Factors Associated with Smoking in HIV-Infected Patients and Potential Barriers to Cessation

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Abstract

Smoking is common in patients with HIV and is associated with increased morbidity and mortality. With the goal of targeting future cessation interventions, we sought to identify factors associated with smoking status, readiness and confidence in cessation, and success in quitting. As part of a larger study in New York City assessing predictors of chronic obstructive pulmonary disease (COPD), we enrolled HIV-infected subjects at least 35 years of age without known asthma or COPD. Current smokers received detailed tobacco history, and smoking status was assessed by chart review at 3 and 6 months post-enrollment. Two hundred subjects were enrolled (29% current smokers, 31.5% never smokers, 39.5% former smokers, mean age of 49, 84% male, 64% had AIDS, and 97% were receiving antiretroviral therapy). Current smokers had higher unemployment and increased rates of other substance use than former smokers or never smokers. In multivariate analysis, being unemployed and having used inhalant drugs were associated with current smoking. Substance abuse history was not correlated with readiness to quit or patient estimated cessation. Lower education was associated with decreased readiness to quit. Follow-up smoking status for baseline current smokers was available for 47/58 enrollees at 6 months; 4 (9%) stopped smoking completely, and 17 (36%) decreased the number of packs-per-day. Smoking and concomitant substance abuse is common in HIV, and special attention should be given to this issue, in addition to a patient's readiness to quit, when implementing tobacco cessation protocols, especially in busy urban HIV care centers.

Introduction

SMOKING TOBACCO IS VERY COMMON in patients infected with HIV, where nationwide, approximately 50% of individuals currently smoke, and up to 75% have smoked at some point in life.¹⁻⁴ This is in contrast to the most recent prevalence in the US general population in 2010 of 19.3%.⁵ Smoking is a known risk factor for many serious medical conditions including cardiovascular disease, chronic obstructive pulmonary disease (COPD), and cancer, and smoking in the setting of HIV infection can increase the risk for, or the severity of, these conditions.^{3,6} Since smoking has such far-reaching negative impact on health, and because it is a modifiable condition, cessation is an important target in improving the long term health of this population.

In addition to being more likely to smoke, patients with HIV frequently face significant barriers to cessation, with higher rates than the general population of substance abuse, psychiatric disorders, low socioeconomic status, and poor

access to care.^{3,7,8} Because care of patients with HIV often means managing multiple complicated co-morbidities, providers may focus on treatment of active conditions, forsaking preventative treatment and counseling such as that involved in smoking cessation.⁹ In a related fashion, patients themselves may focus self-care on antiretroviral (ART) adherence and management of active health and social issues, putting less importance on prevention. In HIV-infected patients, alcohol abuse and illicit drug use have been tied to active cigarette smoking,^{10,11} and greater use of alcohol or illicit drugs is associated with lower readiness to quit smoking.^{12,13} Depression is associated with increased nicotine dependence,¹³ and may influence cessation success, although this interaction remains controversial.¹⁰

In the general population, much research has been done regarding the effect of a patient's readiness to quit (defined by the trans-theoretical model of stages of change) on cessation, and clearly those smokers who are more ready to quit are more likely to quit.^{14,15} However, the impact of tailoring

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cessation counseling or treatments to an individual's readiness to quit is more controversial.¹⁶ In populations with very high rates of smoking, substance use, and multiple socioeconomic limitations such as those found in most HIV care centers, tailoring cessation treatments to a patient's level of readiness to quit may be important and has not been thoroughly studied. Many cessation programs have been found effective in HIV-infected patients,^{17–19} and there are recent efforts to integrate these into routine HIV care, including efforts at the clinics in this study.^{20,21} The current study aimed to investigate characteristics associated with smoking status, the association with concurrent substance abuse or mental health, and the impact that these and other factors associated with smoking status may have on readiness to quit and success in smoking cessation in HIV-infected patients.

Methods

Study design and population

The study was conducted at the Centers for Special Studies (CSS) HIV primary care clinics of New York Presbyterian Hospital-Weill Cornell Medical College in New York City, which follow approximately 2300 patients at two clinical sites. The present study was nested within a larger study testing a screening approach that included peak flow measurement and a respiratory questionnaire to diagnose chronic obstructive pulmonary disease (COPD), using office spirometry as a gold standard. The study period was from April 5, 2012 to January 14, 2013. Patients with appointments on scheduled screening days, and those who responded to a flyer by phone or e-mail, underwent review of the inclusion criteria (age ≥ 35 years, documented HIV diagnosis, current patient at CSS). Those who showed interest were screened for entrance to the study, and informed consent was conducted as appropriate. Exclusion criteria included: history of asthma or COPD documented by pulmonary function testing or pulmonologist assessment and receiving current treatment, pregnancy, end-stage renal disease on hemodialysis, decompensated liver cirrhosis, class 3 or 4 congestive heart failure, current use of systemic immunosuppressant (equivalent to 10 mg prednisone daily, tumor necrosis factor- α inhibitor, chemotherapy), lung resection, and acute respiratory illness (new fever, cough, or wheeze in the last 7 days). The study was approved by the Weill Cornell Institutional Review Board, and all enrolled subjects provided written informed consent.

Medical history was reviewed with the subject and by viewing the Electronic Medical Record for: demographics (including education, yearly income, and current employment status), medical history related to the respiratory system, medication history, and HIV history. Investigators completed a detailed substance use history focused on smoking, illicit drug and alcohol use. Current smoker status was defined as having smoked at least 100 lifetime cigarettes and an average of one cigarette daily in the last week.²² Current smokers then completed a separate questionnaire about readiness to quit and previous attempts to quit. A quit attempt was defined as either having stopped cold turkey for at least 48 h or having used nicotine replacement or medication formally in an attempt. Readiness to quit was quantified using the stages of change model where subjects answered their desire to quit smoking on a scale from 1 to 6. For analysis,

scores of 1 or 2 constituted pre-contemplation stage, 3 was contemplation, 4 or 5 was preparation, and 6 was action as previously described.¹⁵ Subjects then estimated confidence in complete cessation within 1 week and 6 months on a 1 to 10 scale, where 10 meant complete confidence, similar to previous studies of cessation confidence.²³ For analysis, a score of 1–3 defined low confidence, 4–6 moderate confidence, and 7–10 high confidence. Former smoker status was defined as having smoked at least 100 lifetime cigarettes and less than an average of 7 cigarettes within the week preceding enrollment. Never smoker status was defined as having smoked fewer than 100 cigarettes in a lifetime.

A nurse-led cessation program was piloted at CSS in 2010 where all patients were asked about smoking at each clinic visit during weigh-in. Current smokers were given brief cessation counseling and given a handout produced by the New York Smokers Quitline. As part of the program, smokers were offered further resources for cessation. The pilot study ended in 2010, but the program was adopted as part of routine care at CSS, and has continued to date.²¹

Past marijuana use was defined as ever having smoked marijuana, and current use meant smoking within the last month. Current marijuana use was further separated into daily, weekly, or monthly, and an estimate of "joint years" was done where smoking 1 joint volume equivalent daily for one year equaled one joint-year as previously used in studies.^{24,25} Subjects were screened for current (within 1 week) or former (ever) use of inhalants, which included crack cocaine, inhaled crystal methamphetamine, inhaled heroin, nitrates, petroleum products, or aerosols. Intravenous drug use history was recorded as current (within 1 week) or former (ever), and included use of cocaine, heroin, crystal methamphetamine, hallucinogens, or barbiturates. Alcohol use history was documented as never (less than 5 drinks ever), past (no alcohol in the past month), and current (divided into heavy/greater than 5 drinks per week, or occasional/less than 5 drinks per week). The following co-morbid chronic conditions were captured: coronary artery disease, hyperlipidemia, diabetes mellitus, chronic hepatitis C, chronic hepatitis B, active autoimmune disease, and active cancer.

Follow-up. No in-person follow-up was done for this study, but the Electronic Medical Record of each participant was reviewed to assess smoking status and provider assessment or cessation interventions at 3 and 6 months post-enrollment. If follow-up did not occur exactly at 3 or 6 months post-enrollment, a visit that occurred 1 month before or after the expected time was used. Clinicians or clinic staff recorded smoking status as part of routine clinic visits. If no assessment was noted in the provider note, social work notes were reviewed in an attempt to identify smoking status. If the clinician recorded in a note that smoking was discussed, this qualified for "smoking assessed" in this study.

Statistical analysis

Study data were collected and managed using the Research Electronic Data Capture (REDCap) electronic data capture tools hosted at Weill Cornell Medical College.²⁶ STATA version 12 (StataCorp LP, College Station, Texas, USA) was used for statistical analysis. Unpaired Student *t*-tests were used to compare two groups of continuous variables. Continuous

variables from multiple groups were compared using one-way analysis of variance (ANOVA) or Kruskal-Wallis tests, depending on data distribution, and categorical variables were compared using Pearson's χ^2 or Fisher's exact tests. Univariate logistic regression analysis was done to compare characteristics of current and former smokers. A multivariate model was formulated using those variables from the univariate analysis that had p values of less than 0.1. For all analyses, a p value of less than 0.05 was considered statistically significant. For mean stage of change and confidence in cessation comparisons, scores were calculated and compared using Kruskal-Wallis tests and shown with p values for each group with calculated standard error for each smoking trend, displayed with error bars.

Results

A total of 224 individuals were approached and screened for entry criteria, of whom 13 were not interested, and 11 were excluded (5 with documented asthma under treatment, 2 with documented COPD under treatment, 2 with end-stage renal disease, 1 with decompensated cirrhosis, 1 receiving chronic

prednisone therapy). The final study population included 200 subjects. Fifty-eight (29%) subjects were current smokers, 79 (39.5%) were former smokers, and 63 (31.5%) were never smokers. These rates were comparable to the 1 month period prevalence rates at CSS, assessed as part of routine care during the study period, where 31% were smokers, 35% were former smokers, and 34% were never smokers.

Table 1 summarizes the basic demographic information of the study population. The mean age was 49 years old, 84% of subjects were male, 37% were non-Hispanic black, 30% were Hispanic, and 28% were non-Hispanic white. In HIV-related measures, 68% of subjects were men who have sex with men (MSM), 64% had AIDS diagnoses, 97% were receiving antiretroviral therapy (ART), and 72% had an undetectable viral load on the most recent laboratory examination.

Demographic comparison of current, former, and never smokers

Current smokers had higher rates of current unemployment than former or never smokers, and trended towards lower yearly income, and less education (Table 1). No

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS

Characteristic	Smoking status				p Value
	All (n = 200)	Current (n = 58)	Former (n = 79)	Never (n = 63)	
Sex					
Male, n (%)	168 (84)	50 (86)	67 (85)	51 (81)	0.710 ^a
Age					
Mean age in years, n (range, SD)	49 (35–78, 8.2)	49 (35–66, 6.7)	51 (35–77, 8.2)	48 (36–78, 9.2)	0.048 ^b
Race					
White, n (%)	56 (28)	17 (29)	21 (27)	18 (29)	0.810 ^c
Black, n (%)	73 (37)	23 (40)	26 (33)	24 (38)	
Hispanic, n (%)	60 (30)	16 (28)	25 (32)	19 (30)	
Other, n (%)	11 (6)	2 (3)	7 (9)	2 (3)	
Education					
<= High school, n (%)	66 (33)	25 (43)	24 (30)	17 (27)	0.138 ^a
Employment status					
Unemployed, n (%)	113 (56)	41 (71)	30 (51)	32 (51)	0.035 ^a
Income					
<\$20,000/yr, n (%)	144 (72)	47 (81)	58 (73)	39 (62)	0.060 ^a
HIV-related measures					
Risk factor MSM, n (%)	135 (68)	34 (59)	55 (70)	46 (73)	0.223 ^a
Years since HIV diagnosis, mean (SD)	15.2 (6.7)	15.6 (6.6)	15.2 (6.9)	15.0 (6.6)	0.902 ^b
Nadir CD4 (cells/mm ³), mean (SD)	177 (146)	185 (151)	166 (142)	183 (150)	0.752 ^d
Last CD4 (cells/mm ³), mean (SD)	602 (277)	628 (306)	562 (273)	626 (252)	0.270 ^b
AIDS diagnosis, n (%)	127 (64)	38 (66)	51 (65)	38 (60)	0.813 ^a
OI history, n (%)	67 (34)	20 (34)	25 (32)	22 (35)	0.887 ^a
Last viral load undetectable, n (%)	144 (72)	38 (66)	59 (75)	47 (75)	0.427 ^a
Current HAART therapy, n (%)	193 (97)	56 (97)	76 (96)	61 (97)	0.966 ^a
HAART years, mean (SD)	11.2 (5.7)	11.2 (5.5)	12.1 (5.8)	10.2 (5.8)	0.167 ^b
Psychiatric history					
Past/inactive, n (%)	26 (13)	4 (7)	13 (16)	9 (14)	0.302 ^c
Current/active, n (%)	77 (39)	27 (47)	30 (51)	20 (32)	
Never, n (%)	97 (49)	27 (47)	36 (46)	34 (54)	
Co-morbid chronic medical conditions					
1 or more, n (%)	95 (48)	29 (50)	42 (53)	24 (38)	0.183 ^a

^aChi-square; ^bANOVA; ^cFisher's exact; ^dKruskal-Wallis.

BMI, Body Mass Index; HAART, Highly Active Antiretroviral Therapy; MSM, men who have sex with men; OI, Opportunistic Infection.

significant difference existed between groups in HIV-related measures such as CD4 count nadir, years since HIV diagnosis, AIDS diagnoses, ART use, or recent viral load. Groups were similar with regards to number of co-morbid medical conditions and rates of psychiatric illness.

Substance use by smoking status

Table 2 outlines substance use amongst current, former, and never smokers. Groups differed in past and current marijuana use, and although former smokers were more likely to have used marijuana, current marijuana use rates in this group were similar to that of never smokers, implying higher rates of marijuana cessation than that seen for current tobacco smokers. Current tobacco smokers who smoked marijuana ever had higher lifetime exposure to marijuana (mean, 21.1 joint-years) than former (mean, 12.9 joint-years) or never (mean, 9.8 joint-years) ($p=0.01$). Rates of current inhalant use and intravenous drug use were very low, but past use of both substances was higher in current smokers than former or never smokers ($p<0.001$). The majority of subjects drank alcohol occasionally, but patterns of use differed amongst groups. Current and former smokers were more likely to have used alcohol and stopped (past use of 28% in both) than never smokers. Never smokers were more likely to have never used alcohol than former or current smokers.

Comparison of smoking exposure and quit attempts in current and former smokers

Current and former smokers began smoking at a similar age (mean, 19.5 vs. 19.9 years, $p=0.77$) and smoked a similar average number of packs-per-day (mean, 0.76 vs. 0.78 packs-per-day, $p=0.79$). Current smokers had smoked for more years than former smokers (mean, 27.4 vs. 19.0, $p<0.001$) which led to the difference in lifetime pack-years (mean, 20.6 vs. 16.6 pack-years, $p<0.001$). Current smokers had more

lifetime quit attempts than former smokers (mean, 4.53 vs. 3.27, $p=0.04$).

Assessment of factors associated with readiness to quit smoking

Lower education was associated with lower scores of readiness to quit using a Stages of Change model. Forty-three percent of smokers in this study had a maximum education of a high school diploma or less and of these, 60% were in the pre-contemplation stage of change, and 20% were in the action stage of change at baseline, compared to only 24% pre-contemplative and 33% in action for those with some degree of higher education ($p=0.03$). A trend toward lower readiness to quit was observed for those subjects who identified their race as black, where 57% of individuals were pre-contemplative compared to 44% of Hispanic individuals and 26% of white individuals ($p=0.09$). Similar rates of employed and unemployed subjects were in the pre-contemplation stage (35% vs. 41%, respectively), but more employed subjects were in the action stage compared to those who were unemployed (47% vs. 19.5%, $p=0.17$). Income, depression, and current or past use of marijuana, other inhalant drugs, intravenous drugs, and alcohol did not seem to influence readiness to quit in this study.

Assessment of factors associated with estimation of cessation timing

Subjects were asked to estimate on a scale from 1–10 their confidence that they would not be smoking in 1 week and 6 months. Confidence was compared to potential barriers to cessation including substance use, depression, race, education, employment status, and income. No significant associations were found between these potential barriers to cessation and subjects' confidence in cessation 1 week in the future. For confidence in cessation 6 months in the future, lower education (maximum of high school graduation) was

TABLE 2. SUBSTANCE USE BY SMOKING STATUS

Substance	Smoking status				p Value
	All (n=200)	Current (n=58)	Former (n=79)	Never (n=63)	
Marijuana					<0.001 ^b
Past, n (%)	91 (46)	29 (50)	45 (57)	17 (27)	
Current, n (%)	47 (24)	21 (36)	16 (20)	10 (16)	
Never, n (%)	62 (31)	8 (14)	18 (23)	36 (57)	
Joint years ^a , mean (SD)	15.3 (32.0)	21.1 (34.6)	12.9 (28.7)	9.8 (33.3)	0.014 ^c
Inhalant					<0.001 ^b
Past, n (%)	63 (32)	31 (53)	24 (30)	8 (13)	
Current, n (%)	7 (4)	6 (10)	0 (0)	1 (2)	
Never, n (%)	130 (65)	21 (36)	55 (70)	54 (86)	
Intravenous drug use					<0.001 ^b
Past, n (%)	31 (16)	16 (27)	13 (16)	2 (3)	
Current, n (%)	1 (1)	1 (2)	0 (0)	0 (0)	
Never, n (%)	168 (84)	41 (71)	66 (84)	61 (97)	
Alcohol					0.002 ^b
Past, n (%)	42 (21)	16 (28)	22 (28)	4 (6)	
Current, n (%)	135 (68)	39 (67)	49 (62)	47 (75)	
Never, n (%)	23 (12)	3 (5)	8 (10)	12 (19)	

^aJoint years was measured only for those who were current or past users (all, $n=138$; current, $n=50$; former, $n=61$; never, $n=27$); ^bChi-square, ^cKruskal-Wallis.

associated with lower confidence in cessation ($p=0.01$), and trends existed between lower confidence and black race (35% with low confidence compared to 25% for Hispanic and 6% for white individuals), higher confidence and white race (71% highly confident vs. 50% Hispanic, 30% black) ($p=0.09$). Another trend existed between cessation confidence and marijuana use, where past marijuana users were more likely to have moderate or high confidence and current or never marijuana users were evenly dispersed in confidence ($p=0.09$). There was also a trend towards higher lifetime marijuana exposure in the low tobacco cessation confidence group (mean 38.6 joint-years vs. 17.5 in moderate confidence group and 12.6 in high confidence group, $p=0.16$). Income, employment status, inhalant use, intravenous drug use, alcohol use, and depression did not seem to influence 6 month estimation of cessation success.

Comparison of current and former smokers to evaluate theoretical factors associated with cessation

Demographic characteristics and potential barriers to cessation were compared between current and former smokers. In univariate analysis, both being unemployed (OR 2.4, 95% CI 1.2–4.8, $p=0.02$) and having used inhalant drugs in the past (OR 3.4, 95% CI 1.6–7.0, $p=0.001$) were associated with current smoking. Older age was associated with decreased odds of current smoking (OR 0.94 per year, 95% CI 0.91–1.0, $p=0.06$). Current marijuana smoking (OR 2.0, 95% CI 0.92–4.5, $p=0.08$) and lower education (maximum of high school graduation, OR 1.7, 95% CI 0.86–3.5, $p=0.13$) trended towards an association with increased odds of current smoking. In the multivariate model, increasing age (ORadj 0.94, 95% CI 0.89–0.99, $p=0.03$) was associated with decreased odds of current smoking, whereas being unemployed (ORadj 2.4, 95% CI 1.1–5.5, $p=0.048$) and past inhalant use (ORadj 3.1, 95% CI 1.4–7.0, $p=0.01$) were associated with increased odds of current smoking.

Factors associated with smoking trends at follow-up

Of 58 current smokers in the study, 52 had at least a 3 month post-enrollment regularly scheduled clinic visit where smoking was assessed, and 47 had a 6 month post-enrollment clinic visit. Of the six with no follow-up at 3 months, all six missed the 3 month clinic visit completely. Of the 11 subjects with no 6 month follow-up to date, three missed the visit completely and eight had not reached 6 months post-enrollment by the time of data analysis. No statistically significant difference was observed between those with follow-up and those without in sociodemographic characteristics or substance use history. Of 47 individuals with 6 month follow-up, 4 (9%) stopped smoking, 17 (36%) decreased how many cigarettes smoked per day, 21 (45%) continued the same amount of smoking, and 5 (11%) increased the number of cigarettes smoked per day.

Table 3 shows the smoking trend at 6 months post-enrollment by the known potential barriers to smoking cessation. Among those subjects who stopped smoking or continued smoking the same number of cigarettes daily, a significantly higher proportion had never used intravenous drugs ($p=0.03$) compared to those who decreased or increased the number of cigarettes used daily. Conversely, having decreased or increased the level of smoking at 6 months was significantly as-

sociated with having a yearly income of less than \$20,000 at baseline. Although not a statistically significant association, none of the subjects who stopped smoking at 6 months had any history of depression.

Table 4 shows the smoking trend at 6 months follow-up compared to readiness to quit and confidence in cessation at baseline. No statistically significant associations were found, but a trend was noted between higher stages of change (more ready to quit) and either cutting down or stopping cigarette smoking. Although not statistically significant, those subjects who continued at the same level of smoking were most often in the pre-contemplation stage of change (62%) and were generally less confident that they would achieve cessation in 1 week or 6 months.

Figure 1 shows differences in the mean stage of change and confidence in cessation at baseline by actual smoking trends at 6 month follow-up. A statistically significant difference was noted between the mean stage of change at baseline for those who stopped smoking (mean, 4.5; SD 1.9) and for those who cut down (mean, 4.6; SD 1.7), compared to those who continued smoking at the same level (mean, 3.0; SD 1.7, $p=0.03$). Although not statistically significant, there was a suggestion of a difference between the mean confidence in cessation in 1 week and 6 months where those who stopped or cut down may have higher confidence at baseline. The five individuals who increased the level of daily smoking by 6 months had similar readiness to quit and confidence in cessation to those who decreased the level of daily smoking.

Discussion

The prevalence of smoking remains higher in the HIV-infected population than in the general population, and patients with HIV clearly have increased morbidity and mortality associated with smoking.^{3,6} In this study, 29% of enrollees were current smokers, which is markedly lower than other published smoking rates of HIV-infected patients.²³ The lower smoking rate at CSS is likely due to a combination of factors. As outlined previously, a cessation program involving smoking status assessment and referral to a New York State cessation assistance program remains in place at both CSS sites. Patients included in the study were at least 35 years old and did not have known COPD, which could have effects on observed smoking rates. In addition, New York City has instituted major public health campaigns related to smoking, including increased taxation on cigarettes, aggressive anti-smoking media campaigns, limits on sites where smoking is permitted, and free cessation resources, which has effectively lowered the smoking rate in the city to 14%. Although the effect of these measures specifically on the HIV-infected population is unknown, it is likely that these programs influence rates for all people in New York City including those with HIV. The smoking rate at CSS does remain higher than the 19% of the general population who currently smoke,⁵ and it is important, therefore, to focus on understanding reasons and risks for continued smoking in this population, and potential mechanisms for durable cessation.

Substance abuse, mental illness, and socioeconomic issues likely influence rates of smoking and success in cessation in patients living with HIV. In this study, current smokers were more likely than former or never smokers to be unemployed,

TABLE 3. SMOKING TRENDS IN CURRENT SMOKERS OVER TIME (6 MONTH FOLLOW-UP)

Potential barrier to cessation	All (n=47)	Stopped (n=4)	Decreased PPD (n=17)	Same PPD (n=21)	Increased PPD (n=5)	p Value
Marijuana						0.363 ^b
Past, n (%)	21 (45)	2 (50)	8 (47)	10 (48)	1 (20)	
Current, n (%)	19 (40)	1 (25)	8 (47)	6 (29)	4 (80)	
Never, n (%)	7 (15)	1 (25)	1 (6)	5 (24)	0 (0)	
Joint years, mean (SD) ^a	24.5 (37.8)	14.3 (23.4)	23.9 (31.4)	26.8 (50.0)	25.1 (20.9)	0.504 ^c
Inhalant						0.214 ^b
Past, n (%)	27 (57)	1 (25)	12 (71)	10 (48)	4 (80)	
Current, n (%)	6 (13)	0 (0)	2 (12)	3 (14)	1 (20)	
Never, n (%)	14 (30)	3 (75)	3 (18)	8 (38)	0 (0)	
Intravenous drug use						0.025 ^b
Ever, n (%)	12 (26)	0 (0)	8 (47)	2 (10)	2 (40)	
Never, n (%)	35 (74)	4 (100)	9 (53)	19 (90)	3 (60)	
Alcohol						0.637 ^b
Past, n (%)	11 (23)	0 (0)	5 (29)	6 (29)	0 (0)	
Current, n (%)	33 (70)	4 (100)	10 (59)	14 (67)	5 (100)	
Never, n (%)	3 (6)	0 (0)	2 (12)	1 (5)	0 (0)	
Depression						0.804 ^b
Past, n (%)	12 (26)	0 (0)	4 (23)	6 (29)	2 (40)	
Current, n (%)	5 (11)	0 (0)	3 (18)	2 (10)	0 (0)	
Never, n (%)	30 (64)	4 (100)	10 (59)	13 (62)	3 (60)	
Race						0.690 ^b
White, n (%)	15 (32)	2 (50)	6 (35)	4 (19)	3 (60)	
Black, n (%)	18 (38)	1 (25)	6 (35)	9 (43)	2 (40)	
Hispanic, n (%)	12 (26)	1 (25)	5 (29)	6 (29)	0 (0)	
Other, n (%)	2 (4)	0 (0)	0 (0)	2 (10)	0 (0)	
Education						
<=High school, n (%)	21 (45)	0 (0)	7 (41)	12 (57)	2 (40)	0.236 ^b
Employment status						
Unemployed, n (%)	33 (70)	1 (25)	14 (82)	14 (66)	4 (80)	0.159 ^b
Income						
<\$20,000/yr, n (%)	39 (83)	2 (50)	17 (100)	15 (71)	5 (100)	0.015 ^b

^aJoint years was measured only for those who were current or past users (all, n=40; stopped, n=3; decreased, n=16; same, n=16; increased, n=5); ^bFisher's exact; ^cKruskal-Wallis.

PPD, packs-per-day tobacco.

TABLE 4. SMOKING OVER TIME BY SUBJECT READINESS AND CONFIDENCE IN CESSATION (6 MONTH FOLLOW-UP)

	All (n=47)	Stopped (n=4)	Decreased PPD (n=17)	Same PPD (n=21)	Increased PPD (n=5)	p Value
Readiness to quit						0.096 ^a
Pre-contemplation, n (%)	18 (38)	1 (25)	2 (12)	13 (62)	2 (40)	
Contemplation, n (%)	6 (13)	0 (0)	3 (18)	2 (10)	1 (20)	
Preparation, n (%)	8 (17)	1 (25)	4 (24)	2 (10)	1 (20)	
Action, n (%)	15 (32)	2 (50)	8 (47)	4 (19)	1 (20)	
One week cessation confidence						0.280 ^a
Low, n (%)	21 (45)	0 (0)	7 (41)	12 (57)	2 (40)	
Moderate, n (%)	9 (19)	2 (50)	2 (12)	4 (19)	1 (20)	
High, n (%)	17 (36)	2 (50)	8 (47)	5 (24)	2 (40)	
Six month cessation confidence						0.230 ^a
Low, n (%)	11 (23)	0 (0)	3 (18)	8 (38)	0 (0)	
Moderate, n (%)	12 (26)	1 (25)	3 (18)	5 (24)	3 (60)	
High, n (%)	24 (51)	3 (75)	11 (65)	8 (38)	2 (40)	

^aFisher's exact.

PPD, packs-per-day tobacco.

FIG. 1. Baseline mean readiness to quit and cessation confidence, by smoking trend over 6 months.

and our results suggest a possible link between current smoking and lower education and lower income. These socioeconomic factors are related, and understanding that HIV-infected patients in lower socioeconomic groups might be more likely to smoke could help to focus resources towards smoking education and cessation program strategies in these groups. Substance use was strongly correlated with smoking status, where current smokers were more likely to be currently using, or have a history of using marijuana, other inhaled drugs, and intravenous drugs. Even after controlling for age, past inhalant use and current marijuana use were associated with current smoking. In addition, current smokers smoked more marijuana than former or never smokers. Understanding these associations may allow a provider to use smoking status as a trigger to assess use of other substances, or utilize a cessation mechanism that includes all substances. Smoking cessation may be far from a patient's mind if co-addiction with other substances is ongoing and not discussed. Each of the aforementioned substances has an impact on health alone, but more research is needed to understand the negative interactions with smoking, especially in the lung, since so many patients use multiple inhaled substances.

While complete cessation of smoking is the goal and the most powerful determinant of improved health outcomes related to smoking,²⁷ decreasing the amount of tobacco smoked in a day may still be important for health and could be a more attainable short term goal for many patients, as well as a natural progression through the stages of change to cessation.²⁸ Of the 47 subjects with 6 month follow-up, a significant proportion (45%) were able to cut down or stop smoking. Although the numbers were too low to make a strong correlation, a close look at the results of this study reveal that subjects who were able to stop smoking at 6 months had fewer of the known barriers to smoking cessation, including intravenous drug use history, depression history, and lower education. No significant associations were found between readiness to quit or confidence in

future cessation with smoking trend over time, but a review of the data suggests that those subjects who were able to stop smoking or cut down were clustered towards the higher stages of change (preparation/action) and higher confidence in cessation, whereas those who continued smoking the same number of cigarettes or increased were clustered towards lower stages of change and lower confidence. This adds strength to the idea that patients who are ready to quit are the ones who will quit. However, it also perhaps allows providers to feel confident that discussing smoking cessation with patients at any stage of change or confidence could result in patients cutting down tobacco use. While using a tailored cessation approach remains controversial,¹⁶ and long term, sustained cessation is the goal, providers should be aware of the potential benefits of cutting down cigarette use, and depending on patient readiness, alter the short term goal appropriately.

Nearly half of enrolled subjects had a diagnosis of mental illness at some point in life, and although no strong correlation was found between psychiatric history, or specifically depression, and smoking status, readiness to quit, or confidence in future cessation, numbers were small and this remains an important factor when discussing smoking cessation in this population.

No specific smoking cessation intervention was done in this study, but just asking a detailed smoking history including questions about readiness to quit, confidence in quitting, reasons for continued smoking, and undergoing peak flow measurement led to discussions about the dangers of smoking and may have had some influence on cessation. Notably, the cessation rate in this study at 6 months follow-up (9%) where no specific intervention was done, was similar to rates from control groups receiving nicotine replacement in studies of various more extensive smoking cessation programs.^{17-19,29} Also, the rate of decreased daily cigarette use at 6 months in this study was 36%, an encouraging number.

Our study has several limitations. Enrollment was done via convenience sampling, and although efforts were made to

enroll from a variety of means, the study population was open to bias from sampling. The study size was relatively small, and additional associations may have been possible with more enrollees. Only patients who were at least 35 years old were included, and patients with documented asthma were excluded because of the larger COPD screening study, which could influence the smoking rate found in this study, and limits generalizability to the overall HIV-infected population. The majority of subjects were men who have sex with men, and this population subset may have different smoking behaviors and face different barriers to cessation. Our study population likely had high rates of adherence to antiretroviral therapy, based on the high proportion with suppressed HIV viremia; this may be a marker for adherence to clinic appointments and therapy in general, which could alter smoking rates and cessation potential. Definitions of smoking status were carefully delimited using 100 lifetime cigarettes as the definition of ever-smoker, but to differentiate current versus former smokers, a variation of the definition of current smoker was used to allow for more specific quantification of cigarette use. The confidence in cessation measure is based on previously validated scales but differs in that subjects were asked about current confidence in future cessation, and an arbitrary division was made to define low versus high confidence. Despite the lack of specific validation, we believe these definitions allowed for accurate assessment of smoking status and cessation confidence. Formal self-efficacy measures have been used to describe similar cessation concepts, and although not used in this study, these would add to the strength of results.^{30,31} Follow-up was not complete leading to missing data from several baseline smokers, and follow-up data were obtained via chart review. Data on smoking status were entered by ancillary staff at the time of check-in and by providers as documented in notes, but because of the nature of data entry in the use of EMR, there is a possibility that quantification of cigarette use was subject to staff recall. Because smoking status and follow-up smoking trend were assessed by clinic staff and providers, and because smoking information is ultimately by self-report and not confirmed by laboratory testing, results should be interpreted in that context. Detailed data on provider prescription of or subject use of tobacco cessation pharmacotherapy were not examined for this study. Recent data have shown effectiveness of several medications to assist in cessation in the HIV-infected population, but assessing the effectiveness of these interventions was beyond the scope of this study.^{6,32} Discussing or using these interventions may alter a patient's readiness to quit or confidence in cessation.

Further studies are needed about the utility of tailored cessation programs in HIV-focused clinic settings, and this study provides some justification to focus resources if possible towards patient populations in lower socioeconomic groups, understanding that co-morbid substance use is very common with HIV and may influence cessation, and perhaps to having stage of change (readiness to quit) appropriate discussions about goals of decreasing cigarette use.

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