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Cardiovascular health among persons with HIV without existing atherosclerotic cardiovascular disease

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Abstract

Objectives: We sought to characterize atherosclerotic cardiovascular disease (ASCVD) risk and metrics of CV health in persons with HIV (PWH) eligible for primary prevention of ASCVD.

Design: Cross-sectional study of PWH 40 years and older without documented ASCVD who received care at three HIV clinics in San Francisco from 2019–2022.

Methods: We used ICD-10 codes and electronic health record data to assess ASCVD risk and CV health, as defined by the American Heart Association's Life's Essential 8 (LE8) metrics for nicotine exposure, body mass index (BMI), lipids, glucose, and blood pressure (BP).

Results: Among 2567 PWH eligible for primary prevention of ASCVD, the median age was 55 years, 14% were female, and 95% were on antiretroviral therapy. Seventy-seven percent had undergone complete assessment of ASCVD risk factors, and 50% of these patients had intermediate-high ASCVD risk (≥7.5%). Of those with hypertension, 39% were prescribed an

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McLaughlin: conceptualization, methodology, investigation, formal analysis, writing – original draft, visualization; **Durstenfeld:** methodology, writing - review & editing, visualization; **Gandhi:** writing - review & editing; **Greene:** writing - review & editing; **Ma**: methodology, writing – review & editing, **Beatty:** conceptualization, methodology, writing - review & editing, visualization, supervision; **Hsue:** conceptualization, methodology, writing - review & editing, resources, supervision

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anti-hypertensive. Among those eligible, 43% were prescribed a statin. The mean LE8 CV health score (0 to 100 [best health]) was 55.1 for nicotine exposure, 71.3 for BMI, 70.4 for lipids, 81.2 for blood glucose, 56.0 for BP, with an average score of 66.2 across the five metrics. Patients with Medicare insurance, Black patients, and those with sleep apnea and chronic kidney disease had on average lower CV health scores; patients with undetectable viral loads had higher CV health scores.

Conclusions: We highlight opportunities for improving primary prevention of ASCVD among PWH, especially in the areas of guideline-based therapy, nicotine exposure, and BP control.

Keywords

atherosclerotic cardiovascular disease (ASCVD); human immunodeficiency virus (HIV); cardiovascular health; cardiovascular risk; Life's Essential 8

Introduction

Persons with HIV (PWH) have increased risk of atherosclerotic cardiovascular disease (ASCVD).[1–3] Additionally, as life expectancy with HIV has improved, PWH are experiencing an even greater incidence of age-related diseases like cardiovascular disease (CVD).[4, 5] Despite this increased risk, prior studies have found that most PWH have not discussed CVD risk with their HIV providers.[6] Interventions known to be beneficial in the general population, such as statins, have low uptake among PWH,[7–10] and several studies have shown that PWH have suboptimal cardiovascular (CV) health metrics.[11–14] Quality improvement initiatives have focused on retention of PWH in the HIV care cascade–from testing and diagnosis to viral load suppression. Some experts have proposed that the HIV care cascade could be extended to ASCVD prevention, including screening for CV risk factors, appropriate treatment, and achievement of blood pressure (BP) and cholesterol targets (Figure 1).[15, 16]

In this study, we assessed the ASCVD prevention cascade among PWH in HIV clinics in the San Francisco Bay Area, and we used the American Heart Association's (AHA) Life's Essential 8 (LE8) as a framework for evaluating whether CV health (CVH) goals were achieved.

Methods

This cross-sectional study used routine electronic health record (EHR) data and included PWH age ≥ 40 years seen at three HIV clinics in an academic tertiary referral hospital and county safety-net hospital in San Francisco between September 1, 2019 and December 15, 2022. HIV was defined by ICD-10 (10th revision of the International Statistical Classification of Diseases) code and at least one recorded viral load (Supplementary Table 1).[17, 18] We excluded patients with ICD-10 codes for ASCVD.

We collected most recent primary payor and self-reported demographic data from the EHR. Neighborhood socioeconomic status (SES) quintiles were determined based on ZIP Code, using the UCSF Health Atlas.[19] We evaluated CV risk factors and risk factor control

using the most recent vital signs, laboratory data, and smoking status recorded in the EHR during the study period (Supplementary Table 1). We calculated the proportion of patients who underwent ASCVD risk assessment based on the presence of at least one cholesterol, BP, and hemoglobin A1c or fasting blood sugar result during the study period, and at least one smoking status ever documented. We used the American College of Cardiology (ACC) / AHA pooled cohort equation to estimate ASCVD risk. CVH was assessed using the framework of AHA's LE8, which evaluates eight domains: diet, physical activity, nicotine exposure, sleep health, body mass index (BMI), lipids, blood glucose, and BP.[20] We calculated CVH as a score (0 to 100) for each of the five domains with data available in the EHR (nicotine exposure, BMI, blood lipids, glucose, BP) .[20] Each CV risk factor was considered controlled if it was assessed and met the AHA LE8 definition for ideal CVH (100 points).

Descriptive statistics characterized ASCVD risk estimates and CVH scores. Robust multivariable linear regression models evaluated factors associated with CVH score. In a sensitivity analysis, we used multivariate imputation (MICE package) using the other candidate covariates in the multivariable model as predictors. RStudio (version 2022.12.0) was used for all analyses. This study received ethics approval from the UCSF Institutional Review Board (#22–37224).

Results

Of 3358 patients with HIV age ≥ 40 years, 791 (23.6%) were excluded due to ASCVD, resulting in a study population of 2567. Median age was 55 years (interquartile range [IQR]: 48–61), 86.3% were men, 24.2% were Hispanic/Latinx, and 17.9% were Black (Supplementary Table 2). Median CD4 cell count was 530 cells/mm^3, 95.3% were on antiretroviral therapy (ART), and 83.7% had undetectable viral loads.

Seventy-seven percent of patients had complete assessment of ASCVD risk factors, with lower rates of cholesterol and diabetes screening compared to BP and tobacco (Supplementary Table 3). Among these patients, median 10-year ASCVD risk was 7.6% (IQR: 3.7, 13.2). Half of patients with estimated ASCVD risk were at intermediate or high risk. ASCVD risk estimates by sex, race, and age categories demonstrated a trend toward higher ASCVD risk among Black men in all age categories (Supplementary Figure 1).

Hypertension, defined by ICD-10 code or at least two outpatient BPs > 130/80, was present in 1772 (69.0%) patients. Of these, 696 (39.3%) patients were prescribed anti-hypertensive treatment. The percentage of eligible patients on an anti-hypertensive varied by how hypertension was defined. When defined based on ICD-10 code alone, 677 of 1153 (58.7%) of eligible patients were on an anti-hypertensive. When defined based on outpatient BPs, 473 of 1373 (34.5%) of eligible patients were prescribed anti-hypertensives. In the total study population, 1101 (42.9%) patients had a BP <130/80 and 735 (28.6%) had a BP <120/80 (Supplementary Table 4). Statins were prescribed to 465 (43.4%) of the 1072 patients eligible among those 40–75 years old. In the total study population, 1211 (47.2%) achieved cholesterol control (non-HDL <130 mg/dL). A total of 180 (7.0%) patients were on aspirin.

Only 35 (1.4%) of patients had all five risk factors controlled. A total of 302 (11.8%) patients had no risk factors controlled, and 1838 (71.7%) had two or fewer risk factors controlled. The median number of optimally controlled CV risk factors was 2 (IQR: 1, 3).

The mean CVH scores (out of 100) were 55.1 (SD 40.8) for nicotine exposure, 71.3 (SD 29.8) for BMI, 70.4 (SD 28.9) for lipids, 81.2 (SD 27.4) for glucose, 56.0 (SD 32.1) for BP. The average score across the five metrics studied was 66.2 (SD 16.5). A total of 572 patients (22.3%) had high average CVH (scores ≥80), 1610 (62.7%) had moderate CVH (scores 50–79), and 381 (14.8%) had low CVH (scores <50) (Figure 2). In the multivariable analysis and sensitivity analysis, patients with Medicare, Black patients, those receiving care at the county safety-net hospital, and those with sleep apnea and chronic kidney disease had, on average, lower CVH scores (Supplementary Table 5). Patients with undetectable viral loads had higher CVH scores.

Discussion

We found evidence of suboptimal ASCVD screening, treatment, and control of CV risk factors in this population of PWH receiving care at HIV clinics in San Francisco. This study adds to this literature by examining the care cascade for ASCVD prevention among PWH, from screening to treatment to CVH outcomes. We found that nearly a quarter of patients had not undergone complete ASCVD risk assessment. There were even greater gaps at the treatment level, with fewer than half of eligible patients receiving an antihypertensive or statin. These findings highlight that although there is room for improvement in screening, interventions should also focus on improving prescription rates of guideline-based therapy to optimize CVH for PWH with ASCVD risk factors.

Previous studies have found low rates of prescription of guideline-based therapies for CV risk among PWH. When compared to matched uninfected persons, prescription rates of statins and anti-hypertensives for PWH in an academic HIV clinic in North Carolina were lower, adjusting for ASCVD risk factors.[7] Two prior national U.S. studies found lower rates of statin prescriptions among PWH than uninfected controls.[9, 10] A study among Veterans found that only 23% of statin-eligible PWH were prescribed the medication.[8] Additional research is needed to understand the reasons for low prescription rates of preventive therapies among PWH in this study. Contributing factors may include pill burden, concerns about drug interactions, low perceived risk among patients, competing priorities for both patients and providers, or a lower knowledge base among HIV providers on managing ASCVD risk factors.[8, 21–24]

Several studies have documented low rates of optimal CVH among PWH.[11–14] An analysis of baseline data of participants in the REPRIEVE trial—a randomized controlled trial of statins for primary prevention in PWH with low-moderate ASCVD risk—used the prior iteration of AHA's CVH metric (Life's Simple 7) and found that only 0.3% had 7 out of 7 ideal components and 36% had 2 or fewer ideal components.[13] Poor CVH was associated with coronary plaque and vulnerable plaque features among PWH in the trial, even after adjusting for inflammatory biomarkers and LDL-C.[25]

We also found poor CVH in our study, which used five of the eight metrics from the updated LE8 to assess CVH in PWH spanning the spectrum of ASCVD risk. Compared to national data on the general population from the National Health and Nutrition Examination Survey (NHANES 2013–2018), PWH in this study have worse outcomes on nicotine exposure (55.1 vs. 69.2 points) and BP metrics (56.0 vs. 70.8 points), although it is important to acknowledge that the NHANES cohort was earlier.[26] Patients with suppressed viral loads were more likely to have higher LE8 CVH scores, which may reflect greater engagement in care and more opportunities for screening. We also identified disparities in CVH based on race and insurance status. These findings highlight the importance of addressing health disparities in efforts to improve CV care for PWH.[27]

This analysis has several limitations. First, ICD-10 codes were used to determine HIV status and comorbidities, with inherent limitations in sensitivity and specificity. Second, some of the incomplete data may be due to fragmentation of care; it is possible that some patients with missing data may have undergone CV risk assessment or treatment at other facilities. Third, we were only able to evaluate five of the eight metrics of LE8 using EHR data. Fourth, traditional ASCVD risk calculators tend to underestimate risk in PWH, [28, 29] and we did not have data on several important HIV-specific risk factors for CVD, including delayed ART initiation, total exposure to specific antiretroviral agents, ART duration, nadir CD4 cell count, or highest viral load. Fifth, although we found differences in CVH by site, it is unclear to what degree these differences are due to true practice variation between the sites or differences in unmeasured confounders, care fragmentation, billing, or EHR documentation. Additionally, the COVID-19 pandemic occurred during the study period and may have impacted both patient behavior like diet and exercise, as well as physician prescribing practices due to increased telehealth. Finally, given significant differences in demographics and potential confounders of ASCVD risk between PWH and people without HIV, we did not include a comparison group without HIV, so we cannot evaluate how CV preventive care differed by HIV status.

CVH as assessed by AHA's LE8 was suboptimal in this population of PWH without diagnosed ASCVD. These findings highlight a need for initiatives that extend the HIV care cascade to include diagnosis and management of ASCVD risk factors.[15] As others have pointed out, young PWH with suppressed viral loads are often better engaged with the health care system, compared to their peers without chronic disease, and thus may have more opportunities for appropriate diagnosis and management of ASCVD risk factors.[16] This represents an exciting opportunity to initiate ASCVD risk reduction early in life, which could have profound effects on lifetime risk of CVD among PWH. In particular, attention is needed on BP control, smoking cessation, and initiation of guideline-based therapies among eligible PWH.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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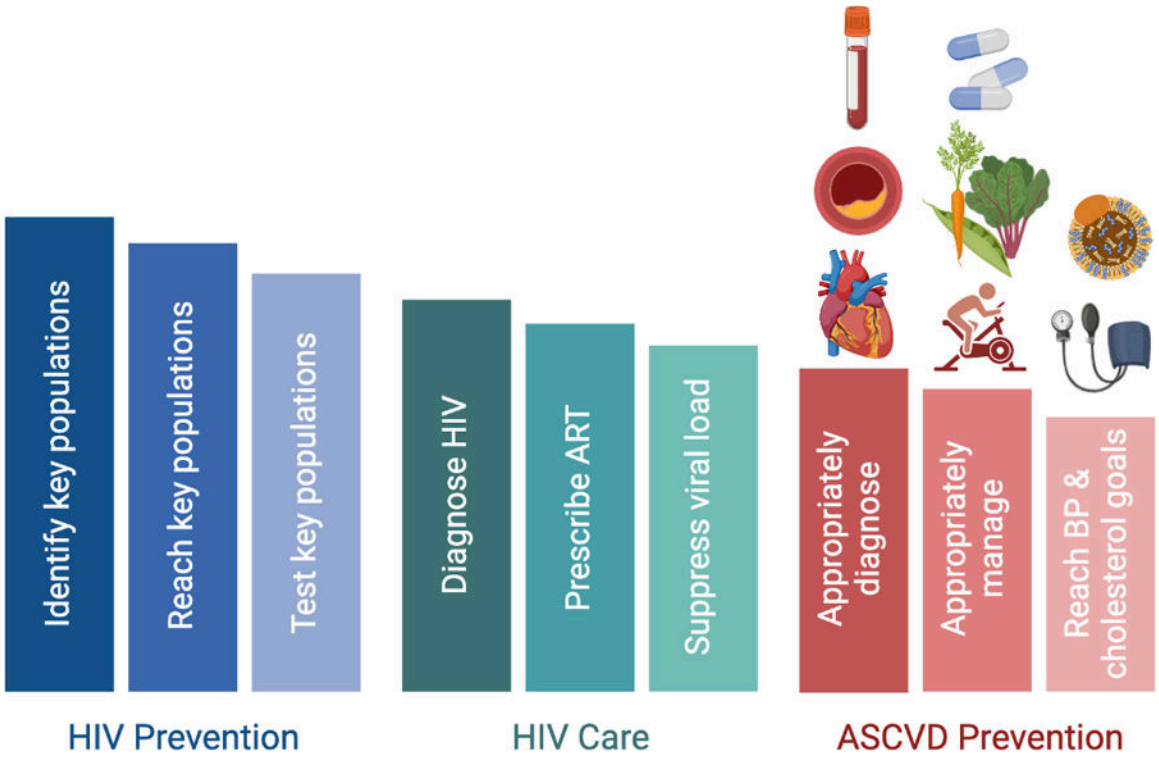

Figure 1.

The extended HIV treatment cascade for atherosclerotic cardiovascular disease (ASCVD) prevention (adapted with permission from Okeke et al. 2019)

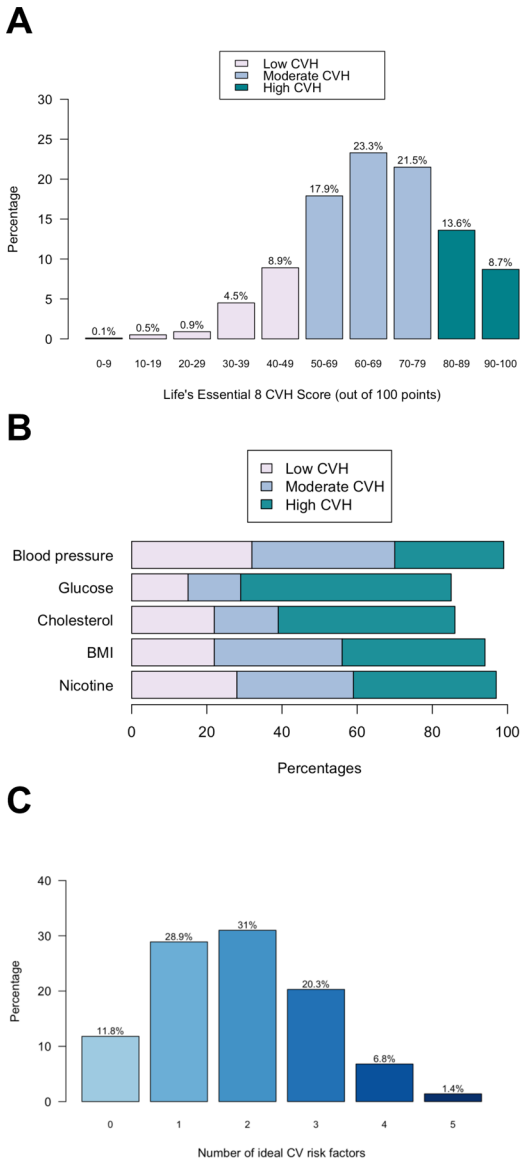

Figure 2.
Distribution of ideal cardiovascular health in the study population