respectively). Former smokers (mean age 45) were more likely to be older than current and never smokers (mean ages 42 and 43, respectively). While no CD4 count differences were found between participants by smoking status, among those on ART, current smokers had the lowest rates of viral suppression compared to former or never smokers (<50 copies/mL 60% vs. 69% and 65%, respectively). Furthermore, current smokers were more likely to not be on ART and to report ART non-adherence (Table 2).

Current smokers, compared to former and never smokers, had higher levels of moderate to severe depression (29% vs. 21% and 18%, respectively), panic symptoms (32% vs. 15% and 18%, respectively), and current substance abuse (48% vs. 32% and 19%, respectively). Similarly, compared to former and never smokers, current smokers were more likely to endorse ever using marijuana (82% vs. 80% and 77%, respectively), crack/cocaine (67% vs. 55% and 25%, respectively), amphetamines (44% vs. 41% and 20%, respectively), and opiates (17% vs. 15% and 4%, respectively). Current smokers were more likely to report ever using intravenous drugs (23%) compared to former smokers (17%) and never smokers (6%) and were more likely to have received substance abuse treatment in the prior year (16% vs. 9% and 4%, respectively).

Factors Comparing Never Smokers to Former and Current Smokers

The results of the multinomial logistic regression comparing current and former smokers to never smokers are presented in Table 3. Individuals of Hispanic ethnicity were significantly

less likely to be current smokers (OR: 0.55). Individuals endorsing moderate to severe depressive symptoms were significantly more likely to be current smokers (OR: 1.37). Older patients (OR per year: 1.03) and those who reported at-risk drinking (OR: 1.61) were significantly more likely to be former smokers. Individuals who endorsed current (OR: 4.71 and OR: 14.09, respectively) and prior substance abuse (OR: 4.92 and OR: 6.62, respectively) were more likely to be former or current smokers, respectively. The treatment site of participants was also a significant predictor of being a current smoker but not of being former smoker. Race, sex, adherence to ART, and having an undetectable viral load were not independently associated with smoking status in adjusted analyses.

We were interested in determining factors associated with quitting smoking among HIV-infected smokers (see Table 4). Current smokers were less likely to have an undetectable viral load (OR: 0.75), were more likely to have moderate to severe depression (OR: 1.50), were more likely to be currently using illicit substances (OR: 2.81) and less likely to score in the Low Risk of alcohol risk on the AUDIT-C (OR: 0.64) compared to former smokers.

Discussion

This study determined risk factors for former and current smoking among almost 3,000 patients with HIV infection in care at four geographically distinct sites in the US. Significant factors associated with being a current smoker relative to a former smoker included being less likely to have an undetectable viral load, current symptoms of moderate to severe depression, current and prior substance abuse, and geographical site. Smoking is known to be associated with worse HIV clinical outcomes and the finding that fewer current smokers had undetectable viral loads compared to former smokers in this sample confirmed previous studies (Crothers et al., 2005). Further, the associations between depressive symptoms and smoking are consistent with studies in the general population of smokers which showed higher rates of depression among smokers as well as more recent studies among PLHIV indicating that smoking and depression are both associated with HIV non-adherence (King et al., 2012).

Current and former Smokers were more likely to have prior and current substance use relative to never smokers. Current and former smokers were nearly twice as likely to have ever used marijuana, cocaine, amphetamine, or opiates and were three times as likely to have entered substance abuse treatment relative to never smokers. Recent studies with HIV populations have noted a similar association between smoking and substance use among PLHIV (Shirley et al., 2013) and suggest that HIV-infected smokers may represent a group of individuals with multiple addictions who are resistant to or unable to quit smoking and other drug use.

Our findings confirm the higher prevalence of smoking among HIV-infected individuals (41%) compared with the general population (18%) in the U.S. (CDC, 2013; Crothers et al., 2005; Demyttenaere et al., 2004; Elzi et al., 2006; Webb et al., 2007; Lifson at al., 2010). The prevalence of current smoking varied among the four sites, from a low of 26% at Fenway, to 37% at UCSD, 42% at UAB and 45% at UW, which are approximately double the relative prevalence of smoking in the general population in each state [14% in

California, 16% in Massachusetts, 16% in Washington and 22% in Alabama] (Tobacco Control State Highlights, 2010). These findings may reflect the important differences between state tobacco policies, prevention efforts, taxation, and treatment programs and highlights the importance of multisite studies for understanding the prevalence rates of smoking and other behaviors.

Smoking status was correlated with ART use, adherence, and HIV viral load in univariate analyses. Among individuals on ART, current smoking was associated with failure to suppress HIV viral load <50 c/mL relative to Former Smokers and Non-Smokers, consistent with previous studies (Feldman et al., 2006; Gritz, Wong, 2004; Webb et al., 2007). Individuals may not be on ART therapy for a variety of reasons, including being too healthy, poor adherence, or intolerability of side effects. Thus, there are several possible interpretations of these findings. Some individuals who become ill enough to start ART may decide to make broad life style changes to ensure better health, including smoking cessation, which improves their health outcomes. Those individuals who do not make such lifestyle changes such as smoking cessation may have worse health outcomes, such as higher HIV viral load. In adjusted analyses, while CD4 count was not associated with smoking status, current smokers were less likely to have undetectable viral loads compared to former smokers, providing partial support for this notion. Finally, other psychological co-morbidities observed more commonly among smokers, including depression and substance abuse, have been consistently associated with ART non-adherence (Taniguchi et al., 2014; Sin & Dimatteo, 2013; Kalichman et al., 2013), which was also more common among current smokers in the current study.

This study was limited by several factors. First, because the psychological measures relied on self-report, the potential remains for under-reporting problem behaviors, although the use of computer-aided questionnaire administration rather than clinical interviewers generally has been shown to be preferred by patients and to result in more valid responses (Kissinger et al., 1999; Kobak et al., 1996; Locke et al., 1992; Sanders et al., 1994). Given the variation in reported rates of substance abuse and mental health symptoms between the Alabama site and the other three sites, a related concern is that particular socio-demographic groups may have under-reported undesirable behaviors. While generally all individuals who attend their regular clinic appointment participated in this study, individuals who attended the clinic for problem visits (e.g., development of an opportunistic infection, etc.) or who missed their regular appointment were not assessed at that time. Also, given that all the participants enrolled in this study were receiving care for their HIV, findings may not necessarily generalize to patients that are not enrolled in clinical care. Finally, while women comprised about 16% of the overall sample, the number of women, particularly at the Fenway site, was relatively small compared to the male participants.

Strengths of this study include a very large and diverse multi-site study population of PLHIV patients from the current treatment era. We are aware of no other studies in the literature which have combined clinical data from four distinct geographical areas of the U.S. Regional differences among our clinic samples demonstrates the importance of multi-site clinical research to better generalize to the HIV-infected population as a whole. The capture of patient reported outcomes, using standardized, validated instruments to measure

highly prevalent and clinically important psychosocial domains, is unique to CNICS among large HIV clinical cohort studies. Finally, our study included individuals in routine clinical care distinct from clinical trials that often exclude individuals with substance use or psychiatric symptoms, factors of high prevalence in this study.

This study highlights the concurrence of smoking with other addictive and psychological symptoms and demonstrates the negative impact that smoking has on HIV-infected individuals, particularly the influence on detectable viral load. The continued high prevalence of smoking in this population suggests that HIV-infected smokers may be particularly recalcitrant or unable to quit smoking and interventions are needed that address engaging even unmotivated smokers in cessation treatment. The authors propose that specific interventions addressing these multifaceted needs will be needed to increase smoking cessation success rates among HIV-infected persons and may lead to improved HIV outcomes for HIV-infected smokers.

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Table 1

Sample characteristics by HIV clinic site (N=2952)

	Total (N=2952)	UCSD (n= 431)	UAB (n= 1292)	Fenway (n= 251)	UW (n= 978)
	Mean±SD or n (%)	Mean±SD or n (%)	Mean±SD or n (%)	Mean±SD or n (%)	Mean±SD or n (%)
Age	43±10	44±9	43±10	43±9	43±9
Male Gender	2468 (84)	396 (92)	997 (77)	248 (99)	827 (85)
Racial Group					
White	1889 (64)	352 (82)	610 (47)	222 (88)	705 (72)
African-American	949 (32)	53 (12)	672 (52)	13 (5)	211 (22)
Asian/Pacific Islander	46 (2)	9 (2)	3 (0)	2 (1)	32 (3)
Native American	27 (1)	2 (0)	2 (0)	--	23 (2)
Other	32 (1)	15 (4)	5 (1)	14 (6)	7 (1)
Ethnicity					
Hispanic	287 (10)	131 (30)	13 (1)	32 (13)	111 (11)
Non-Hispanic	2665 (90)	300 (70)	1279 (99)	219 (87)	867 (89)
CD4 value cells/mm^3	472±282	481±280	472±293	570±299	444±257
Non-adherence to ART	991 (44)	184 (44)	332 (26)	85 (35)	390 (40)
HIV VL (copies/mL) < 50 c/mL	1394 (51)	150 (48)	498 (39.7)	177 72.2)	569 (60)
Smoking Status					
Current	1186 (41)	154 (37)	536 (42)	63 (26)	433 (45)
Former	671 (23)	121 (29)	229 (18)	88 (37)	233 (24)
Never	1017 (35)	138 (33)	500 (40)	88 (37)	291 (30)

Note: All univariate analyses were statistically significant at p<0.001 except for which was not significant.

Table 2

Smoking status and patient characteristics from initial patient-reported outcomes screening (N = 2874).

	Current Smokers (n=1186)	Former Smokers (n=671)	Never Smokers (n=1017)
	Mean ± SD or n(%)	Mean ± SD or n(%)	Mean ±SD or n(%)
Age	42±9	45±10	43±10
Male Gender	1001 (84)	587 (87)	816 (80)
Racial Group			
White	792 (67)	506 (76)	548 (54)
African-American	353 (30)	142 (21)	423 (42)
Other	46 (3)	23 (3)	46 (4)
Ethnicity			
Hispanic	85 (7)	68 (10)	122 (12)
Non-Hispanic	1101 (93)	603 (90)	895 (88)
CD4 value cell/mm^3	464±297	491±272	473±270
Non-adherent to ART	428 (36)	226 (34)	321 (32)
HIV VL (copies/mL) < 50 c/mL	492 (60)	341 (69)	481 (65)
Level of Depression (PHQ))			
None (0 – 4)	566 (49)	361 (56)	614 (62)
Mild (5 – 9)	255 (22)	150 (23)	192 (20)
Moderate to Severe (10 –27)	332 (29)	134 (21)	171 (18)
Panic Symptoms (PHQ-A)	381 (32)	183 (15)	183 (18)
Alcohol Risk (Audit-C)			
No Risk (0)	385 (33)	198 (30)	398 (40)
Lower Risk (1–4)	427 (36)	280 (42)	432 (43)
At-Risk (≥ 5)	359 (31)	188 (28)	169 (17)
Substance Abuse (ASSIST)			
Current	550 (48)	205 (32)	178 (19)
Prior	488 (42)	352 (55)	311 (33)
Never	112 (10)	87 (13)	460 (48)
Ever Used Marijuana	844 (71)	464 (69)	392 (39)
Ever Used Crack/ Cocaine	770 (67)	367 (55)	252 (25)
Ever Used Amphetamines	511 (44)	270 (41)	201 (20)
Ever Used Opioids	202 (17)	97 (15)	42 (4)
Ever Used IV Drugs	260 (23)	116 (17)	63 (6)

	Current Smokers (n=1186)	Former Smokers (n=671)	Never Smokers (n=1017)
	Mean ± SD or n(%)	Mean ± SD or n(%)	Mean ±SD or n(%)
Received Substance Abuse Treatment in the Past Year	182 (16)	61 (9)	41 (4)

Note: Age and CD4 analyses were done using Analysis of Variance (ANOVA). All other analyses were conducted using Chi-Square. All univariate analyses were statistically significant at $p<0.001$ except for CD4 values which were not significant.

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Table 3

Predictors of Former Smoking and Current Smoking Compared to Non-Smoking Among HIV-Infected Patients in Adjusted Analyses (N=2874)

Predictor		**Former Smokers**		**Current Smokers**	
		OR	**95% CI**	**OR**	**95% CI**
Race	White	1.62	0.87–3.01	1.71	0.96–3.03
	African-American	0.85	0.44–1.63	1.14	0.63–2.06
	Other (ref)	--	--	--	--
Hispanic		0.72	0.48–1.09	**0.55**	**0.37–0.81**
Male		0.91	0.65–1.28	0.88	0.66–1.17
Age per year		**1.03**	**1.02–1.04**	0.99	0.99–1.07
Depression (mod-severe)		0.93	0.69–1.25	**1.37**	**1.05–1.77**
Undetectable VL		1.06	0.81–1.40	0.82	0.64–1.05
ART Adherence	Not on ART	0.97	0.69–1.38	0.91	0.67–1.23
	Non-adherent	0.88	0.67–1.15	0.95	0.75–1.21
	Adherent (ref)	--	--	--	--
Alcohol Risk	Low Risk	1.13	0.86–1.48	**0.73**	**0.57–0.92**
	At-risk	**1.61**	**1.16–2.23**	0.76	0.57–1.02
	No Risk (ref)	--	--	--	--
Substance Abuse	Prior	**4.92**	**3.60–6.72**	**6.62**	**4.98–8.80**
	Current (past 3 months)	**4.71**	**3.27–6.80**	**14.09**	**10.17–19.50**
	Never (ref)	--	--	--	--
Site	UW	1.03	0.69–1.54	**2.85**	**1.87–4.32**
	UAB	0.95	0.62–1.43	**3.43**	**2.24–5.29**
	UCSD	1.13	0.71–1.82	**1.98**	**1.21–3.23**
	Fenway (ref)	--	--	--	--

*** p<0.001;

** p<0.001;

* p<0.05

Note. Non-Smokers were the reference group. Analyses were performed using Multinomial Logistic Regression.

Table 4

Predictors of Current Smoking Compared to Former Smoking Among HIV-Infected Patients in Adjusted Analyses (N=1857)

Predictor		**Current Smokers**	
		OR	**95% CI**
Race	White	1.06	0.56–1.99
	African-American	1.36	0.70–2.67
	Other (ref)	--	--
Hispanic		0.79	0.52–1.21
Male		0.95	0.68–1.32
Age per year		0.97	0.96–0.98
Depression (mod-severe)		**1.50**	**1.15–1.96**
Undetectable VL		**0.75**	**0.58–0.97**
ART Adherence	Not on ART	0.93	0.67–1.29
	Non-adherent	1.07	0.83–1.38
	Adherent (ref)	--	--
Alcohol Risk	Low Risk	**0.64**	**0.49–0.84**
	At-risk	0.76	0.57–1.02
	No Risk (ref)	--	--
Substance Abuse	Prior	1.23	0.86–1.76
	Current (past 3 months)	**2.81**	**1.89–4.18**
	Never (ref)	--	--
Site	UW	**2.82**	**1.88–4.24**
	UAB	**3.87**	**2.53–5.91**
	UCSD	**1.84**	**1.14–2.98**
	Fenway (ref)	--	--