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Association of Patient Perceptions of Cardiovascular Risk and Beliefs on Statin Drugs With Racial Differences in Statin Use

Insights From the Patient and Provider Assessment of Lipid Management Registry

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IMPORTANCE African American individuals face higher atherosclerotic cardiovascular disease risk than white individuals; reasons for these differences, including potential differences in patient beliefs regarding preventive care, remain unknown.

OBJECTIVE To evaluate differences in statin use between white and African American patients and identify the potential causes for any observed differences.

DESIGN, SETTING, AND PARTICIPANTS Using the 2015 Patient and Provider Assessment of Lipid Management (PALM) Registry data, we compared statin use and dosing between African American and white outpatient adults who were potentially eligible for primary or secondary prevention statins. A total of 138 US community health care practices contributed to the data. Data analysis was conducted from March 2017 to May 2018.

MAIN OUTCOMES AND MEASURES Primary outcomes were use and dosing of statin therapy according to the 2013 American College of Cardiology/American Heart Association guideline by African American or white race. Secondary outcomes included lipid levels and patient-reported beliefs. Poisson regression was used to evaluate the association between race and statin undertreatment, a category combining people who were not taking a statin or those taking a dose intensity lower than recommended.

RESULTS A total of 5689 patients (806 [14.2%] African American) in the PALM registry were eligible for statin therapy. African American individuals were less likely than white individuals to be treated with a statin (570/807 [70.6%] vs 3654/4883 [74.8%]; $P = .02$). Among those treated, African American patients were less likely than white patients to receive a statin at guideline-recommended intensity (269 [33.3%] vs 2145 [43.9%], respectively; $P < .001$; relative risk, 1.07 [95% CI, 1.00-1.15]; $P = .05$, after adjustment for demographic and clinical factors). The median (interquartile range) low-density lipoprotein cholesterol levels of patients receiving treatment were higher among African American than white individuals (97.0 [76.0-121.0] mg/dL vs 85.0 [68.0-105.0] mg/dL; $P < .001$). African American individuals were less likely than white individuals to believe statins were safe (292 [36.2%] vs 2800 [57.3%]; $P < .001$) or effective (564 [70.0%] vs 3635 [74.4%]; $P = .008$) and were less likely to trust their clinician (663 [82.3%] vs 4579 [93.8%]; $P < .001$). Group differences in statin undertreatment were not significant after adjusting for demographic, clinical, and clinician factors, socioeconomic status, and patient beliefs (final adjusted relative risk, 1.03 [95% CI 0.96-1.11]; $P = .35$).

CONCLUSIONS AND RELEVANCE African American individuals were less likely to receive guideline-recommended statin therapy. Demographic, clinical, socioeconomic, belief-related, and clinician differences contributed to observed differences and represent potential targets for intervention.

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Supplemental content

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The benefits of statin therapy for both primary and secondary prevention are well established.[1-3] African American individuals have a higher risk for atherosclerotic cardiovascular disease (ASCVD) than white individuals.[4] Part of the explanation for this increased risk may be undertreatment of African American peoples for primary prevention. Several studies have shown that African American individuals are less likely to receive statin therapy when indicated compared with white individuals.[5,6] Nevertheless, the reasons for these racial differences in lipid management remain incompletely understood.

The Patient and Provider Assessment of Lipid Management (PALM) registry was a large contemporary national registry conducted at 138 geographically diverse primary care, cardiology, and endocrinology community practices in the United States. Beyond collecting detailed clinical, socioeconomic, and core laboratory lipid data, the PALM registry assessed patient perceptions of personal cardiovascular disease risk, beliefs regarding statin efficacy and safety, and trust in clinicians, all of which have been associated with treatment use and adherence.[7] In this study, we (1) compared overall statin use and use of guideline-recommended statin intensity for African American and white individuals; (2) examined differences in African American and white patients' perceptions of ASCVD risk, statin efficacy and safety, and trust in their clinicians; and (3) determined whether differences in guideline-recommended statin use persisted after adjustment for demographics, clinical characteristics, socioeconomic status, patient beliefs, and clinician characteristics.

Key Points

Question What are the statin treatment patterns in African American vs white adults since the release of the 2013 American College of Cardiology/American Heart Association Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults?

Findings In this registry-based study, African American patients were less likely to receive a statin at the guideline-recommended intensity than white patients, although this association was no longer significant after adjusting for demographic characteristics, clinical characteristics, socioeconomic status, patient beliefs, and clinician factors.

Meaning In this study, African American outpatient adults were less likely to receive guideline-appropriate statin therapy, and this was explained by a combination of demographics, clinical characteristics, socioeconomic status, patient beliefs, and clinician factors.

Methods

Data Description and Outcomes of Interest: PALM

The PALM registry is a nationwide registry of patients who have ASCVD or are at high risk for ASCVD. Data were collected at 138 primary care, cardiology, and endocrinology practices that enrolled patients between May 2015 and November 2015.[7] Patient clinical data (comorbidities, medication use, and demographics) and current statin use were abstracted from the medical record by study coordinators at each site.[7] Patient surveys were conducted to determine self-reported race, education level, socioeconomic status, and beliefs about statins, cholesterol, ASCVD, and clinician trust. All participants were asked to complete the survey at enrollment (response rate 95.3%); those who did not complete the survey were not eligible for inclusion. Surveys were administered on an iPad while patients were waiting to be seen in clinic.[7] Patient numeracy was assessed using the subjective numeracy score.[8,9] The Duke Institutional Review Board provided approval for coordinating center activities, and individual sites obtained approval from their local institutional review board or from the central institutional review board for the study before enrolling patients in the PALM registry. All patients provided written informed consent prior to participation.

Self-reported income was missing for 1725 patients (30.3%). Missing income data were imputed using 2014 median census household income from the area health resource files from the Health Resource and Services Administration website (https://www.hrsa.gov/) based on the zip code of the patient's residence or the enrolling site. Core laboratory lipid panels were measured for all patients. Clinicians in clinics that participated in the PALM registry also completed surveys prior to patient enrollment, assessing their self-reported treatment patterns and the primary guideline that they used.

In this analysis, we included all patients who (1) were either African American or white and (2) were recommended for statin therapy based on the 2013 American College of Cardiology (ACC)/American Heart Association (AHA) Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults.[1] Other races were excluded from the analysis, including those who self-identified as Asian, American Indian/Alaskan Native, and Native Hawaiian/Pacific Islander.

Participants were classified as eligible for high-intensity statin therapy per guideline recommendations: (1) patients with clinical ASCVD defined as coronary artery disease (prior myocardial infarction, obstructive coronary artery disease, coronary artery bypass grafting, or percutaneous coronary intervention), cerebrovascular disease (prior transient ischemic attack or stroke), other ASCVD (peripheral arterial disease, abdominal aortic aneurysm, noncoronary arterial revascularization, and carotid stenosis), combined with an age of 75 years or younger; (2) patients with a low-density lipoprotein cholesterol (LDL-C) level of 190 mg/dL or more (to convert to millimoles per liter, multiply by 0.0259); or (3) diabetes with a 10-year ASCVD risk of 7.5% or greater (based on a pooled cohort risk equation), combined with an age of 40 to 75 years and a LDL-C level of 70 mg/dL or more.[1] We also considered adults aged 40 to 75 years who had diabetes and a predicted 10-year ASCVD risk of 7.5% or higher who were taking a statin at the time of enrollment and were eligible for high-intensity statin therapy, regardless of their LDL-C level. Participants were eligible for moderate-intensity statin therapy if they did not meet any indication for a high-intensity statin regimen and met 1 of the following criteria: (1) patients with clinical ASCVD, combined with an age older than 75 years; (2) patients with diabe-

tes who either had a 10-year ASCVD risk less than 7.5% combined with an age of 40 to 75 years and a LDL-C level of 70 mg/dL or greater or were already taking a statin; or (3) patients who had either a 10-year risk of 7.5% or more without diabetes who were aged 40 to 75 years with LDL-C level of 70 mg/dL or greater or who were already taking a statin. Statin undertreatment was defined as (1) patients meeting the recommendation for a statin but not being treated, (2) patients who had been recommended for high-intensity statin regimen initiation but who were treated with a moderate or low dose of a statin, or (3) patients who had been recommended for a moderate-intensity statin regimen but treated with a low-intensity statin.

Statistical Analysis

Statin treatment patterns (not taking statin, taking lower than appropriate dose of statin, and taking an appropriate dose of statin) were evaluated by race within the overall population and by indication (primary and secondary prevention). Differences in the frequency of appropriate statin treatment were assessed by race. Patient demographics, socioeconomic status, clinical and laboratory values, prior statin experience, and beliefs about statins, cholesterol, and cardiovascular disease were evaluated by race overall and by indication (primary vs secondary prevention). Categorical variables were presented as frequencies and differences assessed using the χ^2 test when the sample size was sufficient; otherwise, an exact test was used. Continuous variables were presented as a median (interquartile range) and compared using the Wilcoxon rank sum test. A *P* value <.05 indicated that the summary measures (ie, distribution for continuous variables and proportions for categorical variables) differed by analytic group.

We evaluated the degree to which racial differences in statin use among African American and white populations were because of demographic, clinical, socioeconomic, patient beliefs, and clinician factors using sequential multivariable modeling of the association between race and the risk of undertreatment (receiving no statin or a statin intensity lower than recommended) using Poisson regression with generalized estimating equation to account for clustering at the site level. First, univariable analysis using race alone (model 1) was performed to evaluate the unadjusted relative risk between race and undertreatment. Next, the following sequential models were created to evaluate how the relative risk of African American race and statin undertreatment changed when adjusted for possible explanatory factors: model 2 included age and sex; model 3 further adjusted for clinical characteristics including prior ASCVD (grouped into coronary heart disease, cerebrovascular disease, and other ASCVD), diabetes, obesity, smoking, and hypertension. Model 4 further adjusted for socioeconomic factors such as yearly income, insurance status, education level, and numeracy score. Model 5 added in patient beliefs and perceptions, including worry about heart disease, clinician trust, beliefs about statin safety and effectiveness, and beliefs about high cholesterol and heart attack risk. Finally, in addition to demographic, clinical, socioeconomic, and patient belief factors, model 6 included clinician factors, including clinician type (cardiologist vs noncardiologist), whether the patient's clinician reported using the 2013 ACC/AHA guideline as their primary resource for lipid management in the clinician survey, and clinic setting (urban vs rural). Nearly all patients had information from the clinician survey; however, 35 of 5689 patients (0.62%) were excluded from the model because of a lack of clinician information. An additional 40 patients (0.70%) were excluded from the modeling because of a lack of information on current statin use. When covariate data were missing for the regression analysis (with the exception of income data as described above) multiple imputation was used, employing the generalized estimating equation method with exchangeable working correlation structure to account for clustering of patients within sites (eTable in the Supplement). Sensitivity analysis of the multivariable modeling was performed to assess the impact of missing data by rerunning the models with multiple imputation, simple imputation, and excluding missing data. The results were similar. Finally, to determine the relative influence of individual risk factor groups, multivariable modeling of the association between undertreatment and race adjusting for individual confounder groups using Poisson regression was performed for demographic, clinical, socioeconomic, patient belief, and clinician factors (eFigure in the Supplement). Data analysis was conducted from March 2017 to May 2018 using SAS, version 9.4 (SAS Institute, Inc). A *P* value less than .05 was considered significant.

Results

Of the 7736 patients in the PALM registry, 5689 met inclusion criteria for this study (73.5%). Of these 5689 individuals, 806 were African American (14.2%) and 4883 were white (85.8%). Race and ethnicity were both self-reported; 37 of 806 African American patients (4.6%) and 591 of 4883 white patients (12.1%) self-identified as Hispanic. The excluded population included 112 Asian individuals (1.9%), 9 American Indian/Alaskan Native individuals (0.2%), and 8 Native Hawaiian/Pacific Islanders (0.1%).

Table 1 compares the baseline characteristics for African American vs white patients, with stratification by primary and secondary prevention groups. African American participants were younger (African American: median, 64.0 years [IQR, 57.0-70.0 years]; white: median, 68.0 years [IQR, 62.0-74.0 years]; *P* < .001) and more likely to be female (African American: n = 436 [54.1%] and white: n = 2020 [41.4%]; *P* < .001), have diabetes (African American: n = 481 [59.7%] and white: n = 2050 [42.0%]; *P* < .001), smoke cigarettes (African American: n = 134 [17.8%] and white: n = 520 [10.8%]; *P* < .001), and have a higher body mass index (calculated as weight in kilograms divided by height in meters squared; African American: median, 31.6 [IQR, 27.3-37.0] and white: median, 29.9 [IQR, 26.3-34.3]; *P* < .001). African American individuals were less likely to have had prior ASCVD (African American: n = 356 [44.2%] and white: n = 2851 [58.4%]; *P* < .001). However, those considered primary prevention patients had a higher mean predicted 10-year ASCVD risk score than white primary prevention patients (African American: median, 16.2 [IQR,

Table 1. Demographic and Clinical Differences in African American vs White Adults in the PALM Registry Data Set

Characteristic	Patient Group, No. (%)								
	Overall (N = 5689)			Primary Prevention (n = 2482)			Secondary Prevention (n = 3207)		
	African American Patients (n = 806)	White Patients (n = 4883)	*P* Value	African American Patients (n = 450)	White Patients (n = 2032)	*P* Value	African American Patients (n = 356)	White Patients (n = 2851)	*P* Value
Clinical and Demographic Factors									
Age, median (IQR), y	64.0 (57.0-70.0)	68.0 (62.0-74.0)	<.001	62.0 (55.0-68.0)	66.0 (60.0-71.0)	<.001	67.0 (58.0-73.0)	71.0 (64.0-78.0)	<.001
Female	436 (54.1)	2020 (41.4)	<.001	249 (55.3)	1040 (51.2)	.11	187 (52.5)	980 (34.4)	<.001
ASCVD[a]	356 (44.2)	2851 (58.4)	<.001	NA	NA	NA	100	100	
Coronary heart disease[b]	270 (33.5)	2382 (48.8)	<.001	NA	NA	NA	270 (75.8)	2382 (83.5)	<.001
Cerebrovascular disease[c]	71 (8.8)	420 (8.6)	.85	NA	NA	NA	71 (19.9)	420 (14.7)	.01
Other ASCVD[d]	124 (15.4)	937 (19.2)	.01	NA	NA	NA	124 (34.8)	937 (32.9)	.46
Diabetes	481 (59.7)	2050 (42.0)	<.001	280 (62.2)	986 (48.5)	<.001	201 (56.5)	1064 (37.3)	<.001
Hypertension	717 (89.0)	3923 (80.3)	<.001	384 (85.3)	1521 (74.9)	<.001	333 (93.5)	2402 (84.3)	<.001
Chronic kidney disease	97 (12.0)	492 (10.1)	.09	35 (7.8)	135 (6.6)	.39	62 (17.4)	357 (12.5)	.01
BMI, median (IQR)	31.6 (27.3-37.0)	29.9 (26.3-34.3)	<.001	31.8 (28.1-37.4)	30.6 (27.1-35.5)	<.001	31.2 (26.5-36.3)	29.3 (25.8-33.6)	<.001
Smoking	134 (17.8)	520 (10.8)	<.001	68 (16.8)	235 (11.7)	<.001	66 (18.9)	285 (10.1)	<.001
10-y Risk among those without known ASCVD, median (IQR)[e]	16.2 (10.4-25.3)	14.0 (9.2-21.2)	<.001	16.2 (10.4-25.3)	14.0 (9.2-21.2)	<.001	NA	NA	NA
Total cholesterol, median (IQR)	179.0 (152.0-212.0)	167.0 (141.0-198.0)	<.001	184.0 (158.0-212.0)	180.0 (155.0-212.5)	.36	171.0 (143.0-209.0)	156.0 (135.0-186.0)	<.001
LDL-C, median (IQR)	104.0 (82.0-131.0)	92.0 (72.0-119.0)	<.001	110.0 (87.0-133.0)	103.0 (82.5-130.0)	.03	95.0 (75.0-127.0)	84.0 (67.0-108.0)	<.001
HDL-C core laboratory, median (IQR)	55.0 (45.0-66.0)	50.0 (42.0-61.0)	<.001	55.0 (45.0-67.0)	52.0 (43.0-64.0)	<.001	54.0 (45.0-65.0)	49.0 (41.0-59.0)	<.001
Patients with LDL-C <70 mg/dL	107 (14.0)	1045 (21.8)	<.001	49 (10.9)	267 (13.1)	.20	58 (18.4)	778 (28.2)	<.001
Systolic blood pressure, median (IQR)	131.0 (122.0-145.0)	128.0 (119.0-140.0)	<.001	134.0 (124.0-147.0)	130.0 (120.0-140.0)	<.001	130.0 (120.0-140.0)	128.0 (118.0-140.0)	<.001
Socioeconomic Factors									
Insurance[f]									
Private	356 (48.0)	2933 (60.9)	<.001	200 (50.5)	1243 (61.9)	<.001	156 (45.1)	1690 (60.2)	<.001
Medicare	395 (53.2)	3047 (63.2)	<.001	184 (46.5)	1118 (55.7)	<.001	211 (61.0)	1929 (68.6)	.004
Medicaid	162 (21.8)	455 (9.4)	<.001	76 (19.2)	187 (9.3)	<.001	86 (24.9)	268 (9.5)	<.001
Other	26 (3.5)	106 (2.2)	.03	15 (3.8)	33 (1.6)	.005	11 (3.2)	73 (2.6)	.53
No insurance	20 (2.7)	102 (2.1)	.32	12 (3.0)	63 (3.1)	.91	8 (2.3)	39 (1.4)	.18
Education (some college or above)[g]	395 (54.0)	3095 (64.2)	<.001	207 (53.6)	1294 (64.5)	<.001	188 (54.5)	1801 (64.0)	<.001
Subjective numeracy score, median (IQR)[g,h]	12.0 (8.0-18.0)	17.0 (12.0-21.0)	<.001	13.0 (8.0-18.0)	17.0 (12.0-21.0)	<.001	12.0 (8.0-18.0)	17.0 (12.0-22.0)	<.001
Income, $									
<35 000	256 (55.3)	1106 (33.9)	<.001	127 (52.0)	466 (32.1)	<.001	129 (58.9)	640 (35.4)	<.001
35 000-75 000	123 (26.6)	1112 (34.1)		68 (27.9)	512 (35.2)		55 (25.1)	600 (33.2)	
75 000-100 000	33 (7.1)	383 (11.7)		20 (8.2)	176 (12.1)		13 (5.9)	207 (11.4)	
≥100 000	51 (11.0)	661 (20.3)		29 (11.9)	299 (20.6)		22 (10.0)	362 (20.0)	
Clinician factors									
Urban clinician	704 (87.3)	4415 (90.8)	.002	394 (87.6)	1825 (90.4)	.07	310 (87.1)	2590 (91.2)	.01
Cardiologist vs noncardiologist[i]	212 (27.2)	1840 (38.4)	<.001	53 (12.1)	302 (15.2)	.10	159 (46.5)	1538 (55.0)	.003
Cardiologist seen at least once per year	377 (50.4)	2943 (61.0)	<.001	114 (28.4)	596 (29.7)	.59	263 (76.0)	2347 (83.2)	<.001

(continued)

Table 1. Demographic and Clinical Differences in African American vs White Adults in the PALM Registry Data Set (continued)

Characteristic	Patient Group, No. (%)								
	Overall (N = 5689)			Primary Prevention (n = 2482)			Secondary Prevention (n = 3207)		
	African American Patients (n = 806)	White Patients (n = 4883)	*P* Value	African American Patients (n = 450)	White Patients (n = 2032)	*P* Value	African American Patients (n = 356)	White Patients (n = 2851)	*P* Value
Endocrinologist seen at least once per year	199 (26.6)	849 (17.6)	<.001	105 (26.2)	388 (19.3)	.002	94 (27.2)	461 (16.3)	<.001
2013 ACC/AHA guideline as primary guideline[j]	443 (59.4)	2818 (64.9)	.004	194 (46.4)	1061 (59.2)	<.001	249 (75.9)	1757 (68.8)	.009
Stopped statin because of adverse effects[k]	17(2.9)	231 (5.7)	.005	4 (1.4)	100 (6.8)	<.001	13 (4.4)	131 (5.1)	.61

Abbreviations: ACC, American College of Cardiology; AHA, American Heart Association; ASCVD, atherosclerotic cardiovascular disease; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); HDL-C, high-density lipoprotein cholesterol; IQR, interquartile range; LDL-C, low-density lipoprotein cholesterol; NA, not applicable; PALM, Patient and Provider Assessment of Lipid Management Registry.

SI conversion factor: To convert HDL-C to millimoles per liter, multiply by 0.0259. To convert LDL-C to millimoles per liter, multiply by 0.0259.

[a] ASCVD was defined as a prior myocardial infarction, coronary artery disease, coronary artery bypass grafting, percutaneous coronary intervention, stroke, abdominal aortic aneurysm, peripheral arterial disease, carotid artery stenosis, or noncoronary arterial revascularization.

[b] Coronary heart disease was defined as prior myocardial infarction, coronary artery disease, coronary artery bypass graft, and percutaneous coronary intervention.

[c] Cerebrovascular disease was defined as a prior transient ischemic attack or stroke.

[d] Other ASCVD was defined as abdominal aortic aneurysms, peripheral artery disease, noncoronary arterial revascularization, and carotid stenosis.

[e] 10-year risk was estimated using the pooled cohort equation.[1]

[f] In insurance, the category "other" includes all answers that are not the ones listed.

[g] Education level and income are by patient report.

[h] Subjective numeracy score as described previously.[8,9]

[i] Cardiologist vs noncardiologist denotes whether the patient's PALM registry clinician was a cardiologist or not.

[j] 2013 ACC/AHA guideline as primary guideline refers to the percentage of patients whose primary clinician listed the 2013 ACC/AHA cholesterol guideline as their primary reference guiding cholesterol treatment.

[k] Stopped statin because of adverse effects refers to the percentage of all patients who were ever taking a statin in that given subgroup.

10.4-25.3] points and white: median, 14.0 [IQR, 9.2-21.2] points; *P* < .001). African American individuals more frequently had a history of hypertension and had higher median systolic blood pressures than white patients. African American patients also had lower income, educational levels, and subjective numeracy scales and were more likely to have Medicare than white patients. African American patients were less likely to report seeing a cardiologist but were more likely to report seeing an endocrinologist annually. Clinicians seen by African American participants were also less likely to report using the 2013 ACC/AHA guideline as their primary guideline. White patients who received a statin were more likely than African American patients to stop their statin because of adverse effects (African American: n = 17 of 586 [2.9%] vs white: n = 241 of 4043 [5.96%]; *P* = .005).

Statin Use and Dosing Intensity

African American patients were less likely than white patients to be treated with any statin (African American: n = 570 [70.61%] vs white: n = 3654 [74.85%]; *P* = .02), or to be treated with a statin at the guideline-recommended intensity (African American: 269/806 [33.3%] vs white: 2145/4883 [43.9%]; *P* < .001; **Figure 1**). In the overall sample, as well as among those taking statin therapy, African American patients had higher LDL-C levels than white patients did, overall (African American: median, 104.0 [IQR, 82.0-131.0] mg/dL vs white: median, 92.0 [IQR, 72.0-119.0] mg/dL; *P* < .001) and among those taking statins (African American: median, 97.0 [76.0-121.0] vs white: 85.0 [68.0-105.0] mg/dL; *P* < .001; **Figure 2**).

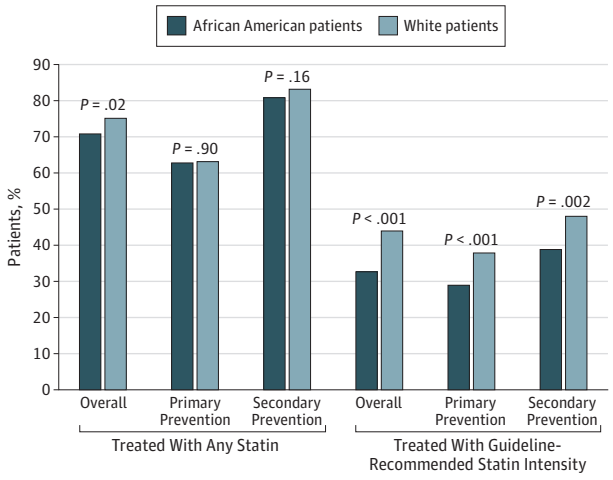
Patient Perceptions and Beliefs

African American patients and white patients had different perceptions and beliefs about statins, cholesterol, and cardiovascular disease (**Table 2**). Among those with ASCVD, African American patients were more likely to report worrying often about heart attack or stroke than white patients (African American: n = 90 [13.4%] vs white: n = 433 [9.4%] ; *P* = .01). In contrast, African American patients were less likely to report that they perceived their risk of cardiovascular disease to be higher (worse) than their peers (African American: n = 213 [28.6%] vs white: n = 1735 [36.2%], *P* < .001). African American patients were less likely to believe statins are effective (African American: n = 564 [70.0%] vs white: n = 3635 [74.4%]; *P* = .01) or safe (African American: n = 292 [36.2%] vs white: n = 2800 [57.3%]; *P* < .001), and were less likely to trust their clinician than white patients (African American: n = 663 [87.0%] vs white: n = 4579 [94.7%]; *P* < .001).

Multivariable and Sequential Modeling of Statin Use

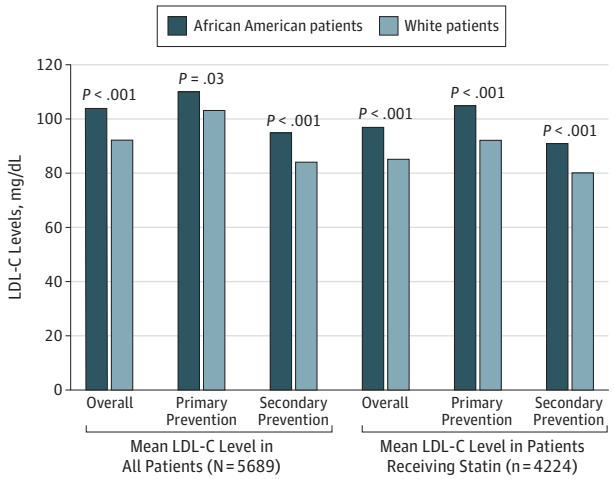
Sequential modeling of statin undertreatment among African American patients vs white patients revealed an association between African American race and statin undertreatment (relative risk [RR], 1.14; 95% CI, 1.06-1.22; *P* < .001), which persisted after correction for demographic factors (**Figure 3**).

Figure 1. Statin Use in African American vs White Patients



Statin treatment and guideline-recommended statin treatment in African American patients vs white patients are presented here, categorized by overall, primary prevention, and secondary prevention subgroups.

Figure 2. Low-Density Lipoprotein Cholesterol (LDL-C) Levels Overall and in Patients Taking Statin Medications in African American vs White Patients



Low-density lipoprotein cholesterol levels for all patients and patients taking statin medications are presented for African American patients and white patients, categorized by overall, primary prevention, and secondary prevention subgroups.

The association was no longer statistically significant when sequentially adjusted for clinical characteristics (RR, 1.07; 95% CI, 1.00-1.15; $P = .05$), socioeconomic status (RR, 1.07; 95% CI 0.99-1.15; $P = .07$), patient beliefs (RR, 1.04; 95% CI, 0.97-1.11; $P = .25$), and clinician characteristics (RR, 1.03; 95% CI, 0.96-1.11; $P = .35$). While the association between race and statin undertreatment lost statistical significance after adjustments for individual sets of confounders in sequential modeling, no individual set of confounders fully accounted for the association between race and statin undertreatment (eFigure in the Supplement).

Discussion

Statins are a cornerstone of therapy for primary and secondary prevention of cardiovascular disease. Among those individuals who meet criteria for statins in the PALM registry, we found that African American individuals were slightly less likely than white individuals to receive statins overall and much less likely to receive the guideline-recommended statin intensity. African American and white individuals had different perceptions and beliefs regarding statin therapy, which, along with other factors including demographics, clinical characteristics, socioeconomic status, and lower frequency of care by cardiologists, accounted for the differences in treatment observed.

Overall treatment rates with any statin by race were modest, with only an absolute 4% difference overall in the rate of any statin use between African American patients and white patients; however, these differences were more pronounced when statin intensity was considered. In both primary and secondary prevention, African American patients were less likely to receive guideline-appropriate statin intensity than white patients. Lower use of appropriate intensity statins among African American patients compared with white patients contributed to higher LDL-C levels observed among African American patients. Given that the association between even a modest LDL-C reduction and cardiovascular disease risk reduction of major vascular events is well established,[2] differences in appropriate statin therapy use and corresponding differences in LDL-C levels may partially explain differences in ASCVD burden between African American and white adults.

Our finding that African American individuals were less likely to receive guideline-appropriate statin therapy is consistent with prior literature. Despite African American people being at higher risk of ASCVD,[4] multiple studies have demonstrated that they have a lower likelihood of treatment and lower adherence to statin therapy.[5,6,10,11] Prior literature also suggests that African American individuals are less likely to have cholesterol screening,[12] have lower long-term adherence to statin therapy after a myocardial infarction despite cardiologist discharge on a statin,[10] and have worse lipid control (according to the Million Hearts initiative).[13] Why these gaps remain has been poorly understood, and prior studies investigating racial disparities in statin therapy have not included the potential influence of individuals' beliefs, preferences, and concerns on treatment patterns.[5,14] To our knowledge, this study is one of the first to investigate racial differences in community statin use since the publication of the 2013 ACC/AHA cholesterol guideline and one of the first to evaluate the influence of patient beliefs relative to sociodemographic and clinical information. We confirm that racial differences in statin use persist in the modern treatment era, with lower statin treatment rates among African American adults compared with white adults.

The reasons for racial differences are complex and may be partially explained by differences in several characteristics.

Table 2. Racial Differences in Patient Beliefs About Statins, Cholesterol, and Heart Disease[a]

Survey Question	Patient Group, No. (%)								
	Overall (N = 5689)			Primary Prevention (n = 2482)			Secondary Prevention (n = 3207)		
	African American Patients	White Patients	*P* Value	African American Patients	White Patients	*P* Value	African American Patients	White Patients	*P* Value
Worry about disease and cholesterol[b]									
How often do you think or worry that you may have a heart attack or stroke?									
Often	90 (13.4)	433 (9.4)		32 (9.0)	123 (6.5)		58 (18.4)	310 (11.5)	
Occasionally	195 (29.1)	1341 (29.2)	.01	104 (29.3)	571 (30.2)	.23	91 (28.8)	770 (28.6)	.001
Rarely or never	386 (57.5)	2811 (61.3)		219 (61.7)	1195 (63.3)		167 (52.8)	1616 (59.9)	
How do you think your risk of heart attack or stroke compares with other men/women your age? (% who answered slightly higher to much higher than peers)	213 (28.6)	1735 (36.2)	<.001	99 (25.0)	618 (31.0)	.009	114 (32.7)	1117 (39.9)	.02
People with high cholesterol are more likely to have a heart attack.	623 (77.3)	3954 (81.0)	.02	360 (80.0)	1640 (80.7)	.73	263 (73.9)	2314 (81.2)	.001
People don't need to worry about their cholesterol if they have never had a heart attack or other heart problem.	71 (8.8)	404 (8.3)	.61	41 (9.1)	154 (7.6)	.27	30 (8.4)	250 (8.8)	.83
Statin efficacy									
Statin medications are effective in reducing the risk of heart disease and stroke.	564 (70.0)	3635 (74.4)	.01	311 (69.1)	1441 (70.9)	.45	253 (71.1)	2194 (77.0)	.01
Statin safety									
Statins are safe medications.	292 (36.2)	2800 (57.3)	<.001	145 (32.2)	1112 (54.7)	<.001	147 (41.3)	1688 (59.2)	<.001
I think statins can cause diabetes.	61 (7.6)	299 (6.1)	.12	26 (5.8)	120 (5.9)	.92	35 (9.8)	179 (6.3)	.01
I think statins can cause muscle aches or pain.	216 (26.8)	1913 (39.2)	<.001	96 (21.3)	728 (35.8)	<.001	120 (33.7)	1185 (41.6)	.004
I think statins can cause liver damage.	157 (19.5)	1406 (28.8)	<.001	67 (14.9)	568 (28.0)	<.001	90 (25.3)	838 (29.4)	.11
I think statins can cause memory loss.	101 (12.5)	558 (11.4)	.36	47 (10.4)	206 (10.1)	.85	54 (15.2)	352 (12.3)	.13
Clinician trust									
How much would you say you trust your doctors' decisions about your medical care? (% generally trust or completely trust)	663 (87.0)	4579 (94.7)	<.001	352 (85.2)	1906 (94.7)	<.001	311 (89.1)	2673 (94.7)	<.001

[a] Statin-related beliefs and perceptions are presented here for African American patients vs white patients, categorized by worries about disease, beliefs about efficacy, beliefs about safety, clinician trust, and adverse effect experiences.

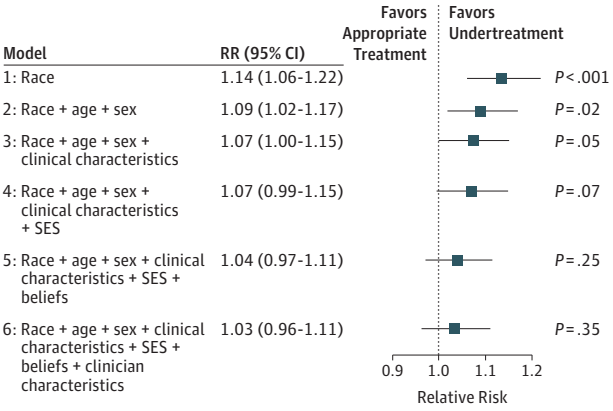
[b] Responses presented are collected from patient survey questions asked on a 5-point Likert scale from strongly disagree to strongly agree. Results shown are the percentage of participants who reported agree to strongly agree.

African American patients were more frequently female, had higher rates of diabetes and tobacco use, were less likely to have prior ASCVD, and had lower socioeconomic and educational levels than white people. African American individuals were more likely to have Medicaid rather than private insurance or Medicare, which may have influenced their access to health care services, along with lower socioeconomic status. Financial barriers may be a component of statin underuse, and some have suggested that interventions such as reduction of insurance copayments for statins may improve adherence in African American communities.[15] Nonetheless, adjusting for socioeconomic status did not fully account for the racial differences in statin use found in PALM. Prior work has demonstrated that long-term statin persistence is lower among African American individuals, even among those with prescription drug coverage.[16] Improving racial disparities in statin use will likely require multiple approaches.

The type of clinician that a patient sees may also play a role in differential treatment patterns. African American patients were more likely to have seen an endocrinologist and were less likely to be treated by a cardiologist or a clinician who reported following the 2013 ACC/AHA cholesterol guideline. These findings may have influenced the observed treatment differences.

While many of the demographic, clinical, and socioeconomic factors that could contribute to treatment differences remain potential confounders in data on PALM registry participants, this study is the first to investigate the potential influence of African American persons' ASCVD risk perception, clinician trust, and beliefs about statin therapy. Differences in beliefs between African American and white participants may play a role in differences in treatment patterns. Specifically, African American patients were more likely to believe they were at lower risk than their peers but were more likely to worry

Figure 3. A Sequential Modeling Approach for Racial Differences in Statin Undertreatment of African American Patients



In all cases, values for African American patients are compared with a white population (whose outcomes constitute the reference values). SES indicates socioeconomic status.

about having a heart attack or stroke. African American participants were less likely to believe that statins are effective and far less likely than white participants to believe statins are safe. Such perceptions and experiences may influence adherence to statin therapy and willingness to consider therapy; altering that perception can often change patients' willingness to take a medication.[17-20]

Adding complexity to these observations, while most African American and white individuals reported completely trusting their clinicians, there were differences by race, with fewer African American patients reporting complete trust in their clinician than white patients did. Medical mistrust among African American patients for nonstatin-based clinical decisions has been previously documented,[21,22] representing an important challenge for both clinicians and patients. Trust-building in clinical practice settings is more difficult than ever because shorter office visits and electronic medical records consume clinicians' attention, but the process remains crucial to the implementation and efficacy of educational efforts. Medical mistrust may also be influenced by poor clinician communication. The psychological, cultural, and community aspects that may contribute to differences in statin beliefs and clinician trust, as well as their potential influence on statin use, merit further investigation.

Although this study focused on differences by race, it is worth noting that there was a strikingly high rate of undertreatment among both African American patients and white patients overall, with less than half of all patients receiving the guideline-recommended statin therapy level of intensity.[23] Therefore, even if African American adults were treated at the same rate as white adults, significant room for improvement would remain. Despite very low rates of serious adverse effects observed in clinical trials,[24-27] we observed important, ongoing safety concerns on the part of patients. We observed a wider racial gap in statin adverse effects in primary prevention than secondary prevention, likely reflecting the more standardized treatment approach seen in secondary prevention populations and less consensus on use in primary prevention. Given the track record of statins being relatively safe and well-tolerated medications, the onus is on clinicians and pharmacists to accurately communicate both the safety features and risks of these important preventive medications. On the other hand, we were reassured that approximately 80% of both African American patients and white patients were aware of the association between high cholesterol and heart attacks, while less than 10% of both groups felt they did not need to worry about their cholesterol if they never had a heart attack or heart problem. This represents a significant triumph in terms of patient education and health care awareness. These results highlight the importance of refocusing clinical emphasis on systemic improvements to better care for our most vulnerable patients by improving the care of the population as a whole. This includes eliciting and addressing patients' concerns, emphasizing patient education, performance measures and incentives, providing decision support for clinicians, and creating quality improvement initiatives on the local and national levels.

Limitations

Our study had some limitations. First, we did not directly assess the stated reasoning behind clinician decisions to prescribe or not prescribe statin therapy in study participants; therefore, it is possible that contraindications to therapy in both African American and white participants or patient refusal were present. Second, our study was limited by missing responses for some categories. There was no specific response rate, but African American patients more frequently declined to answer belief questions than white patients (eTable in the Supplement). For missing socioeconomic status data, we used median incomes from household zip codes, which may be inaccurate. Similarly, some patients did not fully report disease and belief perceptions. However, we performed sensitivity analysis of the multivariable modeling to assess the impact of missing data by comparing imputing missing data to excluding missing data and found that the results of the models were analogous. The results were robust whether we analyzed only responders, simple imputation, or multiple imputation methods. Third, we did not ask about stroke, which is more common in African American patients and may have influenced overall concern among this group. Finally, patients' trust in their clinicians may be overestimated because these surveys were deployed in the clinic setting for study participants who were already being seen by their clinician.

Conclusions

Racial differences persist in statin use among adults surveyed in community practice. African American adults were less likely to be treated with any statin or guideline-recommended statin intensity than white adults, which may contribute to higher LDL-C levels among African American patients. The reasons underlying racial differences in statin therapy are complex, with African American patients differing from white patients in their risk perception, trust in clini-

cians, and beliefs about efficacy and safety of statins. Future interventions must consider this complexity while being driven by identified patient perceptions, attitudes, and concerns. While improving racial disparities may help reduce the burden of ASCVD in African American patients, most African American and white patients were not receiving guideline-appropriate statin therapy. Greater emphasis on following national guidelines when treating both African American patients and white patients may improve care and outcomes for all patients.

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Study concept and design: Nanna, Navar, Goldberg, Robinson, Virani, Wang.
Acquisition, analysis, or interpretation of data: Nanna, Navar, Xiang, Robinson, Roger, Wilson, Wang, Peterson.
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Statistical analysis: Nanna, Xiang, Peterson.
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Editor's Note

Addressing Cardiovascular Disease Disparities—Are We Getting Closer to the Truth?

Clyde W. Yancy, MD, MSc

Getting to the root cause of differing health outcomes as a function of race/ethnicity has been a complex journey of explorations of inherent differences in demographics, comorbidities, and fundamental biology. Where differences in health outcomes persist after accounting for plausible causes, the presence of disparate care is acknowledged. When discovered, disparate care is a disquieting phenomenon that requires our attention and provokes changes in behavior.

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In the pages of *JAMA Cardiology*, we have continued to highlight racial differences in cardiovascular medicine not only because differences exist—such is well known—but because well-done contemporary research argues that the differences may be narrowing and in certain situations are nil, which would more precisely reflect global variations in care not specifically limited to race (and/or ethnicity).

Nanna et al[1] add to this narrative in this issue of *JAMA Cardiology*. In the Patient and Provider Assessment of Lipid Management registry, which assesses patient and provider perceptions about statin therapy, the differences in statin use as a function of race in guideline-prompted care for primary and secondary prevention were eliminated after accounting for clinical characteristics and differences in perceptions and beliefs. The presence of mistrust and (in some cases) misinformation contributed to differences in statin use. In this study, clinician characteristics are limited to cardiologist vs noncardiologist and the clinicians' choice of referent atherosclerotic cardiovascular disease guideline directives, but these characteristics mattered as well. Insight regarding clinician decision making (ie, bias) may have yielded even more insight.

Were these additional data addressing perceptions, beliefs, and clinician characteristics unavailable, this would have been yet another article declaring the presence of an unacceptable health care disparity. Instead, this study gets us closer to the truth and to actionable directions. Consistent clinical decision making, managing trust, and emphasizing patient education regardless of the patient cohort should be our unyielding clinical priorities.

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