ORIGINAL RESEARCH

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

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***Background*—**Cardiovascular disease is emerging as a major cause of morbidity and mortality among patients with HIV. We compared use of national guideline-recommended cardiovascular care during office visits among HIV-infected versus HIV-uninfected adults.

***Methods and Results*—**We analyzed data from a nationally representative sample of HIV-infected and HIV-uninfected patients aged 40 to 79 years in the National Ambulatory Medical Care Survey/National Hospital Ambulatory Medical Care Survey, 2006 to 2013. The outcome was provision of guideline-recommended cardiovascular care. Logistic regressions with propensity score weighting adjusted for clinical and demographic factors. We identified 1631 visits by HIV-infected patients and 226 862 visits by HIV-uninfected patients with cardiovascular risk factors, representing ≈2.2 million and 602 million visits per year in the United States, respectively. The proportion of visits by HIV-infected versus HIV-uninfected adults with aspirin/antiplatelet therapy when patients met guideline-recommended criteria for primary prevention or had cardiovascular disease was 5.1% versus 13.8% (P=0.03); the proportion of visits with statin therapy when patients had diabetes mellitus, cardiovascular disease, or dyslipidemia was 23.6% versus 35.8% (P<0.01). There were no differences in antihypertensive medication therapy (53.4% versus 58.6%), diet/exercise counseling (14.9% versus 16.9%), or smoking cessation advice/pharmacotherapy (18.8% versus 22.4%) between HIV-infected versus 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 that may partially explain higher rates of adverse cardiovascular events among patients with HIV. US policymakers and professional societies should focus on improving the quality of cardiovascular care that HIV-infected patients receive. **(*J Am Heart Assoc*. 2017;6:e007107. DOI: 10.1161/JAHA.117.007107.)**

Key Words: cardiovascular disease • HIV • medical care • quality of care

Cardiovascular disease is emerging as a major cause of morbidity and mortality among patients with HIV.[1,2] As antiretroviral therapy 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% to 100% increased risk of myocardial infarction and stroke compared with 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 such as smoking, which tend to be more prevalent among patients with HIV.[6] Some antiretroviral

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Accompanying Tables S1–S5 are available at http://jaha.ahajournals.org/content/6/11/e007107/DC1/embed/inline-supplementary-material-1.pdf

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Clinical Perspective

What Is New?

- Patients with HIV experience approximately a 50% to 100% increased risk of myocardial infarction and stroke compared with 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 US policymakers and professional societies should focus on improving the quality of cardiovascular care that HIV-infected patients receive.

medications also induce metabolic changes that interact with cardiovascular risk.[7] Efforts to tailor cardiovascular risk prediction models for patients with HIV are under way.[8] However, we know little about physicians' provision of cardiovascular care to patients with HIV, or how their cardiovascular care patterns compare with 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 with 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 sharing: The full data set is available at the National Ambulatory Medical Care Survey/National Hospital Ambulatory Medical Care Survey. Study results will be disseminated to Clinical and Translational Science Institute/University of California's Resource Centers for Minority Aging Research and The Charles R. Drew University/University of California Project Export Center, which includes community representatives and a community advisory board.

Data

We analyzed data on adults aged 40 to 79 years from the 2006 to 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 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 is surveyed systematically. Data collection is expected to be carried out by the physician or the physician's staff but data are also abstracted by US Census field representatives. Data are recorded in standardized patient record forms. For the NHAMCS, a systematic random sample of patient visits in selected noninstitutional 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 US 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 to 2013, but the majority of ambulatory care is performed in office-based visits and captured by the NAMCS (93% of visits during 2006 to 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 2 care sites in regression analyses and used the ratio of estimates derived from 2006 to 2011 with and without hospital outpatient/community health center visits to adjust 2012 to 2013 estimates of care provision and visit volume.

The NAMCS and NHAMCS intake materials allow physicians and staff to record up to 3 reasons for each visit and 3 diagnoses related to the visit, in addition to capturing several other major comorbid diagnoses (coded by National Center for Health Statistics staff using the *International Classification of Diseases, Ninth Revision, Clinical Modification* [*ICD-9-CM*]).[10] The data are publicly available through the National Center for Health Statistics' website and the analytic methods and study materials will be made available upon reasonable

request to other researchers by the corresponding author for purposes of reproducing the results or replicating the procedure. This study was exempt from Institutional Review Board review.

Study Population

We identified visits by adults aged 40 to 79 years 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), hypertension, diabetes mellitus, 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 US Food and Drug Administered–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 National Center for Health Statistics 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 Clinical and Translational Science Institute/UCLA's Resource Centers for Minority Aging Research 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, American Heart Association/American College of Cardiology, US Preventive Services Task Force, 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 aged 45–79 years, women aged 55–79 years, or any patient with prior CVD)[13,14]; (2) statin therapy in patients with a history of CVD, diabetes mellitus, 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.[18–20]

Medications prescribed by physicians were identified using Multum Lexicon drug codes and therapeutic drug categories and National Center for Health Statistics generic codes for antiplatelet agents (aspirin, clopidogrel, ticagrelor, and prasugrel), statins, antihypertensive medications, and smoking

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 aged 45 to 79 y; women aged 55 to 79 y	Adults with GI bleeding, peptic ulcer disease, gastritis, duodenitis, or cerebral hemorrhage	AHA/ACC, USPSTF
Statin therapy	Any statin medication	Adults with CVD, diabetes mellitus, 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 mellitus, dyslipidemia, or obesity/overweight; men aged 45 to 79 y; women aged 55 to 79 y	None	USPSTF

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. 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,[21] Public Health Rep, 2015. ACC indicates American College of Cardiology; AHA, American Heart Association; ATP III, Adult Treatment Panel III; CVD, cardiovascular disease; GI, gastrointestinal; JNC 7, Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; LDL, low-density lipoprotein; USPSTF, US Preventive Services Task Force.

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 and 2011 and this increased to 10 medications in 2012 to 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 1 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 antiretroviral therapy 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 examinations) 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 versus 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 Tables S2 and 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 $1/(1\text{-}e)$), 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 and 95% confidence intervals (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 1631 visits by HIV-infected adults and 226 862 visits by HIV-uninfected adults with cardiovascular risk factors from 2006 to 2013, representing ≈2.2 million and 602 million visits per year, respectively (Table 2). Compared with 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 2 groups (Table S4).

Pharmacologic Therapy

The unadjusted proportion of visits by HIV-infected versus HIV-uninfected adults with an aspirin/antiplatelet prescription when patients met US Preventive Services Task Force criteria for primary prevention or had CVD was 5.1% (95% CI, 2.8%–7.3%) versus 13.8% (95% CI, 13.3%–14.3%); the proportion of visits with a statin prescription when patients had diabetes mellitus, CVD, or dyslipidemia was 23.6% (95% CI, 16.3%–30.9%) versus 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%) versus 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 versus HIV-uninfected adults with any cardiovascular risk factors

Table 2. US Ambulatory Care Visits for HIV-Infected and HIV-Uninfected Patients With Cardiovascular Risk Factors, by Demographic and Clinical Characteristics, 2006 to 2013

Characteristic	HIV-Infected Patients With Cardiovascular Risk Factors				HIV-Uninfected Patients With Cardiovascular Risk Factors				*P* Value*
	Unweighted Visits, n	Annual Weighted Visits, n	Percent, %	SE	Unweighted Visits, n	Annual Weighted Visits, n	Percent, %	SE	
All visits	1631	1 776 000	100.0	0.0	226 862	487 600 000	100.0	0.0	
Age, y									
40 to 49	746	794 000	44.7	2.3	37 417	73 745 000	15.1	0.2	
50 to 59	691	750 000	42.2	2.2	67 715	139 100 000	28.5	0.2	
60 to 69	166	191 000	10.7	2.0	69 675	153 100 000	31.4	0.2	<0.001
70 to 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	1187	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	1588	1746 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
Cardiovascular 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 mellitus	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	1462	1640 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

All analyses account for the complex sampling design of the National Ambulatory Medical Care Survey and National Hospital Ambulatory Medical Care Survey. CVD indicates cardiovascular disease.

**P* values calculated with Wald χ^2 test from simple ordinal (age) or binomial/multinomial (sex, race/ethnicity, insurance, setting, risk factors, comorbid diseases) logistic regression models comparing patients with HIV with patients without HIV.

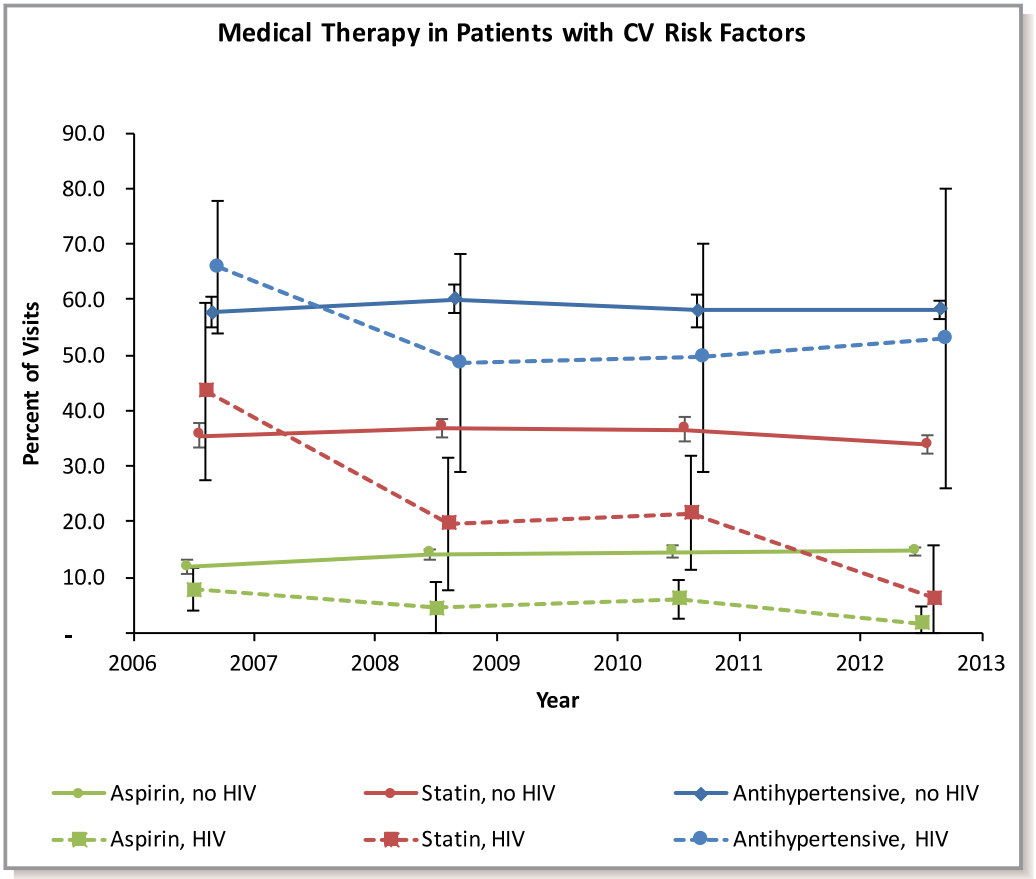

Figure 1. Unadjusted trends in medication use among HIV-infected and HIV-uninfected patients with cardiovascular risk factors seeing physicians in US Ambulatory Care Visits, 2006 to 2013. In some years, data in HIV-infected patients did not meet statistical reliability standards because of small sample 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). CV indicates cardiovascular.

during which diet/exercise counseling was provided was 14.9% (95% CI, 8.4%–21.4%) versus 16.9% (95% CI, 16.1%–17.6%), and 18.8% (95% CI, 11.4%–26.1%) versus 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 nonsignificant after adjustment (Table 3).

Sensitivity Analyses With Physician Specialty and Blood Pressure

On the basis of 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 mm Hg higher diastolic blood pressure, however (P=0.04). In another sensitivity analysis involving patients with HIV and diabetes mellitus, CVD, or dyslipidemia, a prescription for antiretroviral therapy 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 mellitus, and CVD as

Table 3. Propensity Score Analysis: Association Between HIV Status and Cardiovascular Therapy in HIV-Infected and HIV-Uninfected Patients With Cardiovascular Risk Factors Seeing Physicians in US Ambulatory Care Visits, 2006 to 2013

	Aspirin/Antiplatelet		Statin		Antihypertensive		Diet/Exercise Counseling		Smoking Cessation Advice or Medications*	
Characteristics	Adj. OR (95% CI)	*P* Value	Adj. OR (95% CI)	*P* Value	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	0.78 (0.51–1.21)	0.27	1.51 (0.90–2.53)	0.12
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	1.31 (0.93–1.84)	0.12	1.21 (0.85–1.71)	0.30
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	1.22 (0.84–1.75)	0.30	0.83 (0.59–1.15)	0.26
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	1.36 (0.91–2.03)	0.14	1.23 (0.76–1.98)	0.40
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	1.08 (0.66–1.76)	0.77	0.98 (0.62–1.53)	0.91
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	1.31 (0.86–1.98)	0.21	1.28 (0.76–2.16)	0.35

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 the supplemental material) are age, urban/rural setting, obesity/overweight, smoker, dyslipidemia, diabetes mellitus, hypertension, CVD, and a year-based time trend. 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 aged 45–79 y, women aged 55–79 y, or any patient with prior CVD) without a history of bleeding. CI indicates confidence interval; CVD, cardiovascular disease; OR, odds ratio.
*Medications for smoking cessation include nicotine replacement therapy, varenicline, and bupropion.

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 significantly 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 1 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 eighth 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 US physicians generally underuse guideline-recommended cardiovascular care for high-risk adults and are less likely to prescribe aspirin and statins to HIV-infected adults versus 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 1 study of 397 patients at University of Alabama at Birmingham's HIV Clinic who met US Preventive Services Task Force 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 American College of Cardiology/American Heart Association cholesterol guidelines to the 2004 Adult Treatment Panel III guidelines, Zanni et al found that application of the updated guidelines would increase the proportion of statin-eligible HIV-infected

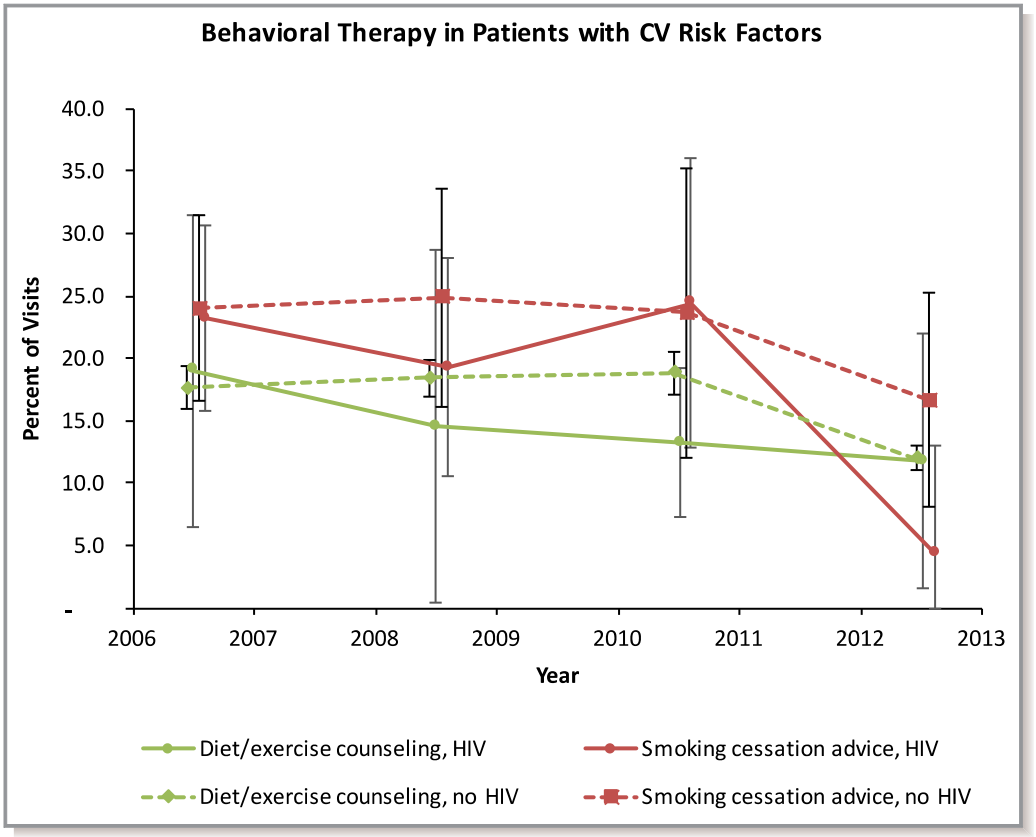

Figure 2. Trends in behavioral therapy among HIV-infected and HIV-uninfected patients with cardiovascular risk factors seeing physicians in US Ambulatory Care Visits, 2006 to 2013. In some years, data in HIV-infected patients did not meet statistical reliability standards because of small sample sizes, 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). CV indicates cardiovascular.

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—2 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 2 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 (eg, 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 because of 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, US physicians generally underused guideline-recommended cardiovascular care for high-risk patients, and were less likely to prescribe aspirin and statins to HIV-infected patients at increased risk—findings that 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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Disclosures

None.

References

1. Feinstein MJ, Bahiru E, Achenbach C, Longenecker CT, Hsue P, So-Armah K, Freiberg MS, Lloyd-Jones DM. Patterns of cardiovascular mortality for HIV-infected adults in the United States: 1999 to 2013. *Am J Cardiol*. 2016;117:214–220.
2. Antiretroviral Therapy Cohort C. Causes of death in HIV-1-infected patients treated with antiretroviral therapy, 1996–2006: collaborative analysis of 13 HIV cohort studies. *Clin Infect Dis*. 2010;50:1387–1396.
3. Centers for Disease Control and Prevention. HIV Surveillance Report, 2015. 2016.
4. Sico JJ, Chang CC, So-Armah K, Justice AC, Hylek E, Skanderson M, McGinnis K, Kuller LH, Kraemer KL, Rimland D, Bidwell Goetz M, Butt AA, Rodriguez-Barradas MC, Gibert C, Leaf D, Brown ST, Samet J, Kazis L, Bryant K, Freiberg MS. HIV status and the risk of ischemic stroke among men. *Neurology*. 2015;84:1933–1940.
5. Tseng ZH, Secemsky EA, Dowdy D, Vittinghoff E, Moyers B, Wong JK, Havlir DV, Hsue PY. Sudden cardiac death in patients with human immunodeficiency virus infection. *J Am Coll Cardiol*. 2012;59:1891–1896.
6. Mdodo R, Frazier EL, Dube SR, Mattson CL, Sutton MY, Brooks JT, Skarbinski J. Cigarette smoking prevalence among adults with HIV compared with the general adult population in the United States: cross-sectional surveys. *Ann Intern Med*. 2015;162:335–344.
7. Funderburg NT, Mehta NN. Lipid abnormalities and inflammation in HIV infection. *Curr HIV/AIDS Rep*. 2016;13:218–225.
8. Feinstein MJ, Nance RM, Drozd DR, Ning H, Delaney JA, Heckbert SR, Budoff MJ, Mathews WC, Kitahata MM, Saag MS, Eron JJ, Moore RD, Achenbach CJ, Lloyd-Jones DM, Crane HM. Assessing and Refining Myocardial Infarction Risk Estimation Among Patients With Human Immunodeficiency Virus: A Study by the Centers for AIDS Research Network of Integrated Clinical Systems. *JAMA Cardiol*. 2017;2:155–162.
9. National Center for Health Statistics (U.S.). Ambulatory Health Care Data: NAMCS and NHAMCS description. 2013; June 4, 2013: Published on ftp site April 26, 2012.
10. National Center for Health Statistics (U.S.). 2009 NAMCS Public-use Data File Documentation. 2009.
11. Ladapo JA, Blecker S, Douglas PS. Physician decision making and trends in the use of cardiac stress testing in the United States: an analysis of repeated cross-sectional data. *Ann Intern Med*. 2014;161:482–490.
12. Sigmund AE, Stevens ER, Blitz JD, Ladapo JA. Use of preoperative testing and physicians' response to professional society guidance. *JAMA Intern Med*. 2015;175:1352–1359.
13. Wolff T, Miller T, Ko S. Aspirin for the primary prevention of cardiovascular events: an update of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2009;150:405–410.
14. Fihn SD, Gardin JM, Abrams J, Berra K, Blankenship JC, Dallas AP, Douglas PS, Foody JM, Gerber TC, Hinderliter AL, King SB III, Kligfield PD, Krumholz HM, Kwong RY, Lim MJ, Linderbaum JA, Mack MJ, Munger MA, Prager RL, Sabik JF, Shaw LJ, Sikkema JD, Smith CR Jr, Smith SC Jr, Spertus JA, Williams SV, Anderson JL. 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines, and the American College of Physicians, American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. *Circulation*. 2012;126:e354–e471.
15. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. *Circulation*. 2002;106:3143–3421.
16. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, Jones DW, Materson BJ, Oparil S, Wright JT Jr, Roccella EJ; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289:2560–2572.
17. U. S. Preventive Services Task Force. Counseling and interventions to prevent tobacco use and tobacco-caused disease in adults and pregnant women: U.S. Preventive Services Task Force reaffirmation recommendation statement. *Ann Intern Med*. 2009;150:551–555.
18. U. S. Preventive Services Task Force. Behavioral counseling in primary care to promote physical activity: recommendations and rationale. *Am Fam Physician*. 2002;66:1931–1936.
19. U. S. Preventive Services Task Force. Behavioral counseling in primary care to promote a healthy diet: recommendations and rationale. *Am Fam Physician*. 2003;67:2573–2576.
20. Lin JS, O'Connor E, Whitlock EP, Beil TL. Behavioral Counseling to Promote Physical Activity and a Healthful Diet to Prevent Cardiovascular Disease in Adults: A Systematic Review for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2010;153:736–750. doi: 10.7326/0003-4819-153-11-201012070-00007
21. Byrd KK, Mehal JM, Schillie SF, Holman RC, Haberling D, Murphy T. Chronic Liver Disease-Associated Hospitalizations Among Adults with Diabetes, National Inpatient Sample, 2001–2012. *Public Health Reports*. 2015;130(6):693–703.
22. Ladapo JA, Chokshi DA. Continuity of care for chronic conditions: threats, opportunities, and policy. *Health Affairs Blog*. 2014;2016. Available at http://www.healthaffairs.org/do/10.1377/hblog20141118.042672/full/. Accessed November 8, 2017.
23. Singh S, Willig JH, Mugavero MJ, Crane PK, Harrington RD, Knopp RH, Kosel BW, Saag MS, Kitahata MM, Crane HM. Comparative effectiveness and toxicity of statins among HIV-infected patients. *Clin Infect Dis*. 2011;52:387–395.
24. Ridgeway G, Kovalchik SA, Griffin BA, Kabeto MU. Propensity score analysis with survey weighted data. *J Causal Inference*. 2015;3:237–249.
25. Dugoff EH, Schuler M, Stuart EA. Generalizing observational study results: applying propensity score methods to complex surveys. *Health Serv Res*. 2014;49:284–303.
26. National Center for Health Statistics (U.S.). Ambulatory Health Care Data: NAMCS and NHAMCS, Reliability of Estimates. 2013. Published on ftp site April 26, 2012.

27. Mafi JN, Edwards ST, Pedersen NP, Davis RB, McCarthy EP, Landon BE. Trends in the ambulatory management of headache: analysis of NAMCS and NHAMCS data 1999–2010. *J Gen Intern Med*. 2015;30:548–555.

28. Abbo ED, Zhang Q, Zelder M, Huang ES. The increasing number of clinical items addressed during the time of adult primary care visits. *J Gen Intern Med*. 2008;23:2058–2065.

29. U.S. National Institutes of Health. Evaluating the Use of Pitavastatin to Reduce the Risk of Cardiovascular Disease in HIV-Infected Adults (REPRIEVE). 2016;2017.

30. Gilbert JM, Fitch KV, Grinspoon SK. HIV-related cardiovascular disease, statins, and the REPRIEVE trial. *Top Antivir Med*. 2015;23:146–149.

31. Burkholder GA, Tamhane AR, Salinas JL, Mugavero MJ, Raper JL, Westfall AO, Saag MS, Willig JH. Underutilization of aspirin for primary prevention of cardiovascular disease among HIV-infected patients. *Clin Infect Dis*. 2012;55:1550–1557.

32. Zanni MV, Fitch KV, Feldpausch M, Han A, Lee H, Lu MT, Abbara S, Ribaudo H, Douglas PS, Hoffmann U, Lo J, Grinspoon SK. 2013 American College of Cardiology/American Heart Association and 2004 Adult Treatment Panel III cholesterol guidelines applied to HIV-infected patients with/without subclinical high-risk coronary plaque. *AIDS*. 2014;28:2061–2070.

33. Pandya A, Sy S, Cho S, Weinstein MC, Gaziano TA. Cost-effectiveness of 10-year risk thresholds for initiation of statin therapy for primary prevention of cardiovascular disease. *JAMA*. 2015;314:142–150.

34. Greving JP, Buskens E, Koffijberg H, Algra A. Cost-effectiveness of aspirin treatment in the primary prevention of cardiovascular disease events in subgroups based on age, gender, and varying cardiovascular risk. *Circulation*. 2008;117:2875–2883.

SUPPLEMENTAL MATERIAL

Table S1. Multum Lexicon generic drug codes and therapeutic drug categories

Medication	Generic code	Therapeutic class code
Aspirin	d00170	--
Other antiplatelet medication (clopidogrel, ticlopidine, and prasugrel)	d04258, d00514, d07409	--
Statin	d07110, d05348, d05048, d04787, d04105, d00746, d00280, d04787, d00348, d04851, d03183	173
Antihypertensive medication	--	041, 042, 043, 044, 047, 048, 049, 052,053, 055, 056, 274, 275, 154, 155, 156, 157, 158, 274, 275
smoking cessation medication (nicotine replacement therapy, varenicline, or bupropion)	d00316, c00080, d05807, d00181	320

Table S2. Propensity Score Method: 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
Sex												
Men	1.00				1.00				1.00			
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
Race/ethnicity												
White	1.00				1.00				1.00			
Non-Hispanic 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
Other/unknown	1.36	(0.88-	2.11)	0.17	0.63	(0.42-	0.95)	0.03	2.06	(1.02-	4.18)	0.05
Age												
40-49	1.00				1.00				1.00			
50-59	1.54	(0.98-	2.40)	0.06	1.56	(0.84-	2.89)	0.16	1.21	(0.73-	2.01)	0.45
60-69	2.39	(1.42-	4.03)	<0.01	0.99	(0.50-	1.99)	0.99	0.91	(0.47-	1.76)	0.79
70-79	1.7	(1.1-	2.6)	0.01	1.59	(1.04-	2.44)	0.03	0.79	(0.32-	1.92)	0.60
Insurance												
Private												
Medicare	0.69	(0.44-	1.08)	0.10	0.85	(0.42-	1.72)	0.65	0.91	(0.47-	1.78)	0.79
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
Other/unknown	0.58	(0.27-	1.21)	0.15	0.60	(0.27-	1.31)	0.20	0.21	(0.06-	0.70)	0.01
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
Urban or rural setting												
Urban	1.00				1.00				1.00			
Rural	1.21	(0.90-	1.65)	0.21	1.20	(0.69-	2.09)	0.53	1.09	(0.63-	1.89)	0.76
U.S. region												
Northeast	1.00				1.00				1.00			
Midwest	1.66	(1.12-	2.46)	0.01	1.36	(0.77-	2.40)	0.29	1.14	(0.68-	1.92)	0.62
South	1.44	(0.86-	2.42)	0.16	0.96	(0.58-	1.58)	0.86	0.86	(0.43-	1.69)	0.65
West	1.40	(0.92-	2.14)	0.12	1.50	(0.94-	2.38)	0.09	1.19	(0.61-	2.31)	0.61
Cardiovascular Risk Factors												
Obese/overweight	1.70	(1.17-	2.47)	<0.01	1.11	(0.71-	1.74)	0.64	1.00	(0.55-	1.82)	1.00
Smoker	2.63	(1.08-	6.38)	0.03	1.20	(0.61-	2.36)	0.60	1.16	(0.62-	2.16)	0.65
Dyslipidemia	2.10	(1.44-	3.08)	<0.001	3.95	(2.57-	6.06)	<0.001	0.94	(0.51-	1.76)	0.86
Diabetes	0.63	(0.41-	0.96)	0.03	0.98	(0.68-	1.42)	0.93	1.07	(0.57-	2.00)	0.83
Hypertension	1.72	(1.04-	2.86)	0.04	1.03	(0.78-	1.35)	0.86	1.00	(1.00-	1.00)	.
CVD												
No	1.00				1.00				1.00			
Yes	6.39	(4.13-	9.87)	<0.001	1.94	(1.31-	2.88)	<0.001	2.25	(1.38-	3.67)	<0.01
HIV status												
No	1.00				1.00				1.00			
Yes	0.53	(0.30-	0.94)	0.03	0.51	(0.32-	0.82)	<0.01	0.88	(0.48-	1.58)	0.66
Time trend	1.04	(0.96-	1.13)	0.34	1.03	(0.95-	1.12)	0.43	1.04	(0.95-	1.15)	0.38

Table S3. Propensity Score Method: 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

	Diet/Exercise Counseling				Smoking Cessation Advice or Medications			
Characteristics	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value
Sex								
Men	1.00				1.00			
Female	1.31	(0.93-	1.84)	0.12	1.21	(0.85-	1.71)	0.30
Race/ethnicity								
White	1.00				1.00			
Non-Hispanic 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
Other/unknown	0.71	(0.44-	1.14)	0.16	0.46	(0.29-	0.72)	<0.001
Age								
40-49	1.00				1.00			
50-59	0.94	(0.68-	1.29)	0.70	1.40	(0.98-	2.00)	0.06
60-69	0.54	(0.38-	0.79)	<0.01	0.56	(0.38-	0.82)	<0.01
70-79	0.4	(0.2-	0.6)	<0.001	1.0	(0.4-	2.1)	0.92
Insurance								
Private								
Medicare	0.78	(0.57-	1.07)	0.13	0.99	(0.63-	1.56)	0.97
Medicaid	1.08	(0.66-	1.76)	0.77	0.98	(0.62-	1.53)	0.91
Other/unknown	0.52	(0.29-	0.92)	0.03	0.38	(0.12-	1.21)	0.10
Uninsured	1.31	(0.86-	1.98)	0.21	1.28	(0.76-	2.16)	0.35
Urban or rural setting								
Urban	1.00				1.00			
Rural	1.04	(0.74-	1.46)	0.84	1.10	(0.72-	1.68)	0.65
U.S. region								
Northeast	1.00				1.00			
Midwest	1.01	(0.61-	1.70)	0.96	0.82	(0.49-	1.38)	0.45
South	0.72	(0.50-	1.05)	0.09	0.46	(0.33-	0.64)	<0.001
West	0.95	(0.62-	1.45)	0.82	0.48	(0.32-	0.72)	<0.001
Cardiovascular Risk Factors								
Obese/overweight	5.04	(3.46-	7.34)	<0.001	1.81	(1.21-	2.71)	<0.01
Smoker	1.23	(0.81-	1.87)	0.33	1.00	(1.00-	1.00)	.
Dyslipidemia	2.16	(1.61-	2.89)	<0.001	1.82	(1.04-	3.18)	0.04
Diabetes	1.58	(1.01-	2.47)	0.05	1.11	(0.79-	1.55)	0.55
Hypertension	0.64	(0.46-	0.88)	<0.01	0.81	(0.60-	1.08)	0.15
CVD								
No	1.00				1.00			
Yes	1.61	(1.12-	2.32)	0.01	2.57	(1.82-	3.63)	<0.001
HIV status								
No	1.00				1.00			
Yes	0.78	(0.51-	1.21)	0.27	1.51	(0.90-	2.53)	0.12
Time trend	0.89	(0.82-	0.96)	<0.01	0.89	(0.84-	0.96)	<0.001

Table S4. Propensity Score Method: 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	Percent, %	Std. Err.	Percent, %	Std. Err.	
All visits	100.0	0.0	100.0	0.0	
Age, yrs.					
40-49	15.5	4.0	16.8	0.2	
50-59	22.1	5.5	30.0	0.1	
60-69	24.4	6.6	30.5	0.1	
70-79	38.0	14.5	22.7	0.2	0.34
Sex					
Female	52.5	11.4	52.5	0.2	
Male	47.5	11.4	47.5	0.2	0.997
Race/ethnicity					
Non-Hispanic white	48.2	12.3	52.8	0.6	
Non-Hispanic black	10.4	2.9	10.9	0.4	0.926
Hispanic	8.4	2.5	7.8	0.3	0.749
Other/unknown	33.1	9.6	28.5	0.5	0.657
Insurance					
Private	30.6	8.0	39.2	0.3	
Medicare	24.4	8.0	36.3	0.2	0.676
Medicaid	10.8	2.8	10.1	0.3	0.129
Other/unknown	27.9	15.9	8.0	0.2	0.542
Uninsured	6.3	2.4	6.4	0.2	0.061
US Region					
Northeast	31.3	9.1	21.8	0.6	
Midwest	14.7	5.4	23.8	0.6	0.044
South	40.9	13.6	33.9	0.8	0.768
West	13.2	4.1	20.5	0.5	0.02
Setting					
Urban	94.2	3.0	87.9	1.0	
Rural	5.8	3.0	12.1	1.0	0.12
CV risk factors					

Obese/overweight	8.1	2.6	11.0	0.2	0.326
Smoker	10.1	2.9	15.6	0.2	0.113
Dyslipidemia	20.4	6.1	23.6	0.3	0.619
Diabetes	45.4	12.9	21.5	0.2	0.032
Hypertension	57.5	10.4	43.6	0.3	0.189
Good continuity of care	59.2	13.8	77.6	0.2	0.129
CVD	4.5	1.6	9.0	0.2	0.053

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 S5. Propensity Score Method: 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. Sensitivity analysis with no adjustment for hypertension, dyslipidemia, diabetes, or CVD in regression models.

	Aspirin/Antiplatelet				Statin				Antihypertensive				Diet/Exercise Counseling				Smoking Cessation Advice or Medications			
Characteristics	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value	Adj. OR (95% CI)			P value
HIV	0.48	(0.27-	0.86)	0.01	0.47	(0.29-	0.76)	<0.01	0.85	(0.47-	1.54)	0.59	0.86	(0.53-	1.39)	0.53	1.60	(0.85-	2.98)	0.14
Demographics																				
Female	0.81	(0.51-	1.30)	0.39	0.84	(0.57-	1.23)	0.36	0.53	(0.27-	1.06)	0.07	1.29	(0.91-	1.83)	0.15	1.14	(0.76-	1.70)	0.53
Black	1.17	(0.73-	1.90)	0.51	1.20	(0.71-	2.04)	0.49	1.84	(0.96-	3.52)	0.07	1.07	(0.73-	1.56)	0.73	0.75	(0.51-	1.10)	0.14
Hispanic	1.76	(0.80-	3.90)	0.16	0.75	(0.44-	1.26)	0.28	2.15	(1.07-	4.32)	0.03	1.40	(0.93-	2.11)	0.10	1.11	(0.64-	1.94)	0.71
Insurance																				
Medicaid	0.77	(0.35-	1.69)	0.52	0.86	(0.41-	1.81)	0.70	0.74	(0.40-	1.36)	0.33	1.01	(0.61-	1.69)	0.97	0.93	(0.56-	1.54)	0.78
Uninsured	0.75	(0.43-	1.31)	0.31	0.79	(0.45-	1.39)	0.42	1.01	(0.48-	2.09)	0.99	1.16	(0.76-	1.76)	0.49	1.14	(0.64-	2.02)	0.66