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Cigarette Smoking among HIV+ Men and Women: Examining Health, Substance Use, and Psychosocial Correlates across the Smoking Spectrum

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Abstract

The prevalence of cigarette smoking among HIV+ individuals is greater than that found in the general population. However, factors related to smoking within this population are not well understood. This study examined the associations between smoking and demographic, medical, substance use, and psychosocial factors in a clinic-based sample of HIV+ men and women. Two hundred twelve participants completed self-report measures of tobacco use, HIV-related symptoms, viral load, CD4, alcohol and illicit drug use, depression, and social support. Multinomial logistic regression analyses modeled the independent associations of the cross-sectional set of predictors with smoking status. Results indicated that 74% of the sample smoked at least one cigarette per day; using standard definitions, 23% of the sample were light smokers, 22% were moderate smokers, and 29% smoked heavily. Smoking was associated with more HIV-related symptoms, greater alcohol and marijuana use, and less social support. Light smoking was related to minority race/ethnicity and less income; moderate smoking was associated with less education; and heavy smoking was related to less education and younger age. Viral load, CD4 count, and depression were not associated with smoking status. Psychosocial interventions targeting this population should consider the relationships between biopsychosocial factors and smoking behavior.

Keywords

smoking; cigarette; HIV+; social support

High Smoking Prevalence among HIV+ Men and Women: Examining Health, Substance Use, and Psychosocial Correlates across the Smoking Spectrum

Smoking is highly prevalent among persons living with HIV and may contribute to premature morbidity and mortality. Among HIV+ individuals, prevalence rates of smoking range from 50% to 70% (Burkhalter et al., 2005; Miguez-Burbano et al., 2005; Niaura et al., 2000) compared to 21% for the general population (CDC, 2005). Smoking is strongly associated with two of the primary causes of illness and death in HIV+ patients: community-acquired pneumonia (CAP) and *Pneumocystis jiroveci* pneumonia (formerly known as *Pneumocystis ciroveci*; Arcavi & Benowitz, 2004; Miguez-Burbano et al., 2005). HIV+ smokers are also at increased risk for oral lesions (Palacio et al., 1997), periodontal disease (Arcavi & Benowitz,

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2004; Beck & Slade, 1996), and AIDS-related spontaneous pneumothorax (Metersky et al., 1995).Young smokers infected with HIV may be particularly vulnerable to malignant tumors, such as lung cancer (Patel et al., 2006; Spano et al., 2004). Moreover, smoking by HIV+ patients may facilitate the progression to Acquired Immune Deficiency Syndrome (AIDS) (Neiman et al., 1993).

Evidence also suggests that smoking has adverse effects on the health-related quality of life (HRQL) of HIV+ men and women. Vidrine et al. (2006) tested a framework for HRQL of life among HIV+ individuals. They found that HRQL is influenced by relationships among physical symptoms, and cognitive, psychological, and social functioning (Brenner et al., 1995; Wilson & Cleary, 1995). They also found that smoking, alcohol use, and SES impair overall HRQL. Other work has also found relationships between smoking and lower HRQL in HIV+ (Turner et al., 2001) and non-HIV+ samples (Crothers et al., 2005; Strine et al., 2005).

The model developed by Vidrine et al. (2006) was used as a heuristic guide for the current study. We investigated correlates of tobacco smoking at the physical, social, psychological and behavioral levels in a sample of HIV+ patients. We hypothesized that smoking among HIV+ people would be associated with markers of HIV disease progression (e.g., CD4 count, viral load). There is mixed support for the association between smoking and a decrease in CD4 count, with some research suggesting that there is no association (Gritz et al., 2004), and other studies finding decrements in CD4 counts as a function of smoking status (Royce & Winkelstein, 1990; Wewers et al., 1998). In a large-scale longitudinal study, Feldman et al. (2006) found that HIV+ female smokers – who were prescribed antiretroviral therapy (HAART) – had poorer immunologic and viral responses. Relative to non-smokers, these smokers also had a greater likelihood of developing AIDS-defining conditions (ADCs) and death.

Smoking may also exacerbate HIV-related symptoms. HIV+ patients are vulnerable to a variety of symptoms (e.g., cough, respiratory problems, dizziness) affected by smoking. These symptoms are common among smokers, but might be worsened among people with HIV. Such HIV-related symptoms could be manifestations of opportunistic infections or the faster progression of smoking-related diseases. For instance, respiratory problems may be a sign of emphysema, which may be hastened among smokers infected with HIV (Diaz et al., 2000). Increases in the number and severity of medical symptoms may also impair health-related quality of life (HRQL) (Bing et al., 2000; Hays et al., 2000). These findings highlight the need to understand the association of smoking with HIV-related symptoms.

Little is known regarding psychosocial factors that increase HIV+ patients' propensity to smoke. Persons living with HIV experience elevated rates of depression (Pence et al., 2006). Thus, the prevalence of smoking among HIV+ people may be related to patients' attempts to reduce negative affect and other symptoms of distress (Reynolds et al., 2004). There is an established relationship between smoking and depression in the general population (Breslau et al., 1991; Brown et al., 2000; Covey et al., 1998; Quattrocki et al., 2000). However, little research has explored this relationship among people with HIV.

Because HIV is a stigmatized illness (Vanable et al., 2006), many infected men and women also experience a loss of social support following diagnosis (Gostin & Webber, 1998). The positive relationship between social support and improved health is well-established (House, 1987), with studies providing evidence that social support is positively related to immune functioning in HIV patients (Dixon et al., 2001; Theorell et al., 1995). In contrast, lack of social support is associated with the use of avoidant coping strategies among HIV+ gay and bisexual men (Tate et al., 2006) and depression among HIV+ patients (Lyketsos et al., 1996; Murphy

et al., 1991). Lack of social support may also contribute to elevated rates of smoking. Indeed, research suggests that one of the mechanisms linking deficits in social support to increased risk for mortality is its relationship with health behaviors such as smoking (Kaplan et al., 1994; Lewis & Rook, 1999). However, studies examining the influence of social support on the smoking status of HIV+ individuals are lacking.

In addition, alcohol and other drug use may also influence smoking among persons living with HIV. Previous research documents a robust association between alcohol use and smoking in the general population (e.g., Dierker et al., 2006; Wetzels et al., 2003) and among psychiatric patients (Vanable et al., 2003). For example, drinking and smoking frequently co-occur, with most smokers also consuming alcohol (e.g., Hoffman et al., 2001) and 80% of dependent drinkers smoking (Patten et al., 1996). Heavy alcohol use is associated with decreased medication adherence and viral suppression among HIV+ persons (Chander, Lau, & Moore, 2006). Population-based estimates of drinking suggest that over 50% of HIV+ people consume alcohol, and 15% of these are heavy drinkers (Galvan et al., 2002), but we are aware of only one study documenting the association of alcohol use and smoking among persons living with HIV. In a cross-sectional survey of smoking in a low-income, multiethnic sample of HIV+ patients, Gritz et al. (2004) found that daily smoking was associated with heavy alcohol use. In addition, illicit drug use is an important factor in the acquisition of HIV, and a substantial proportion of HIV+ individuals do not completely abstain from use following diagnosis (Lucas et al., 2006). Marijuana use, in particular, is used at a high rate for recreational and medicinal purposes (Furler et al., 2004; Prentiss, Power, Balmas, Tzuang, & Israelski, 2004). Evidence linking any drug use and smoking in this population is mixed, with some research finding no relationship (Gritz et al., 2004) and others finding a positive relationship (Burkhalter et al., 2005).

The Current Study

With recent medical advances HIV is now considered a chronic illness, rather than a catastrophic disease (Halloran, 2006). Indeed, life expectancy estimates for persons living with HIV now mirror those seen among patients with type 1 diabetes (Lohse et al., 2007) Given extended life-expectancies for persons living with HIV, health-related complications and premature mortality associated with smoking are of much greater concern than it was earlier in the epidemic. Thus, an understanding of biopsychosocial factors associated with smoking among HIV+ people is important for the development of medical, psychological, and quality of life-related interventions. We did not conduct a direct test of HRQL among HIV+ patients per se; rather, we sought to test the relationships between factors that are associated with quality of life and the degree of smoking. This issue has important implications for assessment and intervention. Many people with HIV want to improve their health (Collins et al., 2001); and, developing effective smoking cessation interventions is particularly important in this population. The few extant studies of smoking cessation interventions among HIV+ smokers have shown promise (Vidrine et al., 2006; Wewers et al., 2000), and a better understanding of psychological and health status correlates of smoking among HIV+ people could enhance existing interventions. Thus, the overarching goal of this study was to examine the independent contributions of multi-level factors on concurrent smoking behavior.

Our primary aims in this study were (1) to confirm the elevated smoking rates observed in prior samples (e.g., Burkhalter et al., 2005; Miguez-Burbano et al., 2005; Niaura et al., 1999) and (2) to examine demographic, health, alcohol use, and psychosocial correlates of cigarette smoking among HIV+ men and women. Previous research suggests that the prevalence of smoking among men who have sex with men is higher than the general population of men (31% to 50% vs. 24%; Greenwood et al., 2005; Ryan et al., 2001; Stall et al., 1999); thus, we also considered this as a demographic correlate.

Many investigators regard smokers as a single, homogeneous group, and use categories such as smoker/ex-smoker/never smokers or any smoking/no-smoking (Furberg et al., 2005; White et al., 2004). National surveys define smokers as having a lifetime history of smoking at least 100 cigarettes and currently smoking on some days or daily (e.g., Barnes & Schiller, 2006). However, regular smokers are highly heterogeneous (Furberg et al., 2005) and level of cigarette use may be an important consideration. For instance, smoking pattern typically differs by racial group (Stellman et al., 2003; USDHHS, 1989; White et al., 2004). And smoking even one cigarette per day may be harmful to individuals with compromised immune functioning. Therefore, consistent with prior research (Okuyemi et al., 2000, 2004), we classified participants as: nonsmokers (no smoking for at least one month); light smokers (1-10 cigarettes daily); moderate smokers (11-19 cigarettes daily); or heavy smokers (≥ 20 cigarettes daily). We hypothesized that (a) compared to nonsmokers, light, moderate, and heavy smokers would have fewer years of education, lower income, older age, and MSM status; we also expected a dose-response relationship such that (b) increasing levels of smoking would be negatively related to CD4 count, and positively related to viral load status and HIV-related symptoms; (c) heavier smoking would be related to greater alcohol use frequency and quantity, and illicit drug use; and (d) level of smoking would be related to depression and lower social support.

Method

Participants

For this study we obtained data that were collected as part of a survey study of health behaviors and psychological adjustment among HIV+ men and women (Vanable et al., 2006). Eligibility criteria were (1) 18 years of age or older, (2) HIV+, (3) English speaking, and (4) able to provide informed consent. Three-hundred fourteen eligible patients from a university-based infectious disease clinic over a 16-month period from July 2001 to January 2003 were invited to participate. Two-hundred forty (76%) agreed, and 221 completed the survey. Nine participants did not provide a response to items that assessed current smoking and were therefore excluded from the study, yielding a final sample size of 212.

Participant age ranged from 21 to 64 years (M = 41, SD = 7.85). The sample was 57% male, and 74% were unmarried. Thirty-seven percent self-identified as gay or bisexual males. Forty-five percent self-identified as Caucasian, and 43% identified themselves as African American. The mean level of education was 11.81 years (SD = 2.22). The average monthly income was $880 ($SD$ = 711). Whereas 63% indicated that they contracted HIV through sexual intercourse with a male, 9% reported that intercourse with a female was the transmission route. The remaining participants indicated that they likely contracted HIV via needle sharing (14%), blood transfusion (11%), other (1%), or an unknown route (2%). According to medical chart, 64% of participants had a detectable viral load at the time of the survey and 43% had been diagnosed with AIDS. Finally, 79% of patients had been prescribed HAART.

Procedure

Clinic nurses introduced the study to patients and obtained verbal consent to speak with research staff. A trained research assistant (RA) explained the nature of the study to interested patients, who provided written informed consent. Most participants completed a self-administered survey; however, a subset of low-literacy participants completed the measures using an audio computer-assisted self-interview (9%) or a face-to-face (7%) interview with an RA. Participants were paid $10 for participation.

Measures

Participants completed a battery of questionnaires that included hypothesized demographic, health, alcohol, and psychosocial correlates of cigarette smoking.

Demographics

We assessed age, gender, years of education, race/ethnicity, sexual orientation, and monthly income using standard items. Education, age, and income were measured using continuous scales. Ethnic background was assessed using a categorical scale: (1) African American, (2) Caucasian, (3) Hispanic, (4) Native American, (5) Asian/Pacific Islander, and (6) other. Twelve percent of participants self-identified as Native American, Asian/Pacific Islander, or other; none identified as Hispanic. Thus, we formed two categories: Caucasians vs. all other races.[1] A dichotomous indicator differentiated men who reported having sex with other men (i.e., MSM) from other participants.

Health status variables from medical chart review

Participants' medical records were reviewed for viral load. A dichotomous indicator was created to categorize detectable (i.e., viral load > 50) versus undetectable (≤ 50) viral loads. Medical chart data for CD4 count was included as a continuous variable. Higher CD4 counts indicated better health status.

HIV Symptom Index (Justice et al., 2001)

HIV-related symptoms were assessed using a validated measure of symptom frequency and quantity. The 20-item instrument asked about symptoms over the past month on a five-point scale: (0) I do not have this symptom, (1) I have this symptom and it doesn't bother me, (2) it bothers me a little, (3) it bothers me a lot, or (4) it bothers me terribly. The degree of HIV symptoms was the mean score for the composite of the 20 items. The internal consistency of the measure in the current sample was .92.

Alcohol use

Drinking *quantity* was assessed by asking respondents to indicate the number of alcoholic drinks consumed on the average day (“Over the past month, how many alcoholic drinks have you drunk on the average day?”). One alcoholic beverage was defined as a 12 ounces of beer, four ounces of wine, or one ounce of hard liquor. An open-ended response format was used. Drinking *frequency* was assessed by asking participants to report the typical number of days per week that they consumed any amount of alcohol (“On average, on how many days during a typical week do you have one or more drinks of alcohol?”). Response options were on an eight-point scale ranging from zero to seven.

Illicit drug use

Marijuana use (past year) was assessed by asking respondents to indicate whether they had smoked marijuana at least once (Yes or No). Crack use in the past year was assessed by asking respondents to indicate whether they had used crack cocaine at least once during that time (Yes or No).

Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977)

The frequency of depressive symptoms was assessed with the CES-D. This instrument has established reliability and validity (Radloff, 1977) and has been used in research with HIV+ samples (e.g., Ickovics et al., 2001; Moskowitz, 2003). Participants rated depressive symptoms on a four-point scale: (0) rarely or none of the time, (1) some or a little of the time, (2) occasionally or a moderate amount of time, or (3) most or all of the time. We modified the CES-D to eliminate possible confounding with items on the HIV Symptom Index (see

[1]When the 26 participants who identified themselves as Asian, Native American, or other were excluded from the analyses, the pattern of results did not differ.

Kalichman, Sikkema, & Somlai, 1995). We focused on the cognitive-affective items exclusively (i.e., three items asking about appetite, concentration, and sleep were omitted). The total score of the remaining 17 items was used for analyses. This measure demonstrated good internal consistency (alpha = .84) in the present sample.

Social support

Perceived social support was measured by 15 Likert scale items asking about emotional and instrumental support from others (i.e., partner or spouse, friends, and family) (Alferi et al., 2001). Items pertained to illness-related assistance. The same items were asked for each support source and were rated on a five-point scale with three anchors: (1) not at all, (3) somewhat, and (5) a lot. Examples of these questions included: "How often can you count on your partner, spouse, or significant other to help carry out daily chores when you're not feeling well," "Ωlet you talk about your illness," Ωhelp with any financial problems caused by your illness," and "Ωhelp you take your medication as prescribed." This scale was scored by averaging items, with higher scores indicating greater perceived social support. The instrument demonstrated excellent internal consistency (alpha = .90) in the current sample. For patients without a spouse or partner (50%), an average score was computed across data points that were available so that all participants had a social support score.

Cigarette smoking

Participants were classified into categories of smoking according to self-reports of the number of cigarettes smoked daily. Participants responded to the following item, "Over the past month, how many cigarettes have you smoked on the average day?" Using the categories of smoking described by Okuyemi et al. (2000, 2004), participants were considered nonsmokers (0 cigarettes per day; cpd), light smokers (1-10 cpd), moderate smokers (11-19 cpd) or heavy smokers ($\geq$ 20 cpd). This classification system has the advantage of retaining all cases in the analyses, versus arbitrarily excluding participants who do not smoke a certain number of cigarettes per day.

Analyses

First, we examined whether mode of survey administration influenced the results using one-way analyses of variance (ANOVAs) and chi-square tests. Second, descriptive analyses compared mean scores for each smoking subgroup on the hypothesized correlates using ANOVAs and chi-square tests. Third, we conducted multinomial logistic regression (MLR) analyses to model smoking status (nonsmokers served as the reference category). Fifteen percent of participants had at least one missing variable, which are automatically excluded from logistic regression. The findings did not differ when missing data was replaced via linear interpolation; thus, the model excluding these patients is presented here. The odds of smoking were determined by the odds ratio (OR), with 95% confidence intervals (CI). We also assessed multivariate multicollinearity by examining the standard error of beta statistic for each variable, the bivariate correlation, and the variance inflation factor (VIF; Belsley et al., 1980).

Because the distribution of drinking quantity was significantly skewed (skewness = 4.21, *SE* = .17), with some participants reporting a large number of drinks during a single episode (range = 0 to 25), drinking quantity was truncated at 10 (98^{th} percentile), and the variable was transformed using the logarithm ($\log_{10} + 1$). This transformation substantially improved the normality of the distribution (skewness = .97, *SE* = .17). There were also a large range for CD4 counts (0 to 1601) and several extreme values. Thus, we truncated CD4 count values at 1406 (98^{th} percentile), resulting in sufficient improvement in distribution normality (skewness = .79, *SE* = .17).

Results

Descriptive Findings

Comparisons of tobacco use and the hypothesized correlates across modes of survey administration revealed no differences (all *p*s > .05). Also, current HAART use was unrelated to smoking status. Four percent and 10% of participants reported injection drug or cocaine use during the past year, respectively. In contrast, 42% reported past year marijuana smoking, and 26% reported crack use in the past year. Table I summarizes these characteristics by smoking status. The proportions of light, moderate, and heavy cigarette smoking were 25%, 22%, and 27%, respectively. Thus, 74% of the sample reported smoking at least one cigarette per day in the previous month. The mean number of cigarettes smoked per day (cpd) among light smokers was five (*SD* = 2.22). Moderate smokers reported an average of 12 cpd (*SD* = 2.42), and heavy smokers had a mean of 24 cpd (*SD* = 11.60).

Group Differences in Demographic, Medical, Alcohol Use, and Psychosocial Factors

One-way ANOVAs revealed group differences in income across smoking categories, F (3, 204) = 5.83, $p < .01$. Post hoc tests indicated that nonsmokers reported higher income than light, moderate, and heavy smokers. Group differences also emerged in education, F (3, 207) = 6.34, $p < .001$, and age, F (3, 205) = 3.07, $p < .05$. Specifically, nonsmokers had more education and were older than participants in all other smoking categories. Chi-square analyses revealed group differences in smoking status based on race/ethnicity, χ^2 (3, N = 212) = 31.21, $p < .001$. Among ethnic minority participants, 19% were nonsmokers, 36% were light smokers, 28% were moderate smokers, and 17% were heavy smokers. Among Caucasians, 35% were nonsmokers, 11% were light smokers, 15% were moderate smokers, and 39% were heavy smokers. Smoking status did not differ by MSM status or gender. One-way ANOVAs revealed differences in HIV-related symptoms by smoking category, F (3, 207) = 3.37, $p < .01$; that is, nonsmokers reported fewer symptoms compared to light and heavy smokers. There were no differences in viral load or CD4 counts by smoking category.

There were also group differences in drinking quantity, crack and marijuana use in the past year. Nonsmokers reported consuming fewer drinks per occasion compared to moderate and heavy smokers, F (3, 205) = 2.92, $p < .05$. Light, moderate and heavy smokers reported higher rates of crack [χ^2 (3, N = 208) = 8.13, $p < .05$] and marijuana use [χ^2 (3, N = 209) = 19.45, $p < .001$] compared to nonsmokers. Finally, there were differences in symptoms of depression across smoking categories, F (3, 198) = 5.76, $p < .01$; nonsmokers reported fewer symptoms of depression compared to light and heavy smokers, whereas light and heavy smokers reported more depressive symptoms than moderate smokers. There were no group differences in social support or drinking frequency.

Multivariate Correlates of Cigarette Smoking

Using multinomial logistic regression, we tested the ability of the independent variables to predict smoking classification. First, we found no evidence of multicollinearity, as none of the bivariate correlations exceeded .80 and the VIFs were all < 4 (not displayed). Second, we examined the odds of light smoking status versus classification as a non-smoker. As shown in Table II, compared to nonsmokers, light smoking was associated with income and race/ethnicity. The beta weights indicated that the strongest demographic correlate of light smoking was being an ethnic minority ($p < .05$), followed by less monthly income ($p < .05$). Light smoking was also associated with drinking quantity; that is, the odds of light smoking were higher with more drinks per occasion ($p < .05$). Of the illicit drug use factors, light smoking was related to marijuana use in the past year ($p < .05$). Light smoking was not associated with gender, education, MSM status, CD4, viral load, HIV-related symptoms, drinking frequency, depression, or social support.

Third, we examined the odds of moderate smoking status. Also displayed in Table II, compared to nonsmokers, moderate smoking was associated with education and race/ethnicity ($p = .05$). Specifically, moderate smokers were more likely to have fewer years of education ($p < .04$) and be non-white. Of the medical variables, moderate smoking was associated with more HIV symptoms ($p < .05$). Of the alcohol use variables, being a moderate smoker was associated with drinking quantity, with increasing odds with a greater number of drinks ($p < .05$). Moderate smoking was also positively related to marijuana use ($p < .05$). Moderate smoking was not associated with gender, education, income, MSM status, CD4 count, viral load, drinking frequency, depression, or social support.

Finally, we evaluated the odds of heavy smoking. As can be seen in Table II, compared to not smoking, heavy daily smoking was associated with younger age ($p < .05$), fewer years of education ($p < .01$), having more HIV symptoms ($p < .05$), and drinking quantity per occasion ($p < .05$). Perceived social support was also associated with heavy smoking status such that heavy smokers reported having less social support compared to nonsmokers ($p < .05$). Heavy smoking was not related to age, gender, income, race, MSM status, CD4, viral load, drinking frequency, illicit drug use, or depressive symptoms.

Discussion

This study examined the prevalence and correlates of smoking in a clinic-based sample of men and women living with HIV. We found that the prevalence of smoking one or more cigarettes per day was 74%. The prevalence of “regular smoking” (typically defined as ≥ 10 cigarettes per day; Moolchan et al., 2005; Slovinec D' Angelo et al., 2005;Volpp et al., 2006; Zvolensky et al., 2005) was 49%, substantially higher than the national average of 21% (CDC, 2005). These elevated rates corroborate previous research that has estimated smoking rates among HIV patients to be as high as 70% (Burkhalter et al., 2005; Miguez-Burbano et al., 2005; Niaura et al., 1999).

Given the chronicity and severity of an HIV diagnosis, many HIV+ men and women may minimize the impact of smoking on their health (Feldman et al., 2006; Reynolds et al., 2004). In addition, practitioners may be hesitant to recommend quitting to patients coping with the many challenges associated with HIV (Mamary et al., 2002). However, evidence suggests that smoking is especially harmful to persons living with HIV (e.g., Arcavi & Benowitz, 2004; Neiman et al., 1993). Moreover, recent data suggest that persons infected with HIV can expect to live much longer than previously thought (i.e., 35 years on average; cf. Lohse et al., 2007). Given these data, the high smoking rate warrants increased concern and attention directed towards the development of cessation program for HIV+ people.

Smoking also has a negative impact on the HRQL of patients with HIV (Vidrine et al., 2006). However, few prior studies have delineated health and psychosocial correlates of cigarette use among HIV+ people. Burkhalter et al. (2005) determined that HIV+ smokers were more likely to report lower health risk perceptions for smoking, illicit drug use, and less pain compared to nonsmokers. The current study adds to this developing body of knowledge by using a biopsychosocial approach to examine factors associated with the levels of smoking behavior in this population. We hypothesized that demographic, medical, substance use, and psychosocial variables would be associated with each level of smoking. In the multivariate analysis, light smoking was associated with less income, and non-white ethnicity. Compared to not smoking, moderate smoking was also associated with less education and minority race/ethnicity. The odds of heavy smoking were greater among participants with less education and younger age. Across analyses, MSM status was not associated with a greater likelihood of smoking. This contrasts with Greenwood et al. (2005), who found that MSM were more likely than heterosexual men to be current smokers. However, this inconsistency may reflect method

differences; that is, we did not directly contrast heterosexual men with MSM (due to limited sample size); instead, our analyses contrasted MSM with all others (i.e., heterosexual men combined with all women).

In terms of light smoking, the findings are consistent with research on this subgroup of smokers in the general population. Seventy-nine percent of light smokers were ethnic minorities (88% of minorities were African American). African-American smokers in particular tend to fall in the category of light or occasional smokers (Okuyemi et al., 2002). Although symptoms did not differ between light smokers and nonsmokers, research suggests that African Americans are more likely to be diagnosed with smoking-related illnesses (Haiman et al., 2006; USDHHS, 1998) despite their lower levels of smoking. Our findings also corroborate research suggesting that smoking is related to fewer years of education (Droomers et al., 2000; Gritz et al., 2004). The finding that light smokers were likely to be younger than nonsmokers is in contrast with a recent study of HIV+ people (Gritz et al., 2004), but is consistent with previous research with the general population (e.g., Hammond, 2005). Thus, the pattern of demographic correlates of smoking in this study is generally consistent with Gritz et al. (2004) and differences may reflect method variability (i.e., Gritz et al. defined current smoking as a history of smoking ≥ 100 cigarettes, lifetime, and smoking on at least some days whereas we operationalized smoking based on the average number of cigarettes smoked daily).

Findings also confirm an association between medical status variables and smoking status. Specifically, HIV-related symptoms were linked to smoking. Moderate and heavy smokers reported greater frequency and degree of physical symptoms compared to nonsmokers. To our knowledge, no previous research has examined this relationship and the mechanisms linking smoking with increased physical symptoms are unknown. Although causal interpretation is not warranted, perhaps smoking-related symptoms, such as dizziness, cough, and shortness of breath, are heightened due to immune system vulnerability among HIV patients. Previous research suggests that smoking places patients at increased risk for cognitive (Burns et al., 1996) and lung-related (Miguez-Burbano et al., 2005) problems. By increasing patients' vulnerability to health problems, smoking may further weaken their resistance to infection (Patel et al., 2006), and contribute to an accelerated progression to AIDS (Nieman et al., 1993).

We did not find associations among CD4 count, viral load, and smoking behavior, consistent with recent research (Feldman et al., 2006; Gritz et al., 2004). Thus, evidence from this study suggests that smoking may exacerbate specific HIV-related symptoms, but provides no direct evidence for an association of smoking to markers of disease progression. Additional studies, involving longitudinal designs can help to clarify the long term impact of smoking on symptoms and disease progression.

There is an established relationship between alcohol consumption and smoking in the general population (Dierker et al., 2006; Wetzels et al., 2003). However, few data are available with HIV+ patients. We examined two drinking-related variables as cross-sectional predictors of smoking status: drinking quantity and frequency. Our findings demonstrated a similar pattern of associations across the three smoking classifications. The odds of smoking were increased by more intense drinking. That is, smokers were likely to have more drinks per occasion than nonsmokers, consistent with Gritz et al. (2004), who found a positive association between heavy drinking and smoking. Strine et al. (2005) also found that current smokers from the general population were more likely to drink heavily compared to nonsmokers. Prior evidence suggests that heavy alcohol consumption impairs the health of HIV patients (Fein et al., 1995; Patton et al., 1998), and the higher quantity drinking among smokers provides another point of intervention for health care professionals.

The current study may be the first to examine the relationship between specific types of illicit drug use and smoking. The prevalence of marijuana smoking and crack use were substantial, and group trends revealed that smokers at any level were more likely to use these drugs compared to nonsmokers. Marijuana use was associated with increased odds of light and moderate-level smoking. This finding is consistent with Burkhalter et al. (2005), who created a composite measure of 'any' drug use (combining heroin, crack, and other illicit drug use). However, in our sample, smokers were less likely to use crack but and more likely to smoke marijuana. Although marijuana smoking for medicinal purposes remains controversial, evidence suggests that some HIV+ individuals believe that marijuana relieves some HIV-related symptoms (Prentiss et al., 2004).

Results also demonstrated an association between psychosocial factors and smoking. The odds of heavy smoking increased with lower levels of perceived social support. The social support measure we used included multiple levels of relationships and types of support. Accordingly, HIV+ individuals who smoke heavily perceive less social support in general (i.e., emotional, daily living, and instrumental support). Recent research has found that less social support increased the likelihood of health-damaging coping (e.g., smoking) in HIV patients (Tate et al., 2006). The inverse relationship between social support and smoking is important for several reasons. Social support has been linked to disease incidence and mortality (House et al., 1988). Maintenance of supportive relationships benefits the health of HIV+ patients, specifically in terms of self-disclosure of HIV status and use of HAART (Waddell & Messeri, 2006). Second, smoking is an independent risk factor for non-AIDS-related mortality in HIV patients (Patel et al., 2006), and to the extent that a synergistic effect exists, deficits in social support could be especially problematic. Third, the lack of social support has been associated with faster progression to AIDS (Leserman et al., 1999; Leserman et al., 2000). Fortunately, social support interventions may facilitate smoking cessation. The "buddy" system approach has evidence for efficacy (May & West, 2000) and could be particularly beneficial for patients with HIV.

Consistent with previous research (Gritz et al., 2004), depression was not associated with smoking in our sample. The somatic complaints of depression overlap with HIV-related symptoms (Kalichman et al., 1995), which can lead to confounded assessment. Symptoms of depression were substantial, despite the exclusion of somatic items to eliminate the overlap with HIV symptoms. With the focus on cognitive-affective depression, there was a high prevalence of depressive symptoms in our sample [(59% with a cut off score of 16) (Weissman et al., 1977) and 39% with a cut off of 24 (Costello & Devins, 1989)]. These symptom levels suggest that the prevalence of mood disorders among HIV+ patients is higher than found in the general population (Pence et al., 2006). Thus, the high rates of depression might have obscured the actual influence of depression on smoking rates (i.e., creating a restricted range). This speaks to the robustness of the influence of HIV-related symptoms, as this relationship remained significant even when depression was simultaneously considered.

These findings should be interpreted mindful of its strengths and weaknesses. Strengths include (a) investigating the relationship of smoking with a broad range of factors related to health in a sample of HIV+ patients; (b) use of a biopsychosocial approach to test predictors of smoking; (c) analyses that examined the independent contributions of each level of analysis while controlling for the others; and (d) inclusion of objective measures of viral load and CD4 count. Limitations include (a) reliance on self-report measures, (b) a cross-sectional design, (c) self-selection, (d) a small sample (other factors may indeed be associated with smoking, but were undetected due to limited power), and (e) sampling from only one clinic. Thus, the results may not generalize to patients in other settings or locations. Although it would have been interesting to examine African American and Caucasian participants separately, the study was not adequately powered to do this.

Continued research on the influence of smoking on the health and quality of life among people living with HIV is needed. This population continues to smoke at high rates, in contrast to the decline in smoking prevalence in the general population. The health consequences of smoking among HIV+ individuals are accelerated compared with the nonsmoking HIV patients. Moreover, a significant number of HIV+ smokers are African American, and this group is known to have unique stress (Turner et al., 1995) and difficulty with smoking cessation (USDHHS, 1989; Novotny et al., 1988). The perception of less social support among heavy smokers suggests that smoking may be a source of support in HIV patients. Yet, this hypothesis awaits testing with prospective studies. This study provides a glimpse into some risk factors that should be considered in tobacco cessation efforts targeted at this population. The good news is that smoking is a modifiable health risk behavior that, if treated, could help to prolong and improve the lives of people living with HIV. Little research has focused on developing smoking cessation interventions for this population, and increasing our understanding of factors associated with smoking is necessary before doing so.

The findings from this study need to be tested longitudinally before definitive clinical practice recommendations can be made. Until that time, these results have initial implications for smoking cessation interventions. First, clinicians should assess HIV+ patients for the presence of multiple factors that may place them at increased risk for smoking. Harm reduction models for HIV+ patients typically include education on the consequences of illicit drug use and risky sexual behavior. Health care providers should also educate HIV+ patients on the consequences of tobacco use. The present research also suggests that targeting heavy alcohol use and marijuana smoking may be an important intervention component. Finally, healthcare providers and researchers should encourage patients to seek social support, which could help heavy smokers manage their response to diagnosis. Longitudinal studies should examine the causal impact of these factors on smoking over time. Future research should also test the impact of smoking on health-related quality of life among people with HIV, and work towards developing biopsychosocial interventions that consider the unique needs of this underserved group.

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Table I

Descriptive Characteristics of Predictor Variables by Smoking Status Category (*N* = 212)

Variable	Smoking Status Category Non (*n* = 56)	Light (*n* = 53)	Moderate (*n* = 46)	Heavy (*n* = 57)	*p*
Age (*M, SD*)	43 (7.79)[a]	40 (8.08)	39 (7.83)	39 (7.48)	.03
Gender (%)					.51
Male	28	21	23	28	
Female	25	30	20	25	
MSM (%)	41	25	35	46	.12
Highest Grade (*M, SD*)	13 (2.32)[a]	11.60 (1.96)	11.37 (1.69)	11.30 (2.43)	< .001
Monthly Income (*M, SD*)	$1182 (1024)[a]	$645 (501)	$784 (408)	$891 (606)	.001
Race/Ethnicity (%)					< .001
Caucasian	35[cd]	11[be]	15[be]	39[cd]	
Ethnic Minority	19[cd]	36[be]	28[be]	17[cd]	
Married, living together (%)	18	8	9	11	.26
Social Support (*M, SD*)	3.13 (1.14)	3.10 (.99)	3.21 (1.23)	2.84 (1.12)	.36
CESD Scores (*M, SD*)	15 (12.55)[b]	24 (11.90)[c]	17 (11.64)[b]	23 (13.51)[c]	< .001
HIV Symptoms (*M, SD*)	1.07 (.76)[ce]	1.51 (.77)[b]	1.32 (.74)[e]	1.64 (.75)[bd]	< .001
Viral Load					.13
Detectable (%)	21	25	22	32	
Undetectable (%)	35	24	20	21	
CD4 (*M, SD*)	481 (328)	525 (299)	470 (315)	491 (340)	.85
Drinking Quantity (*M, SD*) (During a typical episode)	0.59 (1.06)[de]	1.17 (1.96)	1.78 (2.46)[b]	1.98 (3.03)[b]	.006
Drinking Frequency (*M, SD*) (≥ 1 alcoholic beverage per week)	0.76 (1.55)	.83 (1.42)	1.13 (1.47)	1.04 (1.77)	.27
Crack Use Past Year					.04
Yes (%)	13[a]	32[b]	30[b]	25[b]	
No (%)	30[a]	23	19[be]	28	
Smoked Marijuana Past Year					< .001
Yes (%)	12[a]	31[b]	32[b]	25[b]	
No (%)	36[a]	21[b]	15[be]	29[bd]	
Cigarettes/Day (*M, SD*)	0 (0)[a]	5.32 (2.22)[bde]	12 (2.42)[bcd]	24 (11.60)[bcd]	< .001

Note. CESD = Center for Epidemiologic Studies Depression Scale; percentages indicate the proportion of participants within each stratification classified as a non, light, moderate, or heavy smokers.

[a] p < .05 compared to Light, Moderate, Heavy

[b] p < .05 compared to Non

[c] p < .05 compared to Light

[d] p < .05 compared to Moderate

[e] p < .05 compared to Heavy

Table II

Multinomial Logistic Regression Model for Smoking Status Classification *

	Variable	ß	SE	*p*	Odds-ratio	CI
Light Smoker (*n* = 53)						
	Age	−.07	.05	.13	.94	.86-1.02
	Gender	.13	.77	.86	1.14	.26-5.11
	Education	−.11	.16	.49	.90	.66-1.23
	Monthly Income	−.01	.01	.04*	.98	.97-.99
	MSM	1.03	.86	.23	2.81	.52-15.22
	All Other Races vs. Caucasian	1.58	.68	.02*	4.85	1.29-18.18
	CD4	.002	.001	.06	1.00	1.00-1.00
	Viral Load	.02	.62	.97	1.02	.30-3.46
	HIV Symptoms	.29	.43	.50	1.33	.58-3.08
	Drinking Quantity	3.14	1.53	.04*	23.00	1.14-162.64
	Drinking Frequency	−.27	.28	.33	.76	.44-1.31
	Crack Use Past Year	1.07	.79	.18	2.19	.62-13.78
	Marijuana Past Year	1.66	.68	.01*	5.26	1.39-19.87
	Depression	.05	.04	.24	1.05	.97-1.14
	Social Support	−.23	.26	.38	.79	.47-1.33
	Variable	ß	SE	*p*	Odds-ratio	CI
Moderate Smoker (*n* = 46)						
	Age	−.08	.05	.09	.93	.85-1.01
	Gender	.06	.79	.94	1.07	.23-5.04
	Education	−.34	.17	.04*	.71	.51-.98
	Monthly Income	.00	.00	.40	1.00	.99-1.00
	MSM	.21	.84	.80	1.23	.24-6.42
	All Other Races vs. Caucasian	1.24	.64	.05	3.47	1.00-12.03
	CD4	.00	.00	.29	1.00	.99-1.00
	Viral Load	.08	.63	.90	1.08	.32-3.72
	HIV Symptoms	1.37	.45	.01*	1.45	1.15-3.48
	Drinking Quantity	2.83	1.48	.03*	16.98	9.37-337.67
	Drinking Frequency	−.17	.27	.52	.84	.50-1.43
	Crack Use Past Year	1.27	.80	.11	3.56	.74-17.22
	Marijuana Past Year	1.45	.66	.03*	4.27	1.17-15.64
	Depression	−.04	.04	.41	.96	.88-1.05
	Social Support	−.30	.267	.26	.74	.44-1.25
	Variable	ß	SE	*p*	Odds-ratio	CI
Heavy Smoker (*n* = 57)						
	Age	−.08	.04	.04*	.92	.85-.99
	Gender	.13	.80	.87	1.14	.24-5.45
	Education	−.43	.15	.004*	.65	.48-.87
	Monthly Income	.00	.00	.98	1.00	.99-1.00
	MSM	−.15	.81	.86	.86	.18-4.24
	All Other Races vs. Caucasian	−.33	.59	.58	.72	.23-2.29
	CD4	.00	.00	.20	1.00	.99-1.00
	Viral Load	−.38	.58	.51	.68	.22-2.12

Variable	ß	SE	*p*	Odds-ratio	CI
HIV Symptoms	1.28	.42	.02*	2.61	1.14-5.96
Drinking Quantity	2.76	1.39	.04*	15.84	1.04-242.15
Drinking Frequency	−.06	.24	.82	.95	.59-1.51
Crack Use Past Year	.84	.79	.29	2.32	.49-10.99
Marijuana Past year	.36	.63	.57	1.43	.42-4.91
Depression	−.04	.04	.37	.96	.89-1.04
Social Support	−.57	.25	.02*	.57	.34-.93

Note.

Model chi-square = 124.53

df = 42

$p < .001$

Nagelkerke $R^2 = .54$

* = Significant predictor

ß = unstandardized coefficient

SE = standard error

p = significance

CI = 95% confidence interval.

*The reference category for the three analyses is non-smoker (*n* = 56)