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Cardiovascular Disease Risk Management in Persons With HIV: Does Clinician Specialty Matter?

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Background. The impact of clinician specialty on cardiovascular disease risk factor outcomes among persons with HIV (PWH) is unclear.

Methods. PWH receiving care at 3 Southeastern US academic HIV clinics between January 2014 and December 2016 were retrospectively stratified into 5 groups based on the specialty of the clinician managing their hypertension or hyperlipidemia. Patients were followed until first atherosclerotic cardiovascular disease event, death, or end of study. Outcomes of interest were meeting 8th Joint National Commission (JNC-8) blood pressure (BP) goals and National Lipid Association (NLA) non–high-density lipoprotein (HDL) goals for hypertension and hyperlipidemia, respectively. Point estimates for associated risk factors were generated using modified Poisson regression with robust error variance.

Results. Of 1667 PWH in the analysis, 965 had hypertension, 205 had hyperlipidemia, and 497 had both diagnoses. At study start, the median patient age was 52 years, 66% were Black, and 65% identified as male. Among persons with hypertension, 24% were managed by an infectious diseases (ID) clinician alone, and 5% were co-managed by an ID clinician and a primary care clinician (PCC). Persons managed by an ID clinician were less likely to meet JNC-8 hypertension targets at the end of observation than the rest of the cohort (relative risk [RR], 0.84; 95% CI, 0.75–0.95), but when mean study blood pressure was considered, there was no difference between persons managed by ID and the rest of the cohort (RR, 0.96; 95% CI, 0.88–1.05). There was no significant association between the ID clinician managing hyperlipidemia and meeting NLA non-HDL goals (RR, 0.89; 95% CI, 0.68–1.15).

Conclusions. Clinician specialty may play a role in suboptimal hypertension outcomes in persons with HIV.

Keywords. cardiovascular disease; health services; HIV; hyperlipidemia; hypertension.

Persons with HIV (PWH) who achieve viral suppression can now expect near-normal life expectancies in the era of contemporary antiretroviral therapy (ART) [1]. However, increasing evidence suggests that, despite normal life expectancies, PWH are disproportionately affected by noncommunicable chronic diseases and may live longer, with significant comorbidity, than uninfected persons [2]. The burden of atherosclerotic cardiovascular disease (ASCVD), the preeminent contributor to age-related comorbidity in the United States, is increasing among PWH [3]. PWH are 1.5- to 2-fold as likely to have major ASCVD events as uninfected persons [4]. Although the etiology of the excess risk of ASCVD is multifactorial, most of the excess risk observed in this population can be attributed to modifiable risk factors [5]. Unfortunately, chronic disease care delivery to PWH in the United States remains heterogeneous [6, 7]. PWH often receive primary care from their HIV subspecialist or may divide primary care encounters between subspecialists and primary care clinicians (PCCs) [7]. Variations in how PWH navigate chronic disease care, including utilization of clinicians inexperienced in delivering primary care or use of multiple clinicians, may lead to poorer chronic disease outcomes.

From a health services perspective, examining the impact of clinician specialty on ASCVD primary prevention outcomes in PWH is essential to improving ASCVD risk reduction in this high-risk population. To date, the association between the 2 remains incompletely understood. To address this knowledge gap, we conducted a retrospective analysis of persons with HIV receiving care in 3 large academic clinics in the

Southeastern United States, assessing the frequency of meeting evidence-based guidelines for hypertension and hyperlipidemia in this population by clinician type.

METHODS

We conducted a retrospective analysis of PWH whose data are available in the Carolinas Collaborative Common Data Model (CDM). The Carolinas Collaborative CDM is a regional clinical data research network built on a learning health system model. The network uses a harmonized data set containing encounter-level clinical data on patients receiving care in 10 major health systems in North and South Carolina since 2004 [8]. For this analysis, we included clinical data on patients receiving care in 3 of the 10 partner institutions (Duke University Medical Center, Medical University of South Carolina, and Wake Forest Baptist Health) between January 1, 2014, and December 31, 2016.

Study Inclusion and Clinical Data

Persons with HIV (all HIV-1 RNA <200 copies/mL for 12 months before study start) and a diagnosis of either hypertension or hyperlipidemia before January 1, 2013, were included. We chose only persons with durable viral suppression to ensure that addressing a detectable viral load was not an acute and competing medical issue with hypertension and hyperlipidemia management. Hypertension and hyperlipidemia were strictly defined by the presence of the diagnosis in their electronic health record (EHR)–based problem lists. To be included in the analysis, patients must have completed ≥2 care encounters with ID or PCC between January 1, 2014, and December 31, 2016. For inclusion into the hyperlipidemia analyses, patients had to have ≥2 separate lipid profiles available in the medical record during the study observation period. Persons with a known history of major cardiovascular events (acute coronary syndrome, stroke, peripheral vascular disease, percutaneous coronary intervention, or coronary artery bypass grafting) were excluded from the analysis.

Basic patient demographics, clinical encounter-level data (unique clinic encounter identifier, date and location of encounter, encounter diagnosis), antihypertensive and statin prescription data (department/clinic of origination, date or prescription, drug prescribed), laboratory data (CD4 counts, lipid profiles), vital signs (blood pressure), and insurance data were abstracted.

Strata Definitions

Strata for responsible clinician for management of hyperlipidemia or hypertension were assigned by associating medication prescriptions (antihypertensive or statin) to their department of origination. The 5 strata were defined as follows: (1) ID clinician only (≥3 prescriptions in the patient record originating from the ID clinic without evidence of prescription entry from an alternate clinic during the study period), (2) PCC only (all prescriptions in the patient record originating from primary care practices), (3) co-managed by ID and PCC (meets criteria for ID management but also has prescriptions from primary care), (4) medication prescribed by other clinician (all medication orders originating from clinics not identified to be ID clinics or primary care practices, or managed at other sites), or (5) no evidence of prescription for hypertension and hyperlipidemia.

Study Outcomes

The primary outcomes for the study were based on 2 ASCVD risk factors of interest—hypertension and hyperlipidemia. For hypertension, there were 2 main outcomes: (1) average blood pressure over the study observation period below 8th Joint National Committee (JNC-8) guideline targets (ie, 140/90 mmHg) and (2) end observation blood pressure below 140/90 mmHg [9]. The secondary outcome measure was observed days below 140/90. To obtain observed days below goal, interval days between 2 blood pressures were assigned evenly to blood pressures at each end of the interval. For example, if BP at Time 1 was 150/95 and the subsequent BP obtained 28 days later (Time 2) was 130/80, half of the 28 days were assigned a BP of 150/95 and half were assigned a BP of 130/80. For hyperlipidemia, the primary outcome was meeting National Lipid Association non-HDL goals for cholesterol management by the end of the study period. For most patients in our cohort, the goal non-HDL-c was 130 mg/dL [10]. These metrics were chosen because their influence on clinical practice was contemporaneous with the study period.

Statistical Methods

Patients were followed from their first blood pressure (BP) encounter or lab encounter for lipid profile after January 1, 2014, until the date of an ASCVD event, death, or their last BP value or lipid profile recorded before December 31, 2016. Summary statistics are reported for the entire cohort. Comparisons between groups were made using the unpaired t test and analysis of variance for continuous variables and Pearson's χ^2 for categorical variables. To account for the high frequency of the outcome, modified Poisson regression (with robust error variance) was used to assess the association between covariates of interest and the outcome variable. All covariates included in the model were chosen a priori based on known associations with the outcome of interest. Point estimates are reported as relative risk (with associated 95% CIs). All statistical analyses were conducted using SAS, version 9.4 (Cary, NC, USA).

RESULTS

Overall, 1667 PWH with a diagnosis of hypertension or hyperlipidemia were included in the study. Sixty-five percent of cohort members were identified as male, 66% of patients were Black, and 3% were Hispanic of any race. The mean age of the cohort at the start of the observation (SD) was 52.5 (7.7) years.

Table 1. Patient Characteristics (n = 1667)

Characteristic	Number of Patients (%) (n = 1667)
Male	1083 (65)
Black	1093 (66)
Hispanic, any race	53 (3)
Mean age at start of observation (SD), y	52.5 (7.7)
Median CD4 count at start of observation (IQR)	629 (409 842)
Diagnosis	
Hypertension only	965 (58)
Hyperlipidemia only	205 (12)
Hypertension and hyperlipidemia	497 (30)
CVD Events	93 (6)
Acute coronary syndrome	24 (1)
Coronary intervention w/o ACS	6 (<1)
Stroke	41 (2)
Peripheral vascular disease	22 (1)
Deaths	138 (8)

Abbreviations: ACS, acute coronary syndrome; CVD, cardiovascular disease; IQR, interquartile range.

The median CD4 count at the time of study entry (interquartile range) was 629 (409–842). Among cohort members, 965 (58%) had only a diagnosis of hypertension, 205 (12%) had only a diagnosis of hyperlipidemia, and 497 (30%) had both diagnoses. Over the study period, 93 major cardiovascular events occurred (24 acute coronary syndrome, 6 coronary intervention without ACS, 41 cerebrovascular accidents, and 22 diagnoses of peripheral vascular disease). One hundred thirty-eight (8%) cohort members died during the study observation period (Table 1).

Hypertension

For the hypertension outcome, 1462 cohort members were included in the analysis and contributed a total of 3087.3 years of observation (mean [SD], 2.14 [0.99] years). The classifications of cohort members by specialty of clinician rendering blood pressure management are as follows: 349 (24%) by ID only, 243 (16%) by PCC only, 69 (5%) by both PCC and ID specialist, 306 (21%) with medications entered only by a non-ID, non-PCC, and 495 (34%) with no evidence of antihypertensives in the medical record (Table 2). Cohort members who had their blood pressure managed by ID exclusively had significantly higher mean systolic blood pressures (SD) at baseline (140.5 [21.8] mmHg) than persons managed by PCC only (134.4 [18.9] mmHg; *P* < .001). Persons who were managed by both ID and PCC had a distribution of baseline systolic blood pressures similar to persons managed by ID alone (mean [SD], 141.4 [22.0] mmHg) and significantly higher blood pressures than among persons managed by PCC only (Table 3). Mean systolic blood pressures of persons managed by PCC only (SD) were similar to those of cohort members prescribed meds by other clinicians (134.2 [19.8] mmHg) and patients without a documented antihypertensive prescribed (132.3 [19.8] mmHg). Over the

study period, the average systolic blood pressure among persons managed by ID alone (SD) was significantly higher than among persons whose hypertension was managed predominantly by primary care (138.1 [15.6] mmHg vs 133.4 [14.1] mmHg; *P* < .001). The proportion of patients who had mean blood pressures below 140/90 was also significantly lower in the ID-only group compared with the PCC-only group (57% vs 69%; *P* = .002). In the group of patients who met criteria for hypertension co-management by ID and PCC, the mean study period blood pressure (137.7 [13.5] mmHg) and proportion of patients with mean blood pressure below goal (57%) were similar to the ID-only group. At the end of the study observation period, 60% of patients receiving care from PCC met JNC-8 criteria, while 50% of persons in the ID-only group met JNC-8 criteria (*P* = .01). In the group that received care from both clinicians, 52% of patients met the JNC-8 goal of 140/90 (Table 3).

Overall, persons who had hypertension managed by ID alone had a significantly lower proportion of days below goal than persons managed by primary care exclusively (52.1% vs 62.2%; *P* < .001). There was no significant difference in proportion of days below blood pressure goal in the ID-only groups and the ID/PCC-co-managed group (54.2%; *P* = .82) (Table 4). In the regression analysis, persons who were managed by an ID clinician were significantly less likely to meet JNC-8 goal blood pressure at the end of the study observation than the rest of cohort members (relative risk [RR], 0.84; 95% CI, 0.75–0.95). The only other covariate that met statistical significance for not meeting JNC-8 goals was Black race (RR, 0.89; 95% CI, 0.80–0.98) (Table 5). However, in the model with mean study period blood pressure as the outcome variable, having an ID clinician exclusively manage blood pressure was not independently associated with failure to meet JNC-8 goals (RR, 0.96; 95% CI, 0.88–1.05) (Table 5).

Hyperlipidemia

Overall, 702 patients were included in the hyperlipidemia analysis, contributing a total of 1083 person-years (mean [SD], 1.54 [0.7] years). Among cohort members included in the

Table 2. Management of Hypertension and Hyperlipidemia by Clinician Specialty

Characteristic	Hypertension (n = 1462) No. (%)	Hyperlipidemia (n = 702) No. (%)
Managed by ID only	349 (24)	156 (22)
Managed by PCC only	243 (17)	91 (13)
Managed by both	69 (5)	21 (3)
Medication entered by other clinician (or not managed by sites)	306 (21)	98 (14)
No evidence of medication	495 (34)	336 (48)
Total years of observation	3087.3	1083.0
Mean years of observation (SD)	2.11 (0.93)	1.54 (0.70)

Abbreviations: ID, infectious diseases; PCC, primary care clinician.

Table 3. Hypertension Management by Responsible Clinician Specialty (n = 1462)

Characteristic[a]	All Patients (n = 1462)	ID Only (n = 349)	PCC Only (n = 243)	Both (n = 69)	On Meds Entered by Other (n = 306)	No Evidence of BP Meds (n = 495)
Start of observation						
Mean systolic BP (SD)	135.5 (19.8)	140.5 (21.8)	134.4 (18.9)	141.4 (22.9)	134.2 (19.8)	132.3 (17.3)
Mean diastolic BP (SD)	79.8 (12.2)	82.4 (13.6)	79.4 (11.0)	82.7 (14.9)	79.2 (11.9)	78.2 (11.2)
% with BP <140/90	846 (58)	165 (47)	141 (58)	29 (42)	190 (62)	321 (65)
% with BP <130/80	449 (31)	84 (24)	82 (34)	15 (22)	93 (30)	175 (35)
Mean BP over study period						
Mean SBP	134.0 (14.1)	138.1 (15.6)	133.4 (14.1)	137.7 (13.5)	133.0 (13.6)	131.5 (12.8)
Mean DBP	79.3 (8.7)	81.2 (9.1)	79.5 (8.1)	82.5 (8.8)	78.5 (8.8)	78.5 (8.4)
Mean SBP <140/90	978 (67)	198 (57)	168 (69)	40 (57)	208 (68)	364 (73)
Mean SBP <130/80	479 (33)	86 (25)	84 (35)	17 (25)	105 (34)	187 (38)
Mean change in SBP over observation period	−1.5	−2.4	−1.0	−3.7	−1.2	−0.8
Change in DBP over observation period	−0.5	−1.2	+0.1	−0.2	−0.7	+0.3
End of observation						
Mean systolic BP (SD)	134.3 (19.2)	137.8 (19.5)	133.1 (20.2)	139.6 (20.7)	133.5 (20.0)	132.2 (17.5)
Mean diastolic BP (SD)	80.3 (12.4)	81.9 (12.6)	79.9 (11.7)	84.4 (12.0)	78.7 (13.0)	79.9 (12.0)
% with BP <140/90	850 (58)	176 (50)	145 (60)	36 (52)	189 (62)	304 (61)
% with BP <130/80	429 (29)	93 (27)	69 (28)	12 (18)	101 (33)	154 (31)

Abbreviations: BP, blood pressure; DBP, diastolic blood pressure, ID, infectious diseases; PCC, primary care clinician.

[a]All BP values in mmHg.

hyperlipidemia analysis, the strata for clinicians rendering hyperlipidemia care were as follows: 156 seen by ID only, 91 managed by PCC only, 21 managed by both, 98 who had medication in the record entered by a non-ID, non-PCC, and 336 without evidence of medication for hyperlipidemia (Table 2). Baseline non-HDL levels (SD) were higher in the ID-only group (156.1 [45.1] mg/dL) compared with the PCC-only group (145.3 [46.0] mg/dL), although the difference did not meet statistical significance ($P = .07$) (Table 6). The mean non-HDL in the group with both clinicians was also higher than in all other groups (178.7 [57.3] mg/dL). At the end of study observation, 42% of persons in the PCC-only group met National Lipid Association guidelines of goal non-HDL <130 mg/dL compared with 37% of persons in the ID-only cohort ($P = .42$). Over the study period, non-HDL cholesterol (SD) dropped by 9.6 (57.3) mg/dL in the ID-only group and increased by 3.4 (59.4) mg/dL in the PCC-only group ($P = .04$). In the regression analysis, having an ID clinician was not associated (RR, 0.89; 95% CI, 0.68–1.15)

(Table 7) with failure to meet NLA non-HDL-c goals. Only increasing age was associated with an increased relative risk of meeting NLA goals compared with the rest of the cohort (RR per 10-year increase in age, 1.29; 95% CI, 1.16–1.44).

DISCUSSION

Among 1667 PWH with ASCVD risk factors, persons who received care for hypertension from ID specialists were less likely to achieve JNC-8 blood pressure goals than persons receiving care from other clinicians. Persons who had their blood pressure managed by ID also had significantly fewer days at or below 140/90 mmHg than the rest of the analysis cohort. However, after adjusting for relevant risk determinants and examining trends of blood pressure over time (ie, mean BP over the study period), ID management of blood pressure was not associated with failure to meet evidence-based goals. Notably, management of hyperlipidemia by ID specialists was not associated

Table 4. Participant Duration With Blood Pressure Below Goal (n = 1462)

Characteristic	All Patients (n = 1462)	ID Only (n = 349)	PCC Only (n = 243)	Both (n = 69)	On Meds Entered by Other (n = 306)	No Evidence of BP Meds (n = 495)
Total days of observation	1 130 818	256 671	211 037	52 988	247 602	362 519
Total days <140/90	694 084	133 663	131 303	28 726	156 957	243 434
Mean days of observation per patient	773	735	868	767	809	732
Mean observed days <140/90 (%)	475 (61.4)	383 (52.1)	540 (62.2)	416 (54.2)	512 (63.3)	491 (67.1)
Total BP measurements	36 931	6466	9360	3455	9119	8541
BP measurements per patient	25.2	18.5	38.5	50.1	29.8	17.3
Mean days between BP measurements	30.6	39.6	22.5	15.3	27.2	42.4

Abbreviations: BP, blood pressure; ID, infectious diseases; PCC, primary care clinician.

Table 5. Relative Risk for Meeting JNC-8 Blood Pressure Goals (n = 1462)

Variable	Unadjusted RR (95% CI)	Adjusted RR (95% CI) Mean Study Blood Pressure	Adjusted RR (95% CI) End Study Blood Pressure
Female	1.01 (0.88–1.16)	1.05 (0.98–1.12)	1.05 (0.96–1.16)
Black	0.88 (0.78–1.03)	**0.87 (0.82–0.94)**	**0.89 (0.80–0.98)**
Hispanic	1.03 (0.67–1.57)	0.99 (0.81–1.21)	0.98 (0.74–1.29)
Age (per 10-year increase)	1.01 (0.92–1.10)	1.02 (0.98–1.06)	1.01 (0.96–1.07)
Medicaid/Medicare	1.00 (0.88–1.15)	1.02 (0.86–1.21)	0.97 (0.78–1.19)
Self-pay	0.92 (0.77–1.11)	0.95 (0.77–1.17)	0.95 (0.77–1.17)
ID clinician managing Hypertension	0.83 (0.71–0.97)	0.96 (0.88–1.05)	**0.84 (0.75–0.95)**

Abbreviations: ID, infectious diseases; JNC-8, 8th Joint National Commission; RR, relative risk.

with higher probability of failure to meet evidence-based guidelines for cholesterol management. To our knowledge, our analysis is the first to explore CVD primary prevention outcomes among PWH based on managing clinician specialty. Given the increasing burden of ASCVD among PWH in the United States, the findings of our study give new insight on the implications of care configurations on effective CVD primary prevention in this population [3, 11].

Numerous reports have highlighted potential disparities in CVD risk management among PWH [12–15]. Ladapo and others reviewed ~228 000 outpatient visits from the National Ambulatory Medical Care Survey and showed that PWH were less likely to receive a statin when indicated then uninfected persons [15]. Others have reported inadequacies in aspirin use and antihypertensives in this population compared with uninfected persons [12, 13, 16]. The identification of these care disparities among PWH, particularly in a group known to be at elevated risk of ASCVD, calls for further investigations of factors that may explain these observations. Our study suggests 1 potential explanation for CVD prevention disparities among PWH—heterogeneity in managing clinician specialty/expertise.

Although the exact proportion of all PWH in the United States receiving primary care from ID specialists is unknown,

our data suggest that a substantial fraction of PWH fall in this group. In a survey by the Centers for Disease Control and Prevention's Medical Monitoring Project administered in 2014, 70% of ID-certified HIV physicians reported providing primary care to their patients [7]. Given the scope of practice of most ID-certified HIV physicians, differences in CVD risk management outcomes are plausible. ID clinicians have expressed self-perceived inadequacies in managing CVD risk factors, as reported in a survey of 150 attending-level HIV physicians. In the report by Fultz et al., ID-certified clinicians were less comfortable than general internists in managing diabetes, hyperlipidemia, and hypertension [17]. Among other possible explanations of our findings, ID clinician discomfort may in part explain the differences in outcomes we observed in our analysis. It remains unclear whether most of this discomfort and subsequent suboptimal CVD risk factor management outcomes are due to a knowledge deficit among ID clinicians, complexities of addressing HIV and CVD risk factors in the same ambulatory visit, or uncaptured selection bias of more difficult patients seeking out ID clinicians for primary care. Studies gaining detailed insight from HIV clinicians on the challenges of providing primary care in an HIV clinic setting are warranted.

Table 6. Hyperlipidemia Management by Responsible Clinician Specialty

Variable	All Patients (n = 702)	ID Only (n = 156)	PCC Only (n = 91)	Both (n = 21)	On Meds Entered by Other (n = 98)	No Evidence of BP Meds (n = 336)
Start of observation						
Mean total cholesterol (SD), mg/dL	196.2 (45.7)	202.9 (41.9)	188.9 (46.2)	225.3 (58.2)	192.5 (60.9)	194.4 (40.3)
Mean HDL cholesterol (SD), mg/dL	45.7 (14.8)	46.8 (15.3)	43.6 (13.0)	46.7 (10.7)	44.9 (14.5)	45.9 (15.3)
Mean non-HDL cholesterol (SD), mg/dL	150.6 (45.4)	156.1 (45.1)	145.3 (46.0)	178.7 (57.3)	147.6 (62.1)	148.6 (37.7)
End of observation						
Mean total cholesterol (SD), mg/dL	193.8 (50.0)	194.2 (44.1)	193.7 (72.8)	196.0 (49.1)	187.9 (46.8)	195.2 (45.9)
Mean HDL cholesterol (SD), mg/dL	46.1 (15.1)	47.7 (16.2)	44.9 (14.3)	47.0 (11.6)	44.5 (13.1)	46.1 (15.5)
Mean non-HDL cholesterol (SD), mg/dL	147.6 (48.5)	146.6 (43.1)	148.7 (72.7)	149 (46.7)	143.3 (45.9)	149.0 (43.6)
Non-HDL <130 (%)	263 (37)	57 (37)	38 (42)	7 (33)	43 (44)	118 (35)
Non-HDL ≥190 (%)	104 (15)	20 (13)	14 (15)	3 (14)	14 (14)	53 (16)
Change in non-HDL cholesterol, mg/dL	−2.9 (41.3)	−9.6 (39.7)	3.4 (59.4)	−29.7 (34.0)	−4.2 (49.6)	0.5 (32.1)
Total lipid profiles	2526	658	313	108	337	1110
Lipid profiles per person	3.6	4.2	3.4	5.1	3.4	3.3

Abbreviations: BP, blood pressure; HDL, high-density lipoprotein; ID, infectious diseases; PCC, primary care clinician.

Table 7. Relative Risk for Meeting NLA Non-HDL Hyperlipidemia Goals (n = 702)

Variable	Unadjusted RR (95% CI)	Adjusted RR (95% CI)
Female	0.92 (0.70–1.22)	0.91 (0.72–1.14)
Black	1.01 (0.79–1.29)	1.06 (0.86–1.30)
Hispanic	1.02 (0.58–1.78)	1.32 (0.85–2.07)
Age (per 10-y increase)	**1.32 (1.15–1.52)**	**1.29 (1.16–1.44)**
Medicaid/Medicare	1.10 (0.86–1.41)	1.24 (0.91–1.66)
Self-pay	0.97 (0.69–1.35)	1.15 (0.85–1.54)
ID clinician managing hypertension	0.84 (0.61–1.17)	0.89 (0.68–1.15)

Abbreviations: HDL, high-density lipoprotein; ID, infectious diseases; NLA, National Lipid Association; RR, relative risk.

Interestingly, when we examined average study period blood pressure as the outcome for blood pressure management, there was no significant difference between persons managed by ID alone and others. This observation seems to be in direct contrast with our findings that persons managed by ID alone are less likely to meet JNC-8 criteria at the end of observation and have significantly fewer days <140/90. The regression analysis does suggest that to some degree ID clinicians may be providing care to a subset of PWH that are discernably higher risk for elevated blood pressure than the rest of the clinician groups. Lability in blood pressure would be expected in these higher-risk groups and could explain the lower proportion of days below goal. There was also no significant difference in meeting evidence-based non-HDL goals among PWH who received their primary care from ID specialists and persons who received primary care from general internists. There are fundamental differences between hypertension and hyperlipidemia management that are worth noting. Hypertension management requires intensive follow-up at treatment onset and in the maintenance phases of management [9]. Frequent blood pressure checks are required for monitoring, and blood pressure can be acutely affected by dietary indiscretion and other transient behaviors. In contrast, cholesterol management tends to be less "labor-intensive" and unaffected by unidentified confounders. Most adherent patients on moderate- and high-intensity statins will achieve a 15%–51% reduction in non-HDL within 6–12 weeks of initiation [10]. Finally, we observed in our cohort that only 52% of all patients with documented hyperlipidemia had any record of an active statin prescription. The inadequacies of statin utilization among PWH are well documented, and our findings serve as another reminder that use of these agents in this population continue to fall short [16, 18].

Our findings must be interpreted in context of the reality that, when asked, PWH generally prefer to receive their primary care from their HIV clinician in the HIV clinic setting [6]. For many reasons, including persistent mistrust of the medical system and perceived stigma, it is unlikely that evidence of marginally poorer outcomes for hypertension and hyperlipidemia will convince PWH to seek primary care exclusively from separate general practitioners [19, 20]. As a result, our findings ideally should be interpreted as a cue toward improving care rendered by HIV clinicians, regardless of specialty, in the HIV clinic setting. Although educating ID specialists who offer primary care to their patients with HIV on the most contemporary CVD risk factor management guidelines is an important component of any effort to improve CVD in this population, other avenues to improve chronic disease delivery in general in the HIV clinic should be explored. Utilization of interim nurse BP checks in HIV clinics should be maximized. Initiatives to enhance evidence-based hypertension self-management techniques should be integrated to HIV clinic workflows, including digital-based interventions and home BP monitoring [21–23]. Incorporating nurse coordinators to promote intensive CVD risk factor management either via telephone or in person has also been shown to be effective in uninfected populations and may be beneficial in the HIV clinic setting [24, 25]. Most importantly, interventions to optimize chronic disease care delivery in PWH should be meet the expressed needs and preferences of patients above all else.

Our study has limitations. As part of the study design, we decided to observe patients who were established in care in order to obtain a "snapshot" of what blood pressure values in the maintenance phase of blood pressure and lipid management look like. To this end, we decided to exclude incident cases during the period of observation, which limits our ability to comment on how people with new diagnoses are managed. We acknowledge that persons in the ID group started with higher blood pressures than persons in other groups; however, because these were not incident cases, the higher BPs in this group are likely as much as an indicator of clinician management as they are fundamental differences in the patient populations between strata. The retrospective nature of the study does not allow us to get a full picture of the nuances of patient–clinician interaction guiding management decisions in the context of hypertension and hyperlipidemia control. In the future, in-depth studies of patients and clinicians examining how patients utilize potentially multiple chronic disease clinicians and how clinicians decide who is responsible for chronic disease care in individual patients are warranted. In assigning the specialty of the managing clinician to individual patients, although criteria were strict, we had to rely on the originating department of a medication prescription to determine the clinician's specialty. Fortunately, in our analysis the designators between infectious disease clinics and primary care clinics at all 3 centers were clear and easily discernable. However, if there were general internists practicing in ID clinics (or vice versa), our data would not have captured it.

Among PWH and hypertension, those who received primary care from ID specialists were marginally less likely to meet

evidence-based hypertension goals than PWH who received care from other clinicians. Future studies aimed at improving our understanding of barriers to delivering optimal ASCVD primary preventative care in HIV clinics are needed. These data also highlight the importance of ensuring comprehensive training in ASCVD risk management for ID specialists who provide primary care to PWH and the need for innovative strategies to improve chronic disease care delivery in the HIV clinic setting going forward.

Acknowledgments

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