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Smoking and HIV-related health issues among older HIV+ gay, bisexual, and other MSM

Danielle C. Ompad[1,2], **Molly Kingdon**[1], **Sandra Kupprat**[1], **Sophia N. Halkitis**[1], **Erik David Storholm**[1], and **Perry N. Halkitis**[1]

[1]Center for Health, Identity, Behavior, & Prevention Studies (CHIBPS), Steinhardt School of Culture, Education and Human Development, New York University, New York, NY

[2]Center for Drug Use and HIV Research, New York University College of Nursing, New York, NY

Abstract

The prevalence of cigarette smoking and the relations between smoking and HIV clinical markers, HIV medication adherence, and opportunistic infections (OIs) were examined in a sample of 199 HIV+, gay, bisexual, and other men who have sex with men (MSM) aged 50 and older. Overall, 35.7% were current smokers, 35.7% were former smokers, and 28.6% were never smokers. In the final multivariable polytomous logistic regression model controlling for age, income, and illicit drug use, current smokers were less likely to report an undetectable viral load as compared to never and former smokers. Relative to never smokers, former smokers were more likely report respiratory OIs, and current smokers were more likely to report gastrointestinal OIs. This study demonstrates high prevalence of cigarette smoking among aging, HIV+ MSM and provides additional evidence for a relationship between smoking and poorer HIV clinical markers. Targeted and tailored smoking cessation programs within the context of HIV care services are warranted.

In 2012, the Centers for Disease Control and Prevention estimated that nearly 20% of all Americans currently smoke cigarettes.[1] Among those Americans who are HIV+, studies suggest that upwards of 50%–70% report being current cigarette smokers.[2;3] Many HIV+ individuals on antiretroviral medications engage in unhealthy behaviors in an effort to manage HIV-related physical and psychological symptomology.[4] One common coping mechanism is cigarette smoking.[5] Although some studies have highlighted beneficial side effects of cigarette smoking, including its role as an anti-inflammatory agent and the neuroprotective qualities it may provide, the majority of the literature has focused on the myriad deleterious smoking-related health outcomes,[6;7] including pneumonia and other respiratory infections,[8–10] gastrointestinal problems,[11–13] cardiovascular disease (CVD), increased morbidity and mortality,[14;15] mortality from non-AIDS malignancies,[14] a higher viral load,[16] the decreased effectiveness of HIV antiviral therapies,[17] and a faster progression to AIDS.[17;18]

Research suggests cigarette smoking may interfere with optimal combination antiretroviral treatment (cART) adherence rates among HIV+ individuals. Shuter and Bernstein[3] found that mean cART adherence rates among current smokers were lower than those of former smokers and those who reported never smoking (63.5% vs. 84.8%, $p<0.001$).[3] O'Connor and colleagues[19] reported similar findings in an international trial comprised of 5295 HIV+

individuals currently taking antiviral medication in which 17% of the sample reported suboptimal cART adherence. Current smokers were 1.7 times more likely to report suboptimal adherence as compared to those who did not currently smoke.[19] Peretti-Watel et al.[20] explored the relations among various substances (including cigarettes) on adherence to antiviral medications and found cigarette smoking predicted non-adherence to antiviral medication regimens, but only when in combination with the use of other substances.

It is estimated that by 2015, 50% of adults living with HIV in the US will be age 50 years or older.[21;22] This disproportionate number of older HIV-positive individuals can be accounted for by a combination of those who have benefited from an increased lifespan as a result of cART, and incident HIV infections among adults aged 50+ years.[23;24] At the same time, older cohorts of adults are more likely to have smoked in their lifetimes relative to younger cohorts, with male-female differences (i.e., increased prevalence among males) being more pronounced in earlier birth cohorts.[25] Further, smoking cessation rates for those 50+ appear to be lower than those of later cohorts.[25] Despite these trends, few studies (c.f., Swiss HIV Cohort Study[26]) have explored the prevalence of and relations between cigarette smoking and HIV-related outcomes among individuals aging with HIV.

The present investigation was guided by the two objectives. First, we aimed to describe smoking prevalence among HIV+ gay, bisexual, and other men who have sex with men (MSM) aged 50 years and older. Second, we sought to examine the relations between smoking status and HIV clinical markers (i.e., CD4 cell count and HIV viral load), HIV medication adherence, and lifetime history of opportunistic infections (OIs) among this population of aging, seropositive MSM. Consistent with the literature on smoking, we hypothesized that smokers would have decreased adherence to medication and poorer HIV-related clinical outcomes.

Methods

Sample

Project GOLD was a cross-sectional study of 199 HIV+, gay, bisexual, and other MSM men aged 50 and older. The study design has been described in detail previously.[27] Briefly, participants were recruited and interviewed between August 2010 and August 2011 in New York City via targeted sampling methods employed at community-based organizations, in predominately gay neighborhoods and businesses, and on well-known web-based sex and dating sites. Eligibility criteria included being (1) aged 50 years and older, (2) HIV seropositive, 3) biologically male and self-identifying as male, and 4) sex with a man in the past six months (defined as any physical contact that could lead to an orgasm). The protocol was approved by New York University's Institutional Review Board.

Data collection

Potential participants were screened over the phone and those meeting enrollment criteria were invited to complete a 3-hour survey at a research center in downtown Manhattan. Once written informed consent was obtained, participants completed an Audio Computer-Assisted Self Interview (ACASI) survey and an interviewer-administered *Time Line Followback*

(*TLFB*)[28] which used a calendar format to ascertain participants' recent sex and substance use behavior. The former collected data on sociodemographics, smoking status, health care utilization, HIV clinical markers, HIV medication adherence, and lifetime history of specific OIs. Sociodemographic variables included age, race/ethnicity (i.e., black, white, Latino, or bi/multiracial), sexual orientation (i.e., gay, bisexual, straight, or other), and marital status. Socioeconomic status (SES) measures included perceived socioeconomic status, educational attainment (i.e., high school or less, high school diploma or general education diploma (GED), associate's degree, bachelor's degree, and graduate degree), employment status (i.e., employed full-time, employed part-time, or not currently working), and income (i.e., less than $10,000 a year; $10,001 to $20,000; $20,001 to $40,000; $40,001 to $60,000; $60,001 to $80,000; $80,000–$100,000; or over $100,000). Perceived socioeconomic status was measured by asking, "What do you perceive to be your current economic class?" The response options were lower, lower middle, middle, upper middle, and upper class. We dichotomized perceived SES as low (i.e., lower and lower middle class) vs. not low SES (i.e., middle, upper middle, and upper class). The education variable was dichotomized as high school or less and some college or more. Employment status was dichotomized as yes or no. Income was trichotomized as less than $10,000; $10,001 to $20,000; and more than $20,000.

Smoking status was ascertained with two items. First participants were asked if they had ever smoked cigarettes. Those answering affirmatively were then asked if they currently smoke cigarettes. Finally, current smokers were asked how many cigarettes they smoked on a typical day (i.e., less than 5, between 6 and 10, between 10 and 20; and 20 or more). Participants were then categorized as never smokers, former smokers, and current smokers.

Illicit drug use, including use of marijuana, powder cocaine, crack cocaine, ecstasy, GHB, ketamine, heroin, methamphetamine, Rohypnol, and non-medical use of prescription drugs, such as Cialis, Levitra, Viagra, Percocet, Oxycontin, Adderall, Ritalin, Concerta, Valium, and Xanax, was assessed via the *TLFB*, with use measured by number of days in the previous month in which the drug was used. For analytic purposes, the days of use were recoded to create a dichotomous variable of illicit drug use in the last 30 days (use vs. no use).

HIV clinical markers included self-reported CD4 cell count and viral load (i.e., undetectable, under 500, 500–5,000, over 5,000, don't know, refuse to answer, and not applicable). Nine were missing CD4 cell count data and five were missing viral load data. We dichotomized CD4 count as ≥500 vs. <500 cells/ml and viral load as detectable vs. undetectable. The date of HIV+ test result was dichotomized as before or after 1996. The year of 1996 was the date of demarcation because it marked when the first effective HIV medications were introduced (i.e., the introduction of protease inhibitors and cART).

HIV medication adherence was measured using items from the ACTG Adherence Questionnaire.[29] First, we ascertained whether participants were on cART. Next, participants on cART were asked the following five questions: (1) If you took only a portion of a dose on one or more of these days, please report the dose(s) as being missed. During the past 4 days, on how many days have you missed taking all your doses? (number of days in past four days; dichotomized as yes/no); (2) Most anti-HIV medications need to be taken on a schedule, such as "2 times a day" or "3 times a day" or "every 8 hours." How closely did you follow your specific schedule over the last four days? (never, some of the time, about half of the time, most of the time, or all of the time; dichotomized as all the time vs. less than all the time); (3) Do any of your anti-HIV medications have special instructions, such as "take with food" or "on an empty stomach" or "with plenty of fluids"? (yes/no); (4) How often did you follow those special instructions over the last four days? (never, some of the time, about half of the time, most of the time, or all of the time; dichotomized as all the time vs. less than all the time with those that did not have special instructions categorized with those not on cART); and (5) Some people find that they forget to take their pills on the weekend days. Did you miss any of your anti-HIV medications last weekend - last Saturday or Sunday? (yes/no).

Health care utilization was measured with one item that assessed the participant's most frequent source of health and medical care (i.e., private doctor, physician, or clinic; public or county clinic or hospital; VA hospital or clinic; or emergency department). Finally, we assessed for the following lifetime OI diagnoses: *Mycobacterium avium*, tuberculosis, *Pneumocystis carinii* pneumonia (PCP), cytomegalovirus (CMV), salmonella, candidiasis, cryptococcal disease, cryptosporidiosis, toxoplasmosis, microsporidiosis, isosporiasis, and *E. intestinalis*. Individual OIs were collapsed into two categories; respiratory (i.e., *Mycobacterium avium*, tuberculosis, PCP, and CMV) and gastrointestinal OIs (i.e., salmonella, candidiasis, cryptococcal disease, cryptosporidiosis, toxoplasmosis, and microsporidiosis, isosporiasis, and *E. intestinalis*).

Analysis

Bivariable analyses compared never, former, and current smokers with respect to sociodemographic characteristics, HIV clinical markers, HIV medication adherence, health care utilization, and lifetime history of OIs. For continuous variables, means were calculated and compared with ANOVAs. For categorical variables, proportions were compared with Pearson's χ^2 statistics, unless a cell contained fewer than five participants, in which case Fisher's exact test was utilized.

Multivariable polytomous logistic regression models were constructed to examine correlates of smoking status. Variables that were significant at the $p \leq 0.20$ level in the bivariable analyses were entered into the model. Variables were retained in the model if they were significant at the $p \leq 0.05$ level. We decided *a priori* that illicit drug use would be included in all models because of its likelihood of being a strong confounding variable and because Peretti-Watel et al. found that smoking was only associated with cART adherence while in combination with other drug use.[20] All analyses were conducted with STATA/SE 13.0 (StataCorp, College Station, Texas).

Results

In this sample of older HIV+ men, 35.7% were current cigarette smokers, 35.7% were former smokers, and 28.6% were never smokers. Among the 71 current smokers, 55 (77.5%) typically smoked fewer than 10 cigarettes per day and 16 (22.5%) reported smoking

10 or more per day. In terms of race/ethnicity, overall, 47.5% of the sample identified as black, 23.5% as white, 14.3% as Latino, and 14.8% as bi- or multiracial (Table 1). The mean age was 55.5 (SD = 4.5, range 50–69) and the vast majority (74.9%) self-identified as gay. With respect to perceived SES, 40.7% reported low perceived SES, 47.4% had a high school education, and 76.9% were unemployed. More than 10% (21) of participants reported being married, in a domestic partnership, or in a civil union with a man. It is important to note that most of these data were collected prior to the legalization of gay marriage in New York State on July 24, 2011. A majority of the participants (70.4%) reported testing HIV+ prior to 1996.

In bivariable analyses of sociodemographic characteristics (Table 1), smoking status was significantly associated with age and income. That is, current smokers were younger than never smokers and than former smokers. Current smokers were also more likely to have an income of less than $10,000 as compared to never and former smokers. Smoking status was marginally associated (i.e., $p \leq 0.10$) with race/ethnicity, sexual orientation, and perceived SES. Specifically, current smokers were more likely to be black or biracial/multiracial and report a non-gay sexual orientation. Those who reported low perceived SES were less likely to be current smokers.

Bivariable analyses indicated that smoking status was significantly associated with HIV clinical markers as well as some aspects of HIV medication adherence (Table 2). Current smokers were significantly more likely to have CD4 cell counts less than 500 cells/ml, report adherence to a specific medication schedule, and utilize a public or county clinic or hospital. Current smokers were less likely to have an undetectable viral load, and were also marginally more likely to be adherent if their medication included special instructions recommended by their doctors.

With regard to OIs, one hundred twenty-four (62.3%) men reported at least one OI in their lifetime (Table 3), with 67 (33.7%) reporting respiratory OIs and 82 (41.2%) reporting gastrointestinal OIs. Current and former smokers were significantly more likely to report any OI and a respiratory OI in their lifetime; they also were marginally more likely to report a gastrointestinal OI. When OIs were disaggregated, current and former smokers were significantly more likely to have had candidiasis and former smokers were marginally more likely to have had PCP.

In the final multivariable polytomous logistic regression model, smoking status was significantly associated with viral load, respiratory OIs, and gastrointestinal OIs, after controlling for age, income, and illicit drug use (Table 4). Specifically, current smokers were significantly less likely to report an undetectable viral load as compared to both never smokers (adjusted odds ratio [AOR] = 0.32, 95% confidence interval [CI] = 0.13, 0.81) and former smokers (AOR = 0.25, 95% CI= 0.10, 0.62) after controlling for age, income, respiratory OIs, gastrointestinal OIs, and illicit drug use. Former smokers were significantly more likely to have had a respiratory OI as compared to never smokers (AOR = 2.82, 95% CI= 1.12, 7.12). There was no significant association between status as a current smoker and lifetime report of respiratory OIs. Finally, current smokers were significantly more likely to report a gastrointestinal OI as compared to never smokers (AOR = 2.65, 95% CI= 1.07, 6.60).

Discussion

Smoking prevalence in this sample of older HIV+ gay, bisexual, and other MSM men was 35.7%. Research on the prevalence of tobacco use suggests that as many as 31–77% of those living with HIV/AIDS are current cigarette smokers.[2;30–34] A 2010 study of HIV+ individuals in New York City reported a smoking prevalence of 47% for HIV+ patients in care aged 46 and older.[2] The estimates presented here are slightly higher than those from the 2011 NYC Community Health Survey, which reported that 31.5% of gay and lesbian New Yorkers were current smokers.[30]

Current smoking was associated with lower CD4 cell count and higher viral load in bivariable analyses. In a final multivariable model controlling for age, income, and illicit drug use, current smokers were significantly less likely to have an undetectable viral load relative to both never and former smokers. The mechanisms by which cigarette smoking is related to HIV clinical outcomes are not fully understood. A recent review summarizes the effects of smoking on the immune system and proposes mechanisms for these effects.[10] In brief, smoking has been shown to suppress immune function. A growing body of research has explored the association between smoking and immune function among HIV+ individuals in particular. In a small study of 36 HIV+ women, current smoking was associated with a higher viral load and a history of smoking was associated with a lower CD4 cell count.[16] Analyses of the Women's Interagency HIV Study suggest that, among HIV+ women on cART, smoking is associated with poorer virologic and immune response, as well as a greater risk for virologic rebound, immunologic failure, and faster progression to the AIDS stage of the disease.[17] However, the evidence for these associations are mixed. There was no significant association between smoking and HIV disease progression in the HIV Alcohol Longitudinal Cohort,[34] the HIV Longitudinal Relationships of Viruses and Ethanol Study,[34] or in preliminary analyses of the Multicenter AIDS Cohort Study[44] suggesting that there are multiple factors at play.

Smoking could be a marker for other risk factors for HIV clinical prognosis such as HIV medication adherence. Although previous studies have found a relationship between HIV medication adherence and smoking status,[3;19] we did not observe a significant association when we controlled for age, income, HIV clinical markers, and illicit drug use. This could be because we were studying older HIV+ adults, the majority of whom (70.4%) are long term survivors. Furthermore, no significant associations between the adherence variables and seroconversion prior to 1996 were detected.

Smoking status also was significantly associated with a lifetime history of OIs. As compared to never smokers, former smokers were significantly more likely to report a respiratory OI in their lifetime. Studies have demonstrated a positive association between smoking and respiratory infections among HIV+ individuals, including tuberculosis,[35] PCP,[36;37] community acquired pneumonia,[36] and invasive pneumococcal disease.[9] Indeed, a recent meta-analysis estimated that smokers had a 70% to 100% increased risk of bacterial pneumonia as compared to never smokers.[37] These findings are also consistent with the studies suggesting an association between immune function in the lungs and smoking. One study demonstrated that smokers have fewer CD4 and CD8 cells in their lungs relative to non-smokers, along with suppression of interleukin-1β and tumor necrosis factor-α.[38]

Current smokers were significantly more likely than both never smokers and former smokers to report a gastrointestinal OI in their lifetime. Results are mixed as to whether smoking is related to gastrointestinal illnesses in the general population and even less is known about the relationship between smoking and gastrointestinal illnesses among HIV-positive populations. Some researchers have found that smoking is not related to esophageal candidiasis[39] or gastrointestinal bleeding,[40] and protective for ulcerative colitis.[41] Others have found that smoking is associated with an increased likelihood of helicobacter pylori infection,[42;43] gastric cancer,[42] oral candidiasis,[44–47] cryptococcosis,[48] and Crohn's disease.[41] Recent studies have explored the association between smoking and gut-associated lymphocytic tissue (GALT),[49] as well as the gut microbiome,[50] in the search for possible mechanisms to explain the relations between smoking and gastrointestinal infections and neoplasms. This is an area for further research.

We recognize several limitations in this investigation. First, we utilized data from a relatively small sample of HIV+ MSM. As such, these findings may not be representative of the larger community of aging HIV+ MSM. Second, only three items were used to describe smoking status, limiting our understanding of onset and duration of smoking behaviors. As a result, we do not know how long ago former smokers stopped smoking and if smoking cessation was a result of with HIV seroconversion or OI diagnoses. Third, we did not obtain specific data on cardiovascular disease (CVD) outcomes and associated risk factors. Finally, all data were self-reported and as a result may be subject to recall bias or social desirability. However, the likelihood of these biases was reduced due to the use of ACASI to ascertain potentially stigmatized behaviors.

This study demonstrates elevated rates of cigarette smoking in a sample of aging, HIV+ MSM in New York City. These data also provide additional evidence for a relationship between smoking and poorer HIV clinical outcomes. Targeted and tailored smoking cessation should be combined with medication adherence programs within the existing HIV care services framework in order to better meet the needs of this high-risk population, especially in light of the perception that smoking is not a high priority health issue for gay and bisexual men.[51] To address the nuances of service delivery for older HIV-positive populations, providers could benefit from utilizing a multifaceted approach to smoking cessation. Providing a variety of tools and methodologies for service providers could help clinicians better customize interventions for this group who have possibly been chronic smokers for most of their lives. Moreover, CVD is an important cause of morbidity[15] and mortality[14;52] among HIV+ individuals and smoking is an important, and highly prevalent, risk factor for CVD in this population.[14] Further longitudinal research is needed, with more nuanced and robust measures of smoking exposures (i.e., frequency, duration, onset), to more fully understand whether the relations between smoking and HIV clinical markers can be explained biologically, psychosocially, a combination of both biologic and psychosocial phenomenon, or are spurious.

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Table 1

Sociodemographic characteristics of 199 HIV seropositive men aged 50–69

	Total	**Smoking status**			
	***N* (%)**	**Never *N*=57 *N* (%)**	**Former *N*=71 *N* (%)**	**Current *N*=71 *N* (%)**	***p*-value[1]**
Mean age (SD)	55.5 (4.5)	55.6 (4.6)	56.6 (4.9)	54.3 (3.8)	0.011[2]
Race/ethnicity					0.067
Black	93 (47.5)	24 (25.8)	34 (36.6)	35 (37.6)	
White	46 (23.5)	14 (30.4)	19 (41.3)	13 (28.3)	
Latino	28 (14.3)	12 (42.9)	10 (35.7)	6 (21.4)	
Biracial or multiracial	29 (14.8)	6 (20.7)	6 (20.7)	17 (58.6)	
Sexual orientation					0.063
Gay	149 (74.9)	48 (32.2)	54 (36.2)	47 (31.5)	
Not gay	50 (25.1)	9 (18.0)	17 (34.0)	24 (48.0)	
Low perceived SES					0.063
No	118 (59.3)	36 (30.5)	37 (31.4)	45 (38.1)	
Yes	81 (40.7)	21 (25.9)	34 (42.0)	26 (32.1)	
Educational attainment					0.149
High school or less	94 (47.2)	23 (24.5)	31 (33.0)	40 (42.6)	
Some college or more	105 (52.8)	34 (32.4)	40 (38.1)	31 (29.5)	
Employed					0.576
No	153 (76.9)	41 (26.8)	56 (36.6)	56 (36.6)	
Yes	46 (23.1)	16 (34.8)	15 (32.6)	15 (32.6)	
Income					0.040
Less than $10,000	92 (46.2)	24 (26.1)	26 (28.6)	42 (45.7)	
$10,001 to $20,000	63 (31.7)	17 (27.0)	30 (47.6)	16 (25.4)	
More than $20,000	44 (22.1)	16 (36.4)	15 (34.1)	13 (29.6)	

	Total	Smoking status			
	***N* (%)**	**Never *N*=57 *N* (%)**	**Former *N*=71 *N* (%)**	**Current *N*=71 *N* (%)**	***p*-value[1]**
Married, domestic partnership, or civil union with a man					0.577
No	178 (89.5)	49 (27.5)	64 (36.0)	65 (36.5)	
Yes	21 (10.6)	8 (38.1)	7 (33.3)	6 (28.6)	
Any illicit drug use					<0.001
No	103 (51.8)	38 (36.9)	41 (39.8)	27 (23.3)	
Yes	96 (48.2)	19 (19.8)	20 (31.3)	47 (49.0)	

[1]Pearson's χ^2 unless otherwise noted

[2]ANOVA

Table 2

HIV clinical markers, medication adherence, and health care utilization among 199 HIV seropositive men aged 50–69

	Total	Smoking status			
	N (%)	Never *N*=57 *N* (%)	Former *N*=71 *N* (%)	Current *N* =71 *N* (%)	p-value[1]
Seroconverted prior to 1996					0.237
No	59 (29.7)	18 (30.5)	16 (27.1)	25 (42.4)	
Yes	140 (70.4)	39 (27.9)	55 (39.3)	46 (32.9)	
HIV clinical markers					
CD4 cell count					0.022
500+	88 (46.1)	27 (30.7)	39 (44.3)	22 (25.0)	
<500	103 (53.9)	27 (26.2)	31 (30.1)	45 (43.7)	
Undetectable viral load					<0.001
No	149 (76.4)	10 (21.7)	9 (19.6)	27 (58.7)	
Yes	46 (23.6)	46 (30.9)	61 (40.9)	42 (28.2)	
HIV medication adherence					
Missed doses in the last 4 days					0.577[2]
No	144 (72.4)	46 (31.9)	50 (34.7)	48 (33.3)	
Yes	36 (18.1)	7 (19.4)	15 (41.7)	14 (38.9)	
Not currently on HIV medication	19 (9.6)	4 (21.1)	6 (31.6)	9 (47.4)	
Always adherent to specific schedule					0.025[2]
No	93 (46.7)	26 (28.0)	43 (46.2)	24 (25.8)	
Yes	87 (43.7)	27 (31.0)	22 (25.3)	38 (43.7)	
Not currently on HIV medication	19 (9.6)	4 (21.1)	6 (31.6)	9 (47.4)	
Always follow medication instructions					0.074
No	96 (81.9)	30 (31.3)	42 (43.8)	24 (25.0)	
Yes	61 (33.0)	14 (23.0)	19 (31.2)	28 (45.9)	

	Total	Smoking status			
	***N* (%)**	**Never** ***N*=57** ***N* (%)**	**Former** ***N*=71** ***N* (%)**	**Current** ***N* =71** ***N* (%)**	**p-value[1]**
Not currently on HIV medication or no special instructions	28 (15.1)	8 (28.6)	8 (28.6)	12 (42.9)	
Missed doses last weekend					0.679
No	147 (73.9)	44 (29.9)	55 (37.4)	48 (32.7)	
Yes	33 (16.6)	9 (27.3)	10 (30.3)	14 (42.4)	
Not currently on HIV medication	19 (9.6)	4 (21.1)	6 (31.6)	9 (47.4)	
Health care utilization					
Most frequent source of care					0.048[1]
Private doctor, physician or clinic	102 (51.3)	28 (27.5)	45 (44.1)	29 (28.4)	
Public or county clinic, hospital	80 (40.2)	22 (27.5)	23 (28.8)	35 (43.8)	
VA hospital or clinic	14 (7.0)	7 (50.0)	2 (14.3)	5 (35.7)	
Emergency room	3 (1.5)	0 (0.0)	1 (33.3)	2 (66.7)	

[1] Pearson's χ^2

[2] Fisher's exact test

Table 3

Opportunistic infections 199 HIV seropositive MSM aged 50–69

	Total	Smoking status			
	N (%)	Never *N*=57 *N* (%)	Former *N*=71 *N* (%)	Current *N*=71 *N* (%)	p-value[3]
Any opportunistic infection					0.049
No	75 (37.7)	29 (38.7)	24 (32.0)	22 (29.3)	
Yes	124 (62.3)	28 (22.6)	27 (37.9)	49 (39.5)	
Any respiratory opportunistic infection					0.008
No	132 (66.3)	47 (35.6)	41 (31.1)	44 (33.3)	
Yes	67 (33.7)	10 (14.9)	30 (44.8)	27 (40.3)	
Mycobacterium avium					
No	191 (96.0)	57 (29.8)	68 (35.6)	66 (34.6)	0.152
Yes	8 (4.0)	0 (0)	3 (37.5)	5 (62.5)	
Tuberculosis					
No	179 (90.0)	54 (30.2)	60 (33.5)	65 (36.3)	0.164
Yes	20 (10.1)	3 (15.0)	11 (55.0)	6 (30.0)	
PCP					0.068
No	149 (74.9)	49 (32.9)	49 (32.9)	51 (34.2)	
Yes	50 (25.1)	8 (16.0)	22 (44.0)	20 (28.2)	
Cytomegalovirus(CMV)					0.794
No	192 (96.5)	56 (29.2)	68 (35.4)	68 (35.4)	
Yes	7 (3.5)	1 (14.3)	3 (42.9)	3 (42.9)	
Any gastrointestinal opportunistic infection					0.058
No	117 (58.8)	41 (35.0)	38 (32.5)	38 (32.5)	
Yes	82 (41.2)	16 (19.5)	33 (40.2)	33 (40.2)	
Salmonella					

	Total	Smoking status			
	N (%)	**Never** *N*=57 *N* (%)	**Former** *N*=71 *N* (%)	**Current** *N*=71 *N* (%)	**p-value**[3]
No	194 (97.5)	56 (28.9)	69 (35.6)	69 (35.6)	1.000
Yes	5 (2.5)	1 (20)	2 (40.0)	2 (40.0)	
Candidiasis					0.043
No	123 (61.8)	43 (35.0)	40 (32.5)	40 (32.5)	
Yes	76 (38.2)	14 (18.4)	31 (40.8)	31 (40.8)	
Cryptococcal disease					0.794
No	192 (96.5)	56 (29.2)	68 (35.4)	68 (35.4)	
Yes	7 (3.5)	1 (14.3)	3 (42.9)	3 (42.9)	
Cryptosporidiosis					1.000
No	194 (97.5)	56 (28.9)	69 (35.6)	69 (35.6)	
Yes	5 (2.5)	1 (20.0)	2 (40.0)	2 (40.0)	
Toxoplasmosis					0.901
No	191 (96.0)	54 (28.3)	68 (35.6)	69 (36.1)	
Yes	8 (4.0)	3 (37.5)	3 (37.5)	2 (25.0)	
Microsporidiosis, Isosporiasis, E. intestinalis					1.000
No	195 (98.0)	56 (28.7)	70 (35.9)	69 (35.4)	
Yes	4 (2.0)	1 (25.0)	1 (25.0)	2 (50.0)	

[3] Pearson's χ^2 unless otherwise noted

Table 4

Multivariable polytomous logistic regression models of correlates of smoking among 199 HIV+ MSM aged 50–69

	Crude OR (95% CI)			Adjusted OR (95% CI)		
	Former vs. Never (ref)	**Current vs. Never (ref)**	**Current vs. Former (ref)**	**Former vs. Never (ref)**	**Current vs. Never (ref)**	**Current vs. Former (ref)**
Undetectable viral load						
No	1.0	1.0	1.0	1.0	1.0	1.0
Yes	1.33 (0.90, 1.94)	0.91 (0.60, 1.39)	0.69 (0.46, 1.02)	1.30 (0.47, 3.62)	0.32 (0.13, 0.81)	0.25 (0.10, 0.62)
Any respiratory OI						
No	1.0	1.0	1.0	1.0	1.0	1.0
Yes	3.44 (1.50, 7.88)	2.88 (1.25, 6.64)	0.84 (0.43, 1.64)	2.82 (1.12, 7.12)	1.70 (0.64, 4.50)	0.60 (0.26, 1.39)
Any gastrointestinal OI						
No	1.0	1.0	1.0	1.0	1.0	1.0
Yes	2.23 (1.06, 4.68)	2.23 (1.06, 4.68)	1.00 (0.52, 1.93)	1.51 (0.64, 3.55)	2.65 (1.07, 6.60)	1.76 (0.77, 4.04)
Age	1.05 (0.97, 1.13)	0.93 (0.86, 1.01)	0.89 (0.82, 0.96)	1.06 (0.98, 1.15)	0.96 (0.87, 1.05)	0.90 (0.83, 0.98)
Income						
Less than $10,000	1.0	1.0	1.0	1.0	1.0	1.0
$10,001 to $20,000	1.76 (0.97, 3.20)	0.94 (0.48, 1.86)	0.53 (0.29, 0.98)	1.43 (0.60, 3.37)	0.61 (0.24, 1.55)	0.43 (0.18, 1.00)
More than $20,000	0.94 (0.46, 1.90)	0.81 (0.39, 1.69)	0.87 (0.41, 1.82)	0.89 (0.34, 2.35)	0.67 (0.24, 1.86)	0.75 (0.28, 2.04)
Any illicit drug use						
No	1.0	1.0	1.0	1.0	1.0	1.0
Yes	1.46 (0.71, 3.02)	3.92 (1.87, 8.20)	2.68 (1.35, 5.29)	1.57 (0.71, 3.48)	4.12 (1.79, 9.47)	2.63 (1.21, 5.70)