Short Communication

Trends in cigarette smoking among adults with HIV compared with the general adult population, United States - 2009–2014

Emma L. Frazier, Madeline Y. Sutton*, John T. Brooks, R. Luke Shouse, John Weiser

Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, U.S. Centers for Disease Control and Prevention, United States

ABSTRACT

Smoking increases HIV-related and non-HIV-related morbidity and mortality for persons with HIV infection. We estimated changes in cigarette smoking among adults with HIV and adults in the general U.S. population from 2009 to 2014 to inform HIV smoking cessation programs. Among HIV-positive adults, rates of current smoking declined from 37.6% (confidence interval [CI]: 34.7–40.6) in 2009 to 33.6% (CI: 29.8–37.8) in 2014. Current smoking among U.S. adults declined from 20.6% (CI: 19.9–21.3) in 2009 to 16.8% (CI: 16.2–17.4) in 2014. HIV-positive adults in care were significantly more likely to be current smokers compared with the general U.S. population; they were also less likely to quit smoking. For both HIV-positive adults in care and the general population, disparities were noted by racial/ethnic, educational level, and poverty-level subgroups. For most years, non-Hispanic blacks, those with less than high school education, and those living below poverty level were more likely to be current smokers and less likely to quit smoking compared with non-Hispanic whites, those with greater than high school education, and those living above poverty level, respectively. To decrease smoking-related causes of illness and death and to decrease HIV-related disparities, smoking cessation interventions are vital as part of routine care with HIV-positive persons. Clinicians who care for HIV-positive persons who smoke should utilize opportunities to discuss and implement smoking cessation strategies during routine clinical visits.

1. Introduction

Cigarette smoking is the leading cause of premature illness and death in the United States (Jamal et al., 2016). Recent data show significant reductions in the proportion of U.S. adults in the general population who smoke cigarettes (from 20.9% in 2005 to 15.1% in 2015) (Jamal et al., 2016), but more is needed to reach the Healthy People 2020 target of ≤12.0% of adults smoking (Office of Disease Prevention and Health Promotion, 2016). For HIV-positive adults, cigarette smoking increases both HIV-related and non-HIV-related morbidity and mortality, even for persons taking antiretroviral medications (Helleberg et al., 2015). Higher rates of chronic obstructive pulmonary disease, lung cancers and cardiovascular disease have been described among smokers who are living with HIV infection, and smoking cessation has been associated with increased life expectancy among persons living with HIV infection (Reddy et al., 2016; Reddy et al., 2017). However, smoking cessation programs have not yet been routinely implemented as part of comprehensive clinical care for HIV-positive patients who smoke.

Although cross-sectional data show that adults with HIV were more likely to smoke and less likely to quit smoking compared with the general population (Mdodo et al., 2015), longer term smoking trends among adults living with HIV have been understudied. One report of smoking trends among HIV-positive and negative men who have sex with men (MSM) in North America showed a decline in annual prevalence of current smoking among MSM from 1984 to 2012, though disparities were noted by race, ethnicity and education (Akhtar-Khaleel et al., 2016). For HIV-positive and negative women in the U.S., significant declines in current cigarette smoking were also noted from 1994 to 2011. We found no previous reports of smoking and quitting trends among a sample of HIV-positive adults compared with the general U.S. population (Hessol et al., 2014). Therefore, we estimated the changes in cigarette smoking among adults living with HIV and adults in the general U.S. population from 2009 to 2014 in an effort to inform prevention and care programs, which includes smoking cessation, for HIV-positive persons.

2. Methods

We analyzed matched, self-reported interview and medical record abstraction data from the 2009 through 2014 data collection cycles of the Medical Monitoring Project (MMP), an HIV surveillance system that

provides annual, nationally representative estimates of characteristics of HIV-positive adults receiving medical care in the United States. Briefly, the 2009–2014 MMP cycles used a three-stage, probability-proportional-to-size sampling method and has been described previously (Iachan et al., 2016; Bradley et al., 2013). The Centers for Disease Control and Prevention's National Center for HIV, Viral Hepatitis, STD, and TB Prevention has determined MMP to be a non-research public health surveillance activity used to guide disease control programs and policy, and thus it was not reviewed by a federal institutional review board (IRB). Participating states or territories and facilities obtained local institutional review board approval to conduct MMP if required locally. Informed consent was obtained from all interviewed participants.

Briefly, data were weighted based on known probabilities of selection for each health jurisdiction, by facility, for patients from selected facilities and for nonresponse. The number of participating facilities ranged from 461 to 485 (median = 474) in 2009 to 2014 data cycles. Of sampled patients, the number of patients who completed interviews and had their medical record abstracted ranged from 4217 to 5154 (median = 4503). The median facility response and patient response rates, adjusted for eligibility, ranged from 76%–86% (median = 84%) to 52%–56% (median = 55%). For estimates from the general U.S. population, we used self-reported data from the National Health Information Survey (NHIS). NHIS is an annual, cross-sectional survey of the noninstitutionalized U.S. civilian population. The Census Bureau, under a contractual agreement, is the data collection agent for the NHIS. NHIS data were weighted to account for the sample design, differential probability of selection and nonresponse, and to provide nationally representative estimates. The 2009–2014 NHIS adult core questionnaires collected national health information on illness and disability through in-person interviews with a random probability sample of 27,731–36,697 (median = 33,014) non-institutionalized civilian adults aged ≥18 years; the overall response rate ranged from 59% to 66% (median = 61%) (National Center for Health Statistics, n.d.; Parsons et al., 2014).

The primary outcome variable for both data sets was current smoking status, defined based on respondents' answers to the following questions: 1) "Have you smoked at least 100 cigarettes in your entire life?" (MMP and NHIS); 2) "Do you now smoke cigarettes every day, some days, or not at all?" (NHIS only); and 3) "How often do you smoke cigarettes now? (daily, weekly, monthly, less than monthly, never)" (MMP only). Current cigarette smokers were defined as individuals who reported they had smoked 100 cigarettes or more during their lifetime, and currently smoked every day or some days. We also measured the

quit ratio, which is a measure of successful smoking cessation at the population level. The quit ratio was defined as the ratio of former smokers to ever-smokers (i.e., sum of current smokers and former smokers) and can be considered as a proxy for smoking cessation.

Covariates were based on self-reported socio-demographic variables from both the MMP and NHIS and included age group, gender, race/ethnicity, education, and poverty level. Poverty level was determined using the U.S. Department of Health and Human Services poverty guidelines and poverty thresholds published by the U.S. Census Bureau for 2009–2014 (Department of Health and Human Services, 2015).

2.1. Data analyses

Weighted estimates, percentages, and 95% confidence intervals (CIs) were determined for current smokers among MMP and NHIS samples. We computed adjusted prevalence estimates (predicted marginal percentages), adjusted prevalence ratios (APR), adjusted prevalence differences (APD), and quit ratios using multiple logistic regression analysis after controlling for socio-demographic characteristics (age, gender, race/ethnicity, education, and poverty level).

Assuming that MMP and NHIS were independent samples, with separate design variables and weights, we combined the datasets and constructed a model with current smoking as the dependent variable and an indicator variable for survey type as the independent variable (1 = MMP; 0 = NHIS), all characteristics listed, and interaction terms between the indicator variable and all characteristics (Korn and Graubard, 1999).

We computed percentage change in smoking rates and in quit ratios for the MMP and NHIS populations from 2009 to 2014. Regression models were used to estimate overall smoking trends in both populations. All analyses were performed using SAS 9.3 (SAS Institute, Cary, NC) and SAS-callable SUDAAN 10.0.1 (RTI International, Research Triangle Park, NC) and accounted for clustering, unequal selection probabilities, and non-response by weighting. Using the results from the regression models, we assessed negative beta coefficients to represent an annual average point change. Trends were considered to be statistically significant when $p < 0.05$. Missing data were excluded from the analysis.

3. Results

The final analyses included 28,166 MMP participants, and 192,684 NHIS participants. Of the 28,279 MMP participants from 2009 to 2014, 113 persons (0.40%) with unknown smoking status were excluded from

Table 1
Smoking Rates in HIV-Positive Adults in Medical Care (Medical Monitoring Project) and Adults in the General Population (National Health Interview Survey) - 2009–2014.

Cycle Year	Weighted, not standardized		Weighted, not standardized		Standardized rates		Adjusted prevalence difference - MMP& NHIS		APR
	NHIS %	95% CI	MMP %	95% CI	MMP	95% CI			
2009	20.6	19.9–21.3	42.4	39.7–45.1	37.6	34.7–40.6	17.0	14.0–20.1	1.83
2010	19.4	18.8–19.9	40.8	38.9–42.6	34.4	32.3–36.6	15.0	12.8–17.2	1.77
2011	19.0	18.4–19.6	40.0	37.2–42.8	34.7	31.1–38.5	15.7	11.9–19.4	1.83
2012	18.1	17.5–18.7	40.2	37.1–43.3	33.2	30.5–36.0	15.1	12.3–17.9	1.84
2013	17.8	17.2–18.4	38.2	36.4–40.0	32.4	30.5–34.4	14.6	12.6–16.6	1.82
2014	16.8	16.2–17.4	37.9	34.8–40.9	33.6	29.8–37.8	16.9	12.8–20.9	2.00
% change between 2009 and 2014	−18.45%		−10.61%		−10.64%				
Difference between 2009 and 2014	−3.8		−4.5		−4.0				
β for trend	−0.005		−0.0091						
P value for trend	< 0.0001		0.0068						

Abbreviations: MMP = Medical Monitoring Project; NHIS = National Health Interview Survey; APR = Adjusted Prevalence Ratio CI - Confidence Interval.
Percentage change = (2014% smoking − 2009% smoking)/2009% smoking ∗ 100.
Absolute Difference = 2014% smoking − 2009% smoking.
^Model was adjusted for the covariates - age group, race/ethnicity, education, gender, and poverty.