# Decreased Awareness of Current Smoking Among Health Care Providers of HIV-positive Compared to HIV-negative Veterans

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**BACKGROUND:** Cigarette smoking is an important risk factor for morbidity and mortality in HIV-positive patients on combination antiretroviral therapy.

**OBJECTIVE:** To determine whether awareness of smoking differs between HIV and non-HIV providers, and to identify factors associated with failure to recognize current smoking.

**DESIGN:** Observational study.

**PARTICIPANTS:** 801 HIV-positive and 602 HIV-negative patients, 72 HIV and 71 non-HIV providers enrolled in the Veterans Aging Cohort 5 Site Study.

**MEASUREMENTS:** Data sources included patient and provider questionnaires; electronic medical records; and the national administrative VA database. We calculated sensitivity, specificity, and measures of agreement between patient- and provider-reported smoking, and examined factors associated with failure to recognize current smoking using logistic regression.

**RESULTS:** Whereas most providers were correct when they identified a patient as a current smoker (specificity ≥90%), HIV providers missed current smoking more often (sensitivity 65% for HIV vs. 82% for non-HIV). Kappa scores for current smoking were significantly lower for HIV compared to non-HIV providers (0.55 vs. 0.75, $p<.001$). In models adjusted for age, gender, race, and other differences, patient HIV status and provider specialty in infectious diseases were independent predictors of a provider's failure to recognize current smoking. Comorbid illnesses, cough/dyspnea, degree of immune competence and HIV viral suppression did not impact recognition of current smoking. Only 39% of HIV providers reported confidence in their ability to influence smoking cessation compared to 62% of non-HIV providers ($p=.049$).

**CONCLUSIONS:** Interventions to increase HIV provider awareness of current smoking and skills to influence smoking cessation are needed. Efforts should also target patient populations with smoking-related comorbid diseases who would especially benefit from smoking cessation.

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## INTRODUCTION

According to multiple reports, at least 50% of HIV-positive persons currently smoke.[1–6] Smoking is a leading cause of morbidity and mortality in HIV-negative persons[7] and is associated with increased mortality, increased morbidity, and decreased quality of life in HIV-positive patients in the era of highly active antiretroviral therapy (HAART).[8] Furthermore, HIV-positive patients who smoke may experience a poorer viral and immunologic response to HAART.[9]

Smoking and HIV infection are risk factors for many of the same comorbid illnesses. These include bacterial pneumonia,[10,11] chronic obstructive pulmonary disease,[12,13] and lung cancer.[14] Furthermore, HIV-positive patients who smoke have an increased risk of oral candidiasis[2] and *Pneumocystis* pneumonia.[15] Antiretroviral treatment appears to be an additional risk factor for coronary artery disease.[16] Such findings raise questions as to whether the mechanisms by which smoking influences the development of these diseases is exacerbated by HIV infection, and suggest that cigarette smoking may be especially deleterious in HIV-positive patients.

Because smoking is a modifiable risk factor for diseases such as coronary artery disease, chronic obstructive pulmonary disease, and bacterial pneumonia, increased provider detection of smoking and efforts at smoking cessation among HIV-positive patients are needed.[3] We sought to determine whether health care providers are aware of their patients'

smoking status, and whether awareness differs among HIV and non-HIV (general medical) providers. We studied subjects enrolled in the Veterans Aging Cohort 5 Site Study (VACS 5), focusing on patient and provider-related factors associated with failure to recognize current smoking.

## METHODS

VACS 5 is an observational cohort study of 1,031 HIV-positive subjects who were block-matched to 740 HIV-negative subjects by age, race, and site of care. Subjects were enrolled between 2001 and 2002 from the outpatient Infectious Diseases and General Medicine clinics at 5 US Veterans Affairs (VA) Medical Centers in Atlanta, Bronx, Houston, Los Angeles, and Manhattan. The institutional review boards approved the study at all locations, and participants provided written informed consent.

At study entry, all subjects and providers completed self-administered questionnaires (available at the VACS website, http://www.vacohort.org). The health care providers answered questions regarding their patient's behaviors and medical conditions. Providers also completed a "provider characteristics" questionnaire about their own background, training, and specialty, with questions about their panel of patients in general. Additional data sources included electronic medical records, from which we obtained laboratory data, and the national administrative VA database, from which we obtained ICD-9 diagnostic codes for comorbid conditions. Additional design and methods of VACS 5 are described in detail elsewhere.[17]

### Patient Information

Patient-reported smoking status was determined from baseline questionnaire[18] and was compared to provider-reported smoking status. Patients were asked, "Do you now smoke cigarettes?" If patients reported smoking for 1 year or more, but no longer smoked presently, they were asked if they had quit less than or more than 4 weeks ago. From these items, we defined current smokers as those who reported current or any use within the last 4 weeks, and former smokers as those who reported having quit >4 weeks ago. Subjects were asked how many cigarettes per day and years they had smoked. Cigarettes per day were truncated at ≥4 packs to approximate a normal distribution and years of smoking were truncated when responses suggested initiation of smoking at ages of <10 years old. Provider-reported smoking status was determined from baseline survey in which providers were asked whether the patient smokes cigarettes, with the response options being: "past, present, or never."

The presence of dyspnea or cough was determined from the baseline subject questionnaire using a validated Symptom Index in which subjects were asked whether they had "cough or trouble catching your breath."[19] If the symptom was present, bothersome cough/dyspnea corresponded to a score of ≥3 on the Likert scale. We determined diagnoses of chronic obstructive pulmonary disease, coronary artery disease, and bacterial pneumonia using ICD-9 codes from the national administrative VA database. Inpatient codes had to occur at least once and outpatient codes at least twice, as this improves the accuracy of ICD-9 codes compared to other sources of clinical data.[20]

### Provider Information

Data on health care providers were obtained from a self-completed questionnaire by the providers. The providers were asked whether they regarded themselves as the patients' primary care provider. Within the VA health care system, most HIV-positive patients receive their primary and HIV care through the Infectious Diseases clinic. The HIV-negative subjects in VACS 5 were receiving primary care through the General Medicine clinics. We will refer to providers of HIV-positive patients as "HIV providers" and providers of HIV-negative, general medicine, patients as "non-HIV providers."

Through self-report, we obtained provider demographic data, years in practice since completing training, and their degree (recorded as either "MD/DO," "RN," "NP/PA," or "other"). Providers were also asked to identify their specialty as either infectious diseases (ID), general medicine (GM), or other. In addition, providers were asked on a 5-point Likert scale how strongly they agreed or disagreed with the statement: "I can influence my patients to stop smoking." We used this item to define provider confidence in influencing smoking cessation. Providers who agreed with this statement (corresponding to a score of ≥4) were considered to be confident in their ability to impact smoking cessation.

### Analysis

We included all patients on whom we had a patient- and provider-reported smoking status. Although patient-reported smoking status was available in nearly 100% of patients, provider-reported smoking status was missing in approximately 20% of patients. Our analytic sample thus consisted of 801 HIV-positive and 602 HIV-negative patients, or 80% of patients enrolled. Data on individual provider characteristics were missing in 216 additional patients enrolled. Thus, for analyses that included individual provider characteristics, data were available for 711 HIV-positive and 476 HIV-negative patients, or 67% of all patients enrolled. We had 72 HIV-positive and 71 HIV-negative providers who completed surveys on their patients. Of these providers, 89 (62%) completed the individual provider characteristics survey that included their own demographic and training information. We separately analyzed patients in whom providers considered themselves to be the primary provider; because results were not significantly different, we present the analyses with all patients. Statistical analysis was performed with Stata statistical software (v 9.1). A *p* value of <.05 was considered significant.

Awareness of smoking was assessed by comparing the accuracy and agreement of provider- and patient-reported smoking status. We calculated a sensitivity and specificity of provider-reported status compared to the gold standard of patient-reported status as current, former, or never smoker. Agreement beyond chance between provider and patient report was measured by the kappa statistic.[21]

To determine correlates of providers' failure to recognize current smoking, we examined both patient and provider level characteristics. We consider the clinical consequences of missing current smoking more harmful than mistakenly identifying a former or never smoker as a current smoker. Thus, in this analysis we focus only on false negatives (classifying a current smoker as not a current smoker); we do not attempt to simultaneously analyze factors associated with

false positives (classifying a past or never smoker as a current smoker).

After performing bivariate analyses to determine patient and provider level factors associated with failure to recognize current smoking (false negatives), we generated 3 multivariate logistic regression models. In one, we examined patient characteristics that were associated with a provider's failure to recognize current smoking, adjusting for age, race/ethnicity, gender, and HIV status. We also included factors for which smoking is a risk factor, namely, dyspnea/cough, chronic obstructive pulmonary disease, coronary artery disease, and bacterial pneumonia, hypothesizing that providers would be less likely to miss current smoking in patients with these conditions. We also considered a model restricted to HIV-positive patients and examined whether HIV RNA levels and CD4+ T-cell counts influenced provider recognition of current smoking. In a third model, we examined provider characteristics that were associated with failure to recognize current smoking, including provider age, race/ethnicity, gender, training, specialty, years in practice, and whether providers identified themselves as the primary provider. Multivariate analyses were clustered by individual provider using generalized estimating equations, to account for the fact that 1 provider may have cared for multiple patients.

## RESULTS

### Characteristics of Patients in VACS 5 with Patient- and Provider-reported Smoking Status

HIV-positive patients were significantly younger, and more likely to be Black and male, compared to HIV-negative patients (Table 1). Overall, 75% of HIV-positive and HIV-negative patients had ever smoked. HIV-positive patients were significantly more likely to be current smokers, and nearly 50% of HIV-positive patients reported current smoking. Median pack years of smoking were slightly higher in HIV-negative than

**Table 1. Characteristics of HIV-positive and HIV-negative Veterans with Self-reported and Provider-reported Smoking Status Enrolled in VACS 5**

| Characteristic | HIV-positive veterans *n*=801 | HIV-negative veterans *n*=602 | *p* value |
|---|---|---|---|
| Age, years (median) | 50 | 55 | <.001 |
| Male gender | 99% | 97% | .007 |
| Race/ethnicity | | | .001 |
| Black | 57% | 47% | |
| White and other | 31% | 40% | |
| Hispanic | 13% | 13% | |
| Patient-reported smoking status | | | <.001 |
| Current smoker | 47% | 37% | |
| Former smoker | 29% | 38% | |
| Never smoker | 24% | 24% | |
| Pack years of smoking (median) | 16 | 19 | .03 |
| Provider-reported smoking status | | | .03 |
| Current smoker | 36% | 35% | |
| Former smoker | 39% | 34% | |
| Never smoker | 25% | 31% | |

**Table 2. Self-reported Characteristics of HIV and non-HIV Providers Caring for Patients in VACS 5**

| Characteristic | HIV provider *n*=56 | Non-HIV provider *N*=33 | *P* value |
|---|---|---|---|
| Provider age, years (median) | 43 | 39.5 | .8 |
| Male gender | 50% | 47% | .8 |
| White or other race/ethnicity | 81% | 77% | .6 |
| Training | | | .051 |
| M.D. or D.O. | 85% | 68% | |
| P.A. or N.P. | 15% | 32% | |
| Provider specialty | | | <.0001 |
| Infectious diseases | 87% | 9% | |
| General medicine or other | 13% | 91% | |
| Identified self as primary provider | 79% | 82% | .6 |
| Years in practice (median) | 11 | 5 | .03 |
| Patients seen per week (median) | 15 | 73 | <.001 |
| Confident in ability to influence smoking cessation | 39% | 62% | .049 |

M.D.=Medical doctor
D.O.=Doctor of osteopathy
P.A.=Physician's assistant
N.P.=Nurse practitioner

HIV-positive patients (19 vs. 16 pack years), but both groups had substantial exposure to cigarettes.

### Characteristics of Providers with Self-reported Data in VACS 5

HIV providers were more likely to be physicians compared to non-HIV providers (Table 2). Of the HIV providers, 87% identified their specialty as ID, and 91% of the non-HIV providers identified their specialty as GM/other. Approximately 80% of both HIV and non-HIV providers considered themselves the patient's primary provider. HIV providers had significantly more years in practice since completing training compared to non-HIV providers (11 vs. 5 years, *p*=.03). HIV providers reported caring for fewer patients per week on average compared to non-HIV providers (15 vs. 73, *p*<.001). Fewer HIV providers were confident in their ability to influence their patients to stop smoking (39% vs. 62%, *p*=.049).

### Awareness of Smoking Status

Taken together, most HIV and non-HIV providers were correct when they identified a patient as a current smoker (specificity ≥90%). However, HIV providers demonstrated substantially higher false negative rates, meaning that they failed to recognize current smoking more often (sensitivity 65% for HIV vs. 82% for non-HIV; Table 3). Thus, among patients who reported current smoking, HIV providers failed to identify 35% of current smokers, whereas non-HIV providers failed to identify 18% of current smokers (*p*<.001). Comparing overall agreement between provider- and patient-identified smoking status, kappa scores were significantly lower for HIV providers

**Table 3. Provider Awareness of Smoking According to Patient HIV Status**

| Diagnosis | Overall agreement (%) | Kappa score | Sensitivity (%) | Specificity (%) | PPV (%) | NPV (%) |
|---|---|---|---|---|---|---|
| Current smoker | | | | | | |
| HIV-positive | 78 | 0.55* | 65 | 90 | 85 | 74 |
| HIV-negative | 88 | 0.75 | 82 | 93 | 87 | 89 |
| Former smoker | | | | | | |
| HIV-positive | 69 | 0.31† | 63 | 71 | 47 | 83 |
| HIV-negative | 75 | 0.46 | 61 | 83 | 70 | 78 |
| Never smoker | | | | | | |
| HIV-positive | 77 | 0.38‡ | 54 | 85 | 53 | 85 |
| HIV-negative | 80 | 0.49 | 71 | 82 | 56 | 90 |

PPV=positive predictive value, NPV=negative pedictive value
Provider-reported smoking status is compared to the gold standard of patient-reported smoking status.
*$p<0.001$
†$p=0.003$
‡$p=0.047$

compared to non-HIV providers for current smoking (kappa 0.55 vs. 0.75, $p<.001$), former smoking (kappa 0.31 vs. 0.46, $p=.003$), and never smoking (kappa 0.38 vs. 0.49, $p=.047$; Table 3).

## Patient Characteristics Associated with Failure to Recognize Current Smoking

Next, we sought to examine patient characteristics associated with failure to recognize current smoking (Table 4). In bivariate analysis, providers were less likely to miss current smoking in older patients (odds ration [OR] 0.78 per 10 years, 95% CI 0.66–0.92), but were more likely to miss current smoking in HIV-positive subjects (OR 2.68, 95% CI 1.76–4.08) and in those with a history of bacterial pneumonia (2.17, 95% CI 1.35–3.50). Bothersome dyspnea/cough, or a history of coronary artery disease or chronic obstructive pulmonary disease did not increase the recognition of current smoking. In multivariate analysis, HIV status remained significantly associated with a failure to recognize current smoking (OR 2.28, 95% CI 1.48–3.53) as did a history of bacterial pneumonia (OR 1.59, 95% CI 1.00–2.51, $p=.048$; Table 4). When entered into the model, interaction terms between HIV status and older age, HIV status and race, as well as HIV status and history of bacterial pneumonia were not statistically significant (data not otherwise shown).

Among HIV-positive patients, the degree of immune competence or virologic suppression did not influence recognition of

current smoking. Providers were not more likely to recognize current smoking among patients with CD4+ T-cell counts greater than 200 cells/μl (OR 0.90, 95% CI 0.55–1.46) or HIV RNA levels less than 500 copies/mL (OR 1.09, 95% CI 0.74–1.59).

## Provider Characteristics Associated with Failure to Recognize Current Smoking

Finally, we examined provider characteristics that were associated with failure to recognize current smoking (Table 5). In bivariate analysis, men were less likely to recognize current smoking than women (OR 1.84, 95% CI 1.15–2.97), as were physicians compared to nurse practitioners/physicians' assistants (OR 2.00, 95% CI 1.23–3.23) and ID specialists compared to GM/other specialists (OR 3.13, 95% CI 2.07–4.75). Provider age, race/ethnicity, identification as the primary provider, or years in practice were not associated with a failure to recognize current smoking. In multivariate analysis, only ID specialty was significantly associated with a failure to recognize current smoking (OR 2.71, 95% CI 1.79–4.11).

## DISCUSSION

In this study, we sought to determine whether health care providers were aware of their patients' smoking status and to identify predictors of failure to recognize current smoking among HIV-positive compared to HIV-negative patients. In

**Table 4. Patient Characteristics Associated with Provider Failure to Recognize Current Smoking**

| Patient characteristic | Failure to recognize current smoking | |
|---|---|---|
| | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
| Age, per 10 years | 0.78 (0.66–0.92)* | 0.85 (0.71–1.02) |
| Male gender | 1.91 (0.43–8.47) | 1.57 (0.34–7.27) |
| Race/ethnicity | | |
| Black | 1.40 (0.91–2.16) | 1.25 (0.81–1.94) |
| Hispanic | 1.32 (0.68–2.58) | 1.22 (0.63–2.39) |
| HIV-positive | 2.68 (1.76–4.08)* | 2.28 (1.48–3.53)* |
| Dyspnea/cough | 1.10 (0.78–1.55) | 1.05 (0.74–1.49) |
| COPD | 1.26 (0.80–2.00) | 1.18 (0.70–1.98) |
| CAD | 0.87 (0.53–1.45) | 1.24 (0.71–2.15) |
| Bacterial pneumonia | 2.17 (1.35–3.50)* | 1.59 (1.00–2.51)* |

The multivariate model includes 1,385 subjects with complete data for all variables included. The comparator group for race/ethnicity is White/other.
OR=odds ratio, CI=confidence interval, COPD=chronic obstructive pulmonary disease, CAD=coronary artery disease
*$p<0.05$

**Table 5. Provider Characteristics Associated with Provider Failure to Recognize Current Smoking**

| Provider characteristic | Failure to recognize current smoking | |
|---|---|---|
| | Unadjusted OR (95% CI) | Adjusted OR (95% CI) |
| Age, per 10 years | 1.13 (0.91–1.40) | 0.95 (0.60–1.52) |
| Male gender | 1.84 (1.15–2.97)* | 1.29 (0.78–2.13) |
| Race/ethnicity | | |
| Black | 1.44 (0.31–6.82) | 2.16 (0.37–12.64) |
| Hispanic | 1.33 (0.35–5.04) | 1.10 (0.31–4.01) |
| Training, MD vs. other | 2.00 (1.23–3.23)* | 1.32 (0.68–2.58) |
| Specialty, ID versus GM/other | 3.13 (2.07–4.75)* | 2.71 (1.79–4.11)* |
| Years in practice, per 10 years | 1.12 (0.90–1.41) | 1.22 (0.77–1.93) |
| Identified as primary provider | 0.78 (0.50–1.23) | 0.66 (0.40–1.10) |

*The multivariate model includes 1,126 patients with complete data on all variables.*
*The comparator group for race/ethnicity is White/other.*
*OR=odds ratio, CI=confidence interval, COPD=chronic obstructive pulmonary disease, CAD=coronary artery disease, ID=Infectious Diseases, GM= General Medicine*
*\*p<.05*

general, we found that HIV providers were less aware of smoking than non-HIV providers, and were particularly less likely to recognize current smoking in their patients. Recognition of current smoking was not increased if HIV-positive patients had CD4+T-cell counts greater than 200 cells/μl or HIV RNA levels of less than 500 copies/mL. Of concern, providers were not more likely to recognize current smoking in patients reporting bothersome dyspnea/cough, or with smoking-related diseases such as chronic obstructive pulmonary disease, coronary artery disease, and bacterial pneumonia.

The outcome and management of HIV disease have changed substantially over the 11-year period, on average, that the HIV providers in our study have been in practice. Given the documented prevalence and adverse health consequences of smoking, interventions to facilitate smoking cessation have the potential to substantially reduce morbidity and mortality among HIV-positive populations; this will be particularly true as individuals with HIV are living longer.[22–26] Our findings may facilitate the future design and implementation of programs to improve smoking cessation rates. Although the number of studies are limited, data suggest that smoking cessation interventions can be effectively applied in HIV-positive populations.[27–29] One study combining nicotine patch and counseling found a cessation rate of 50% after 8 months among HIV-positive smokers.[29] Another study using cellular telephones for counseling among HIV-positive smokers increased cessation rates to 37% compared to 10% in the usual care group,[28] results that are very similar to a study of HIV-negative patients utilizing telephone intervention.[30]

Our data suggest that efforts to improve smoking cessation rates should include increased education and training of HIV providers to detect smoking and counsel smoking cessation, as HIV providers reported less confidence in their ability to influence their patients to stop smoking than non-HIV providers. These results are parallel to an earlier report that found that ID-certified physicians were less comfortable with prescribing medications to their HIV-positive patients for hyperlipidemia, diabetes, hypertension, and depression than GM-certified physicians to their patients.[31] Interventions should also target increased detection of smoking particularly among patients with smoking-related diseases such as chronic obstructive pulmonary disease, coronary artery disease, and bacterial pneumonia who would especially benefit from smoking cessation.

To our knowledge, this is the first study to examine awareness of smoking and to identify factors associated with a failure to recognize current smoking in HIV-positive patients. VACS 5 represents a robust cohort to investigate these questions because the rates of current smoking are substantially high among both HIV-positive and HIV-negative veterans. In addition, nearly 80% of both HIV and non-HIV provider surveys were completed by the patient's primary provider. We also have well-characterized data on the complex factors involved in assessing awareness of smoking. Our findings are further strengthened by considering both patient and provider level factors; the multivariate models examining patient and provider characteristics that predict failure to recognize current smoking corroborate one another (patient HIV status and being an HIV provider indicate the same fact, that HIV providers are less aware of current smoking than are general medical providers). We cannot say from this analysis, however, whether there is some factor associated with HIV infection that makes it more difficult to recognize smoking.

Our study has certain limitations. Our estimates of individual provider awareness of smoking may be conservative, as providers sometimes completed their surveys after the patient had left the clinic. Providers may have a greater knowledge of their patients' smoking (when facing the patient) than when completing a survey at the end of the day. However, HIV and non-HIV providers were asked to complete their surveys under the same conditions; thus, whereas the kappa scores may generally underestimate awareness of smoking, our findings nonetheless support that there is a differential and decreased awareness between HIV and non-HIV providers. In addition, patients may not have been truthful to providers in reporting if they were currently smoking. However, there is no evidence that reporting of such behaviors would be different in HIV-positive and HIV-negative patients, and self-reported smoking is accurate in most studies.[18] Finally, there was no time frame specified for defining current versus former smoking in provider surveys. Current smoking was defined as any use within the last 4 weeks on patient survey. If providers mistakenly thought that patients who had last smoked more than 4 weeks ago were current smokers, we should have found an increased number of false positive current smokers by provider report. Instead, we found a greater number of false negatives, as providers were more likely to misclassify current

smokers as former smokers, particularly among the HIV providers.

In summary, we found that HIV providers were less aware of their patients' smoking status compared to non-HIV providers. In particular, HIV providers were significantly less likely to recognize current smoking, and were less confident in their ability to influence smoking cessation. Of patient and provider characteristics, patient HIV status and ID provider specialty (e.g., being in the HIV clinic) were significant predictors of provider failure to recognize current smoking. CD4+T-cell counts, HIV viral load, or comorbid illnesses did not favorably influence recognition of current smoking. Given the high prevalence of smoking and adverse health consequences associated with smoking among HIV-positive persons, these findings support the need for increased detection of smoking and education regarding smoking cessation for HIV providers.

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