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Disparities in the Quality of Cardiovascular Care Between HIV-Infected versus HIV-Uninfected Adults in the United States: A Cross-Sectional Study

Short Title: Disparities in Cardiovascular Care in HIV+ Adults

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Abstract

Background-Cardiovascular disease is emerging as a major cause of morbidity and mortality among patients with human immunodeficiency virus (HIV). We compared use of national

guideline-recommended cardiovascular care during office visits among HIV-infected vs. HIV-uninfected adults.

Methods and Results-We analyzed data from a nationally representative sample of HIV-infected and HIV-uninfected patients age 40-79 in the National Ambulatory Medical Care Survey/National Hospital Ambulatory Medical Care Survey, 2006-2013. The outcome was provision of guideline-recommended cardiovascular care. Logistic regressions with propensity score weighting adjusted for clinical and demographic factors. We identified 1,631 visits by HIV-infected patients and 226,862 visits by HIV- uninfected patients with cardiovascular risk factors, representing approximately 2.2 million and 602 million visits per year in the United States, respectively. The proportion of visits by HIV-infected vs. HIV-uninfected adults with aspirin/antiplatelet therapy when patients met guideline-recommended criteria for primary prevention or had cardiovascular disease (CVD) was 5.1% vs. 13.8% (P=0.03); the proportion of visits with statin therapy when patients had diabetes, CVD, or dyslipidemia was 23.6% vs. 35.8% (P<0.01). There were no differences in antihypertensive medication therapy (53.4% vs. 58.6%), diet/exercise counseling (14.9% vs. 16.9%), or smoking cessation advice/pharmacotherapy (18.8% vs. 22.4%) between HIV-infected vs. HIV-uninfected patients, respectively.

Conclusions–Physicians generally underused guideline-recommended cardiovascular care and were less likely to prescribe aspirin and statins to HIV-infected patients at increased risk—findings which may partially explain higher rates of adverse cardiovascular events among patients with HIV. U.S. policymakers and professional societies should focus on improving the quality of cardiovascular care that HIV-infected patients receive.

Keywords- HIV, quality of care, cardiovascular disease, medical visits.

Clinical Perspective

What is New:

- Patients with HIV experience approximately a 50-100% increased risk of myocardial infarction and stroke compared to HIV-uninfected persons, but physicians underused guideline-recommended cardiovascular care in these patients and were less likely to prescribe them aspirin and statin therapy.

What are the clinical implications:

- This study provides evidence that U.S. policymakers and professional societies should focus on improving the quality of cardiovascular care that HIV-infected patients receive.

Introduction

Cardiovascular disease is emerging as a major cause of morbidity and mortality among patients with human immunodeficiency virus (HIV).[1, 2] As antiretroviral therapy (ART) has become more widely available in developed countries, HIV-infected patients are increasingly living longer in these regions, with more than one-quarter of the 1.2 million HIV-infected persons in the United States now 55 years of age or older.[3] Recent studies have demonstrated that patients with HIV experience approximately a 50-100% increased risk of myocardial infarction and stroke compared to HIV-uninfected persons, and they also face higher risks of stroke, sudden death, and heart failure.[1, 2, 4, 5] Moreover, these increased risks persist even after adjusting for traditional risk factors like smoking, which tend to be more prevalent among patients with HIV.[6] Some antiretroviral medications also induce metabolic changes that interact with cardiovascular risk.[7] Efforts to tailor cardiovascular risk prediction models for patients with HIV are underway.[8] However, we know little about physicians' provision of cardiovascular care to patients with HIV, or how their cardiovascular care patterns compare to those of HIV-uninfected patients.

Examining cardiovascular care patterns among patients with HIV may uncover opportunities for quality improvement through clinician-level, practice-level, or reimbursement-based interventions. Improving the quality of cardiovascular care that physicians provide to patients with HIV may also help improve their health outcomes. To further inform these issues, we used nationally-representative visit data from physician offices and hospital outpatient clinics in the United States to compare guideline-recommended use of aspirin, statins, antihypertensives, smoking cessation counseling and pharmacotherapy, and diet/exercise counseling among HIV-

infected adults with cardiovascular risk factors. We compared these patterns of care to the care provided to HIV-uninfected adults with cardiovascular risk factors.

Methods

The data and study materials are publicly available, and the analytic methods will be made available to other researchers upon request by contacting the corresponding author, for purposes of reproducing the results or replicating the procedure.

Data

We analyzed data on adults age 40-79 from the 2006-2013 National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS), nationally representative surveys of ambulatory care.[9] We included all visits to office-based physicians and hospital-based outpatient clinics. The National Center for Health Statistics (NCHS) and the Centers for Disease Control and Prevention conduct the NAMCS and NHAMCS in the United States annually. The NAMCS is conducted on a nationally representative sample of visits to office-based physicians and the NHAMCS is conducted on a nationally representative sample of visits to hospital-based outpatient clinics and emergency departments. For the NAMCS, each physician is randomly assigned to a 1-week reporting period during which a random sample of visits are surveyed systematically. Data collection is expected to be carried out by the physician or the physician's staff but data are also abstracted by U.S. Census field representatives. Data are recorded in standardized patient record forms. For the NHAMCS, a systematic random sample of patient visits in selected non-institutional general and short-stay hospitals are surveyed during a randomly assigned 4-week reporting period. Data collection is expected to be performed by hospital staff but data are also abstracted by U.S. Census field representatives. Similar to the NAMCS, data are recorded in standardized patient

record forms. In both surveys, data are collected from the medical record on patients' symptoms, comorbidities, and demographic characteristics; physicians' diagnoses; medications ordered or provided; and medical services provided.

Data on community health centers and NHAMCS outpatient hospital departments were unavailable in 2012-2013, but the majority of ambulatory care is performed in office-based visits and captured by the NAMCS (93% of visits during 2006-2011 occurred in NAMCS office visits rather than in NHAMCS hospital outpatient departments, and of the NAMCS visits, 99% of them occurred outside of community health centers). We adjusted for the absence of these two care sites in regression analyses and used the ratio of estimates derived from 2006-2011 with and without hospital outpatient/community health center visits to adjust 2012-2013 estimates of care provision and visit volume.

The NAMCS and NHAMCS intake materials allow physicians and staff to record up to three reasons for each visit and three diagnoses related to the visit, in addition to capturing several other major comorbid diagnoses (coded by NCHS staff using the International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM]).[10] The data, analytic methods, and study materials will be made available to other researchers by the corresponding author for purposes of reproducing the results or replicating the procedure. This study was exempt from IRB review.

Study Population

We identified visits by adults age 40-79 with HIV using ICD-9 codes 042, 079.53, and V08 and reason for visit code 2015.1. Building on methods from our prior work,[11, 12] we also identified the following risk factors for adverse cardiovascular events using visit diagnoses and patients’ chief complaints: existing cardiovascular disease (coronary artery disease, stroke,

carotid stenosis, peripheral vascular disease, and abdominal aortic aneurysm [AAA]), hypertension, diabetes, dyslipidemia, obesity/overweight, and cigarette smoking. ICD-9 codes and reason for visit codes are provided in Table S1.

Patient Involvement

Our study was informed by a 2013 FDA-sponsored focus group of HIV-infected patients in which patients expressed concerns about the increased inflammation associated with HIV and the consequent increased risk of heart disease. The original data for our study were collected by the NCHS and patients were not directly involved in our study design. For these reasons, the outcome measures were not explicitly informed by patient preferences. However, study results will be disseminated to CTSI/UCLA's Resource Centers for Minority Aging Research (RCMAR) and The Charles R. Drew University/UCLA Project Export Center, which includes community representatives and a community advisory board.

Primary Measures

We identified 5 cardiovascular therapies based on guidelines issued by the Adult Treatment Panel III (ATP III), American Heart Association/American College of Cardiology (AHA/ACC), U.S. Preventive Services Task Force (USPSTF), and Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) (**Table 1**). The therapies we evaluated were: (1) aspirin/antiplatelet therapy for primary or secondary prevention of cardiovascular disease (CVD) in patients at increased risk (men age 45 to 79, women age 55 to 79, or any patient with prior CVD)[13, 14]; (2) statin therapy in patients with a history of CVD, diabetes, or dyslipidemia[15]; (3) antihypertensive therapy among patients with diagnosed hypertension[16]; (4) smoking cessation advice/counseling or pharmacotherapy in smokers[17]; and (5) diet/exercise counseling for any patient with a cardiovascular risk factor or existing CVD.[18-21]

Medications prescribed by physicians were identified using Multum Lexicon drug codes and therapeutic drug categories and NCHS generic codes for antiplatelet agents (aspirin, clopidogrel, ticagrelor, and prasugrel), statins, antihypertensive medications, and smoking cessation medications (nicotine replacement therapy, varenicline, or bupropion) (see Table S1 for drug codes). A maximum of 8 medications could be recorded for visits between 2006-2011 and this increased to 10 medications in 2012-2013. We limited our accounting to the first 8 medications for each visit across all years for conformity but performed a sensitivity analysis in which up to 10 medications were assessed. This sensitivity analysis did not alter our results.

Other Measures

To account for factors associated with treatment patterns, we used NAMCS/NHAMCS data on age, sex, race/ethnicity, insurance (private, Medicare, Medicaid, self-pay/no-charge, and other/unknown), US census region (Northeast, Midwest, South, and West), and urban or rural setting. We characterized patients as non-Hispanic white, non-Hispanic black, Hispanic, or other race. We also assessed continuity of care and considered a patient to have good continuity of care if the patient had been seen before and had at least one visit in the practice during the preceding 12 months.[22]

We performed exploratory sensitivity analyses among the subset of patients with physician specialty information or lipid values. We accounted for physician specialty and explored differences in care between HIV-infected and HIV-uninfected patients by comparing lipid levels among statin-eligible patients and blood pressure among patients with hypertension. In other sensitivity analyses, we (1) assessed whether use of ART was inversely associated with statin therapy, because some researchers have cited concerns about drug-drug interactions[23]; and (2) limited our population to only preventive care visits (including general medical exams) and

primary care visits (physicians in family practice and internal medicine, or other specialties when the physician reported serving as the patient's primary care doctor).

Statistical Analysis

We used summary statistics to estimate the prevalence of cardiovascular treatments during our study period. We estimated logistic regression models to compare cardiovascular care among patients with vs. without HIV. To improve the comparability of HIV-infected and HIV-uninfected patients and reduce bias in our estimates of differences in care, we performed a propensity score analysis using methods for survey weighted data and inverse probability weighting.[24, 25] Specifically, we used a survey-weighted logistic regression model to estimate the predicted probability of HIV. This model included patients' clinical risk factors, demographic characteristics, insurance status, geographic region, setting (urban or rural), and care site, as described above and listed in **Table S2** and **Table S3**. Survey weights were also included as a covariate in this model. The predicted probabilities were then inverted to estimate propensity weights (if e is the predicted probability of HIV, HIV-infected patients received a weight of $1/e$ while HIV-uninfected patients received a weight of $1/(1-e)$), and these weights were incorporated into the survey design. Analyses accounting for physician specialty were limited to the NAMCS because specialty information was unavailable in NHAMCS.

We report adjusted odds ratios (aOR) and 95% CIs. All analyses accounted for the complex sampling design of the NAMCS and NHAMCS and were performed using Stata, version 14 (StataCorp, Inc. College Station, TX).[26]

Results

We identified 1,631 visits by HIV-infected adults and 226,862 visits by HIV-uninfected adults with cardiovascular risk factors from 2006-2013, representing approximately 2.2 million

and 602 million visits per year, respectively (**Table 2**). Compared to patients without HIV, patients with HIV were more likely to be younger, male, Hispanic, Black, and uninsured or insured by Medicaid. The prevalence of cardiovascular disease and factors conferring risk for cardiovascular disease was higher among patients without HIV, with the exception of smoking, which was more common among patients with HIV. Propensity score methods improved the balance across the two groups (**Table S4**).

Pharmacologic Therapy

The unadjusted proportion of visits by HIV-infected vs. HIV-uninfected adults with an aspirin/antiplatelet prescription when patients met USPSTF criteria for primary prevention or had CVD was 5.1% (95% CI 2.8-7.3%) vs. 13.8% (95% CI 13.3-14.3%); the proportion of visits with a statin prescription when patients had diabetes, CVD, or dyslipidemia was 23.6% (95% CI 16.3-30.9%) vs. 34.8% (95% CI 33.9-36.8%); and the proportion of visits with antihypertensive therapy when patients had a diagnosis of hypertension was 53.4% (95% CI 42.3%-64.5%) vs. 58.4% (95% CI 57.2-59.9%), respectively. Time trends are shown in **Figure 1**. After adjustment for confounders in the propensity score analysis, aspirin/antiplatelet therapy and statin therapy were prescribed at significantly lower rates among patients with HIV (**Table 3**).

Lifestyle Counseling

The unadjusted proportion of visits by HIV-infected vs. HIV-uninfected adults with any cardiovascular risk factors during which diet/exercise counseling was provided was 14.9% (95% CI 8.4-21.4%) vs. 16.9% (95% CI 16.1-17.6%), and 18.8% (95% CI 11.4-26.1%) vs. 22.4% (95% CI 21.2-23.5%) of smokers received smoking cessation counseling or pharmacotherapy, respectively. Time trends are shown in **Figure 2**. Unadjusted differences between HIV-infected

and HIV-uninfected patients were not significant, and remained non-significant after adjustment (**Table 3**).

Sensitivity Analyses with Physician Specialty and Blood Pressure

Based on our results, we performed further analyses to assess whether differences in care may have been attributable to differences in the specialty of physicians serving as primary care providers. Specifically, we found that the percentage of subspecialists (usually an infectious doctor for patients with HIV in the years when these data were available) serving as the primary care doctor was 33% for HIV-infected patients versus 4% for HIV-uninfected patients. However, we had insufficient sample size and power to incorporate physician specialty in our aspirin and statin regression models.

We also attempted to examine quality of care by comparing lipid levels and blood pressure among patients with or without HIV. These analyses demonstrated that there was no significant difference in lipid values between HIV-infected and HIV-uninfected patients who were statin-eligible. There was also no significant difference in systolic blood pressure among hypertensive HIV-infected and HIV-uninfected patients. HIV-infected patients with hypertension had 3 mmHg higher diastolic blood pressure, however ($p=0.04$). In another sensitivity analysis involving patients with HIV and either diabetes, CVD, or dyslipidemia, a prescription for ART was not associated with statin treatment. When we restricted our analysis to only primary care visits, our main results remained unchanged. In addition, we excluded hypertension, dyslipidemia, diabetes, and CVD as covariates because they could be considered on the causal pathway between HIV and prescriptions for aspirin/antiplatelet, statin, and antihypertensive therapy. Their exclusion did not significant change our findings (**Table S5**).

We performed additional sensitivity analyses to further examine whether differences in aspirin or statin prescribing could be related to differences between the number of medications a patient was taking and the number captured by the NAMCS and NHAMCS data. This analysis showed that the mean number of medications reported was 4.2 for HIV-infected patients versus 3.2 for HIV-uninfected patients (difference = 1.0 medications, P<0.001), and 21% of HIV-infected patients reported 8 medications versus 15% of HIV-uninfected patients. When aspirin or statin prescriptions were reported among patients with at least 8 medications, they were usually reported in one of the first 7 medication positions (76% for aspirin and 92% for statin prescriptions among HIV-infected patients versus 87% for aspirin and 89% for statin prescriptions among HIV-uninfected patients) rather than the 8th and final position. An additional analysis that adjusted for total number of medications (excluding aspirin and statin because of endogeneity) yielded results similar to our main findings.

Discussion

Our results indicate that U.S. physicians generally underuse guideline-recommended cardiovascular care for high risk adults and are less likely to prescribe aspirin and statins to HIV-infected adults vs. HIV-uninfected adults. We did not find any differences in provision of antihypertensive therapy, smoking cessation counseling or medications, or nutrition/exercise counseling. Similar to other studies, including some of our own work in this area,[27, 28] we also found declining trends in provision of smoking and diet/exercise counseling for both HIV-infected and HIV-uninfected patients. These concerning declines in evidence-based behavioral counseling may be attributable to a “crowd out” effect from an increase in the number of competing clinical items addressed during ambulatory visits.[28]

To the best of our knowledge, this study is the first to analyze differences in the quality of cardiovascular care between patients with and without HIV using nationally-representative data. Current research efforts in HIV-related cardiovascular disease are largely focused on elucidating the pathophysiology of heightened cardiovascular risk, calibrating risk prediction equations to improve risk stratification, and more recently, evaluating the effects of statin therapy for primary prevention of cardiovascular disease in patients with HIV.[29, 30] A more modest amount of work has focused on physicians' cardiovascular care patterns among patients with HIV. For example, in one study of 397 patients at University of Alabama at Birmingham's HIV Clinic who met USPSTF criteria for aspirin use, Burkholder et al found that only 17% were prescribed aspirin consistent with our results.[31] In another study comparing the 2013 ACC/AHA cholesterol guidelines to the 2004 ATP III guidelines, Zanni et al found that application of the updated guidelines would increase the proportion of statin-eligible HIV-infected persons (n=108) from 10% to 26% in a cohort that was not currently receiving statin therapy.[32]

The differences in aspirin/antiplatelet and statin prescription rates we found—two medications that substantially reduce the incidence of adverse cardiovascular events in at-risk populations and are cost-effective[33, 34]—may partly explain observed differences in cardiovascular event rates between these two populations. While differences in other risk factors, particularly the substantial differences in smoking and HIV-related inflammation, likely play a larger role, the differences in aspirin and statin prescription rates represent a target for quality improvement efforts.

Higher continuity of care among patients with HIV, as shown in Table 1, also suggests that these patients have more follow-up primary care visits on average than HIV-uninfected patients. This suggests that HIV-infected patients should have more opportunities for preventive

cardiovascular care. It is possible that some primary care physicians focus on HIV care during these brief visits (e.g., checking CD4 counts and viral loads) and less on preventive care. In addition, our sensitivity analysis examining differences in total prescriptions between HIV-infected and HIV-uninfected adults did not support the possibility that the differences we observed were attributable to the 8-medication limit of the surveys.

Our study has several limitations. The NAMCS and NHAMCS provide a limited amount of clinical information on each patient visit, and we were unable to robustly account for lipid/cholesterol levels or blood pressure. Our estimates of medication prescriptions and counseling could also underestimate true rates due to underreporting; this may particularly be a problem for aspirin, which is available over the counter. Importantly, because the NAMCS and NHAMCS collect data in the same manner each year for all patients, we have no reason to suspect that any misclassification of health services would differ between HIV-infected and HIV-uninfected patients. Because the unit of analysis in the NAMCS/NHAMCS is visit-based rather than patient-based, differences in visit frequency between HIV-infected and HIV-uninfected patients could affect our results. However, this is less likely to affect utilization during primary care visits (which are more focused on comprehensive and preventive care), and a sensitivity analysis limited to primary care visits did not alter our findings. We also did not perform additional analyses stratified by insurance status or income because of sample size and data limitations.

In conclusion, U.S. physicians generally underused guideline recommended cardiovascular care for high-risk patients age, and were less likely to prescribe aspirin and statins to HIV-infected patients at increased risk—findings which may partially explain higher rates of adverse cardiovascular events among patients with HIV. Professional guidelines, practice-level,

or reimbursement-based policy changes that focus on quality of care among patients with HIV will be needed to ameliorate these disparities and reduce HIV-related cardiovascular morbidity and mortality.

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Data sharing: The full dataset is available at the National Ambulatory Medical Care Survey/National Hospital Ambulatory Medical Care Survey. Study results will be disseminated to CTSI/UCLA's Resource Centers for Minority Aging Research (RCMAR) and The Charles R. Drew University/UCLA Project Export Center, which includes community representatives and a community advisory board.

Disclosures: None

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Captions for Tables and Figures

Table 1. Cardiovascular therapies and interventions recommended by professional societies and national expert panels during study period (2006-2013)

Notes: USPSTF guidelines for aspirin use published in 2009 were more restrictive in their definition of target populations than 2002 guidelines, and we applied the former. ATP III guidelines recommend consideration of LDL levels but these data were scarcely available so we were unable to incorporate them. USPSTF recommended dietary counseling for patients with cardiovascular risk factors in a 2002 guideline but did not issue a recommendation about physical activity counseling in this patient population.

Table 2. U.S. Ambulatory Care Visits for HIV-Infected and HIV-Uninfected Patients with Cardiovascular Risk Factors, by Demographic and Clinical Characteristics, 2006-2013

Table 3. Multivariate-adjusted Association between HIV status and Cardiovascular Therapy in HIV-Infected and HIV-Uninfected Patients with Cardiovascular Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013

Figure 1. Unadjusted Trends in Medication Use among HIV-Infected and HIV-Uninfected Patients with Cardiovascular Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013

Notes: In some years, data in HIV-infected patients did not meet statistical reliability standards due to small sample sizes, and estimates for these years may be inaccurate (2006-2007, 2008-2009, and 2012-2013 for aspirin/antiplatelet therapy; 2012-2013 for statin therapy; 2012-2013 for antihypertensive therapy).

Figure 2. Trends in Behavioral Therapy among HIV-Infected and HIV-Uninfected Patients with CV Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013

Notes: In some years, data in HIV-infected patients did not meet statistical reliability standards due to small sample sizes, and estimates for these years may be inaccurate (2006-2007, 2008-2009, and 2012-2013 for diet/exercise counseling; and 2012-2013 for smoking cessation advice).

Table 1. Cardiovascular therapies and interventions recommended by professional societies and national expert panels during study period (2006-2013)

Cardiovascular therapy	Description of therapy	Target population	Population excluded	Reference
Aspirin/antiplatelet therapy	Aspirin, clopidogrel, ticlopidine, or prasugrel	Adults with CVD; Men age 45-79; Women age 55-79	Adults with GI bleeding, peptic ulcer disease, gastritis, duodenitis, or cerebral hemorrhage	AHA/ACC, USPSTF
Statin therapy	Any statin medication	Adults with CVD, diabetes, or dyslipidemia	Adults with liver disease	AHA/ACC, ATP III
Hypertension therapy	Any antihypertensive medication	Adults with hypertension	None	JNC 7
Smoking cessation advice	Counseling and/or smoking cessation medications	Adult smokers	None	USPSTF
Behavioral counseling	Counseling about diet, exercise, or weight loss	Adults with hypertension, CVD, diabetes, dyslipidemia, or obesity/overweight; Men age 45-79; Women age 55-79	None	USPSTF

Notes: USPSTF guidelines for aspirin use published in 2009 were more restrictive in their definition of target populations than 2002 guidelines, and we applied the former. ATP III guidelines recommend consideration of LDL levels but these data were scarcely available so we were unable to incorporate them. USPSTF recommended dietary counseling for patients with CV risk factors in a 2002 guideline but did not issue a recommendation about physical activity counseling in this patient population. Patients with chronic liver disease were defined as patients with viral hepatitis B, viral hepatitis C, chronic hepatitis, cirrhosis, and malignancy of the liver or bile ducts, using diagnosis codes reported by Byrd et al, Public Health Rep, 2015.

Table 2. U.S. Ambulatory Care Visits for HIV-Infected and HIV-Uninfected Patients with Cardiovascular Risk Factors, by Demographic and Clinical Characteristics, 2006-2013

	HIV-Infected Patients with CV Risk Factors				HIV-Uninfected Patients with CV Risk Factors				P value*
Characteristic	Unweighted Visits, n	Annual Weighted Visits, n	Percent, %	Std. Err.	Unweighted Visits, n	Annual Weighted Visits, n	Percent, %	Std. Err.	
All visits	1,631	1,776,000	100.0	0.0	226,862	487,600,000	100.0	0.0	
Age, yrs.									
40-49	746	794,000	44.7	2.3	37,417	73,745,000	15.1	0.2	
50-59	691	750,000	42.2	2.2	67,715	139,100,000	28.5	0.2	
60-69	166	191,000	10.7	2.0	69,675	153,100,000	31.4	0.2	<0.001
70-79	28	41,000	2.3	0.7	52,055	121,700,000	25.0	0.2	<0.001

Sex									
Female	444	389,000	21.9	2.3	119,949	259,900,000	53.3	0.2	
Male	1,187	1,387,000	78.1	2.3	106,913	227,700,000	46.7	0.2	<0.001
Race/ethnicity									
Non-Hispanic white	440	555,000	31.2	3.9	120,460	262,400,000	53.8	0.7	
Non-Hispanic black	638	604,000	34.0	4.0	23,767	38,332,000	7.9	0.3	<0.001
Hispanic	282	252,000	14.2	2.7	17,590	34,776,000	7.1	0.3	<0.001
Other/unknown	271	366,000	20.6	4.1	65,045	152,100,000	31.2	0.7	0.656
Insurance									
Private	213	449,000	25.3	3.3	89,668	226,400,000	46.4	0.4	
Medicare	396	404,000	22.8	2.4	82,670	180,400,000	37.0	0.3	0.438
Medicaid	658	508,000	28.6	3.5	22,065	26,351,000	5.4	0.2	<0.001
Other/unknown	167	215,000	12.1	3.3	18,081	33,720,000	6.9	0.3	<0.001
Uninsured	197	199,000	11.2	2.5	14,378	20,738,000	4.3	0.1	<0.001
US Region									
Northeast	674	376,000	21.2	4.0	49,190	99,583,000	20.4	0.6	
Midwest	82	127,000	7.2	2.4	54,384	100,100,000	20.5	0.6	0.004
South	509	856,000	48.2	6.6	76,783	187,000,000	38.4	0.9	0.498
West	366	417,000	23.5	5.2	46,505	100,900,000	20.7	0.6	0.770
Setting									
Urban	1,588	1,746,000	98.3	1.0	199,068	427,300,000	87.6	1.2	
Rural	43	30,000	1.7	1.0	27,794	60,362,000	12.4	1.2	<0.001
CV risk factors									
Obese/overweight	104	86,000	4.8	1.0	25,149	52,980,000	10.9	0.2	<0.001
Smoker	559	579,000	32.6	3.0	34,863	66,918,000	13.7	0.2	<0.001
Dyslipidemia	291	344,000	19.4	2.5	53,722	134,300,000	27.5	0.4	0.005
Diabetes	234	222,000	12.5	2.2	48,904	99,407,000	20.4	0.3	0.004
Hypertension	604	633,000	35.7	3.1	99,219	220,900,000	45.3	0.4	0.003
Good continuity of care	1,462	1,640,000	92.3	1.4	175,726	391,400,000	80.3	0.3	<0.001
CVD	55	48,000	2.7	0.8	20,633	43,824,000	9.0	0.2	<0.001

Abbreviations: CVD, cardiovascular disease; HIV, human immunodeficiency virus

Note: All analyses account for the complex sampling design of the NAMCS and NHAMCS

*P values calculated with Wald chi-square test from simple ordinal (age) or binomial/multinomial (sex, race/ethnicity, insurance, setting, risk factors, comorbid diseases) logistic regression models comparing patients with HIV to patients without HIV

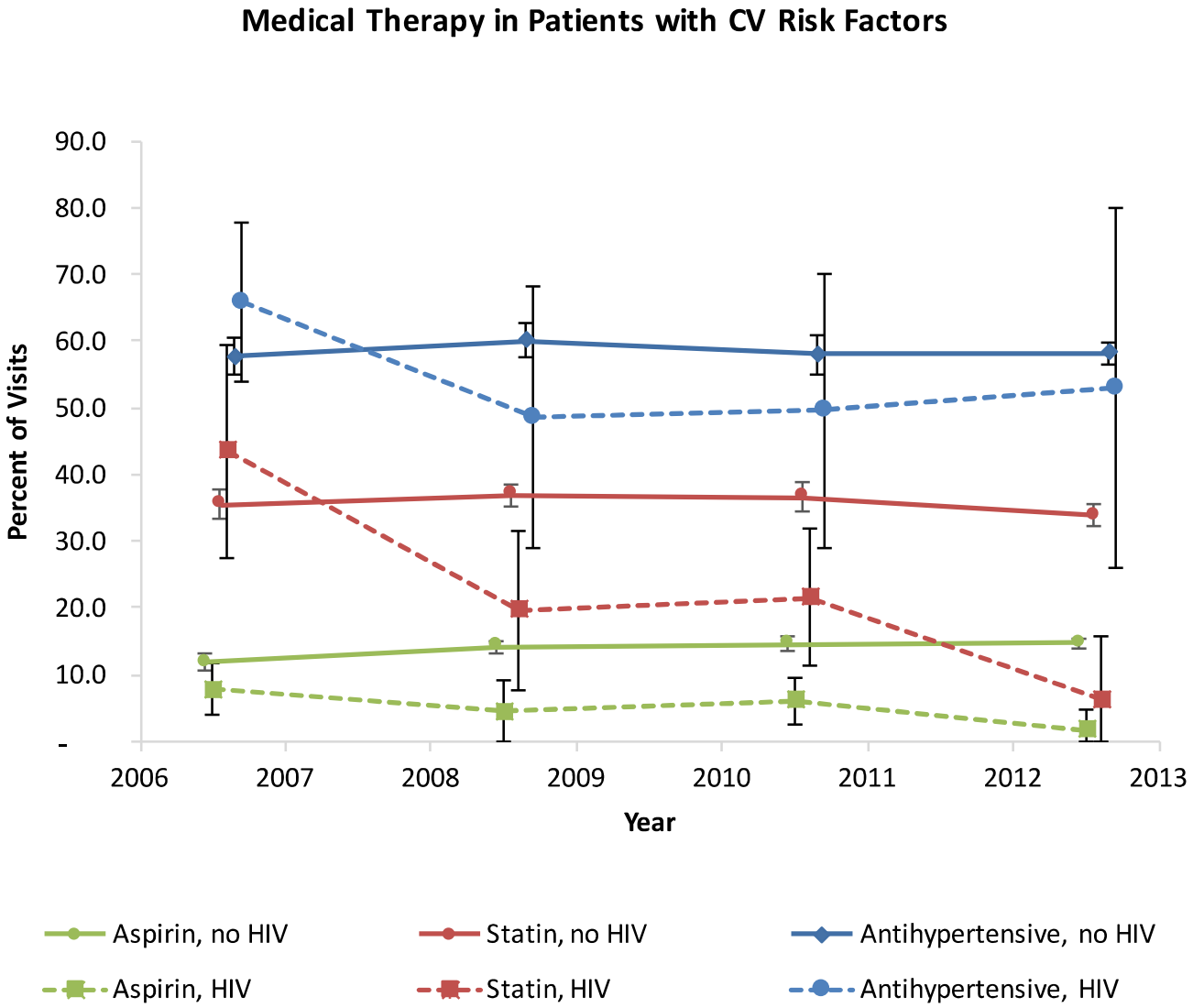
Table 3. Propensity Score Analysis: Association between HIV status and Cardiovascular Therapy in HIV-Infected and HIV-Uninfected Patients with CV Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013

Characteristics	Aspirin/Antiplatelet				Statin				Antihypertensive			
	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value
HIV	0.53	(0.30-	0.94)	0.03	0.51	(0.32-	0.82)	<0.01	0.88	(0.48-	1.58)	0.66
Demographics												
Female	0.81	(0.53-	1.23)	0.33	0.80	(0.56-	1.14)	0.22	0.57	(0.31-	1.03)	0.06
Black	1.09	(0.67-	1.77)	0.73	1.29	(0.72-	2.30)	0.39	1.86	(0.97-	3.56)	0.06
Hispanic	1.30	(0.63-	2.71)	0.48	0.73	(0.41-	1.31)	0.29	1.92	(1.04-	3.57)	0.04
Insurance												
Medicaid	0.70	(0.36-	1.36)	0.29	1.00	(0.52-	1.92)	1.00	0.69	(0.37-	1.28)	0.24
Uninsured	0.75	(0.43-	1.31)	0.31	0.81	(0.48-	1.38)	0.44	1.03	(0.49-	2.14)	0.94

Characteristics	Diet/Exercise Counseling				Smoking Cessation Advice or Medications			
	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value
HIV	0.78	(0.51-	1.21)	0.27	1.51	(0.90-	2.53)	0.12
Demographics								
Female	1.31	(0.93-	1.84)	0.12	1.21	(0.85-	1.71)	0.30
Black	1.22	(0.84-	1.75)	0.30	0.83	(0.59-	1.15)	0.26
Hispanic	1.36	(0.91-	2.03)	0.14	1.23	(0.76-	1.98)	0.40
Insurance								
Medicaid	1.08	(0.66-	1.76)	0.77	0.98	(0.62-	1.53)	0.91
Uninsured	1.31	(0.86-	1.98)	0.21	1.28	(0.76-	2.16)	0.35

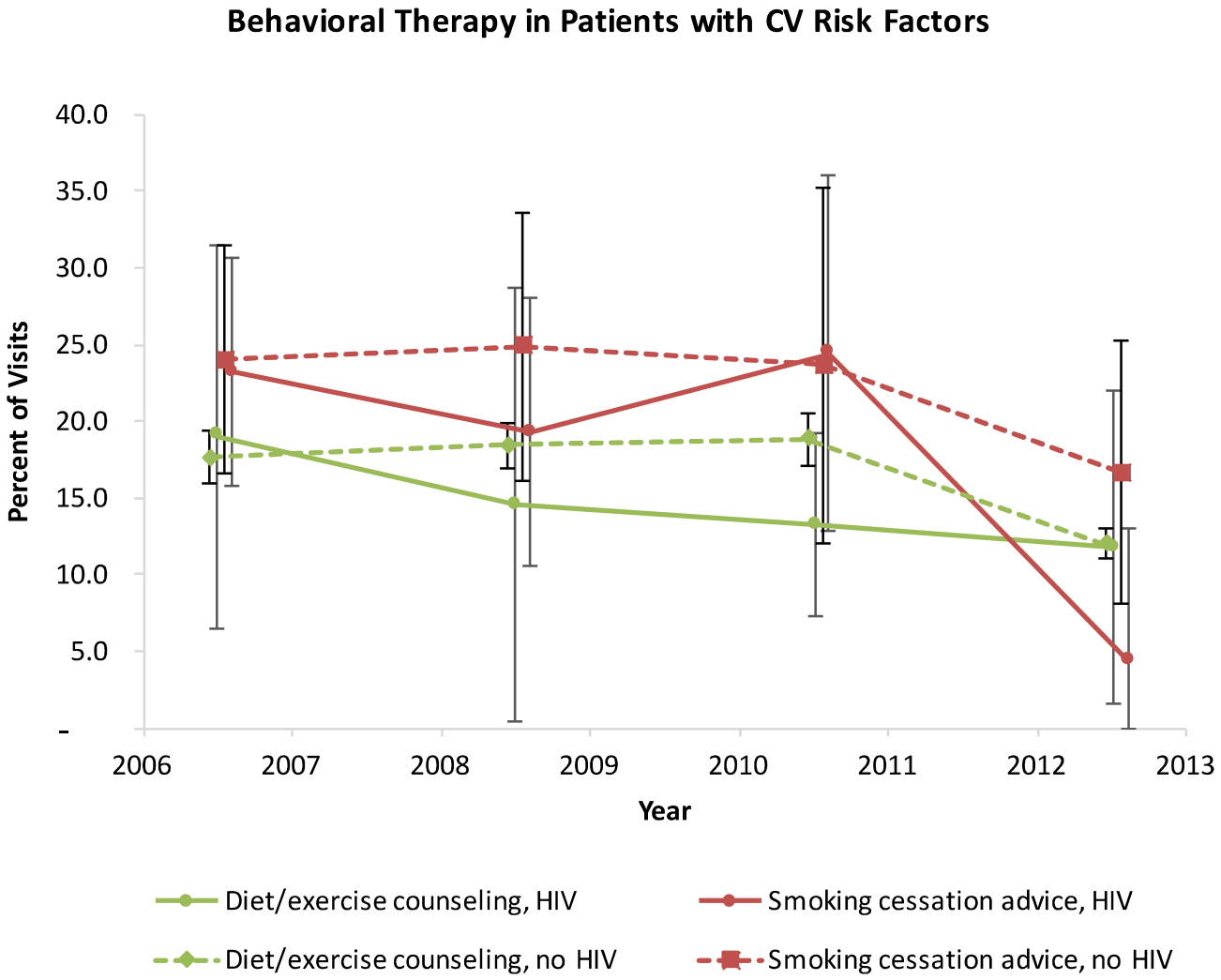
Abbreviations: HIV, human immunodeficiency virus; OR, Odds Ratio
Notes: All analyses account for the complex sampling design of the NAMCS and NHAMCS. Reference groups are male sex, White race/ethnicity, and private insurance. Other independent variables included in logistic regression models (fully reported in Appendix) are: age, urban/rural setting, obesity/overweight, smoker, dyslipidemia, diabetes, hypertension, CVD, and a year-based time trend
*Medications for smoking cessation include nicotine replacement therapy, varenicline, and bupropion
Ambulatory visits for each cardiovascular therapy were limited to patients for whom treatment was indicated, based on demographic and clinical characteristics described in Table 1. For example, aspirin/antiplatelet use was examined in patients at increased CVD risk (men age 45 to 79, women age 55 to 79, or any patient with prior CVD) without a history of bleeding.

Figure 1. Unadjusted Trends in Medication Use among HIV-Infected and HIV-Uninfected Patients with CV Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013 (Please see footnote)



Notes: In some years, data in HIV-infected patients did not meet statistical reliability standards due to small sample sizes, and estimates for these years may be inaccurate (2006-2007, 2008-2009, and 2012-2013 for aspirin/antiplatelet therapy; 2012-2013 for statin therapy; 2012-2013 for antihypertensive therapy).

Figure 2. Unadjusted Trends in Behavioral Therapy among HIV-Infected and HIV-Uninfected Patients with CV Risk Factors Seeing Physicians in U.S. Ambulatory Care Visits, 2006-2013 (Please see footnote)



Notes: In some years, data in HIV-infected patients did not meet statistical reliability standards due to small sample sizes, and estimates for these years may be inaccurate (2006-2007, 2008-2009, and 2012-2013 for diet/exercise counseling; and 2012-2013 for smoking cessation advice).