Ethnic Differences in Achievement of Cholesterol Treatment Goals

Results from the National Cholesterol Education Program Evaluation Project Utilizing Novel E-Technology II

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BACKGROUND: African Americans (AA) have the highest coronary heart disease mortality rate of any ethnic group in the United States. Data from the National Cholesterol Education Program Evaluation Project Utilizing Novel E-Technology (NEPTUNE) II survey were used to assess ethnic differences in low-density lipoprotein cholesterol (LDL-C) goal achievement.

METHODS: NEPTUNE II surveyed patients with treated dyslipidemia to assess achievement of treatment goals established by the Adult Treatment Panel III of the National Cholesterol Education Program. United States physicians working in primary care or relevant subspecialties enrolled 10 to 20 consecutive patients (May to September 2003), and patient data were recorded in Personal Digital Assistants and uploaded to a central database via the internet.

RESULTS: Among 4,885 patients receiving treatment for dyslipidemia, 79.7% were non-Hispanic white (NHW) and 8.4% were AA. Non-Hispanic white and AA patients had significantly different frequencies of treatment success, with 69.0% and 53.7%, respectively, having achieved their LDL-C goal ($P < .001$). African-American patients were more likely to be in the highest risk category, and less likely to be using lipid drug therapy, taking high-efficacy statins, and receiving care from a subspecialist, but the difference in goal achievement remained significant ($P < .001$) after adjustment for these and other predictors of treatment success.

CONCLUSIONS: The frequency of treatment success in dyslipidemia management was significantly lower in AA than NHW patients. Additional research is needed to elucidate reasons for this disparity and to evaluate strategies for improving goal achievement among AA patients receiving therapy for dyslipidemia.

KEY WORDS: National Cholesterol Education Program guidelines; ethnicity; lipid treatment.

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African Americans (AA) have the highest coronary heart disease (CHD) mortality rate of any ethnic group in the United States.¹⁻⁴ The predictive values of traditional CHD risk factors are similar in non-Hispanic whites (NHWs) and AA.^{5,6} Therefore, the higher rates of CHD incidence and mortality among AA appear to be secondary to greater prevalence of certain risk factors such as hypertension, diabetes mellitus, and sedentary lifestyles, and to suboptimal risk factor control.⁷

In the general population, the distribution of low-density lipoprotein cholesterol (LDL-C) values, in the absence of treat-

ment, between AA and NHW men and women in the United States is not strikingly different.⁷ However, the results of the Lipid Treatment Assessment Program, a national survey of dyslipidemia management completed in 1997, showed that treated AA patients were significantly less likely than their NHW counterparts to achieve National Cholesterol Education Program (NCEP) Adult Treatment Panel II LDL-C treatment goals.⁸ Overall, 29% of AA patients achieved their LDL-C goal as compared with 39% of NHW patients.⁸ Because serum lipid responses to lifestyle modifications and drug therapies are generally similar in AA and NHW subjects,⁹⁻¹² the lower frequency of goal achievement among treated AA patients suggests less aggressive management by treating physicians, suboptimal compliance by patients, or some combination of these factors.

The present investigation evaluated LDL-C treatment goal achievement and its determinants among treated AA and NHW patients who participated in the NCEP Evaluation Project Utilizing Novel E-technology (NEPTUNE) II, a national survey of dyslipidemia management for which data were collected between May and September 2003.

DESIGN AND METHODS

The protocol was approved by 1 central Institutional Review Board (IRB), Schulman Associates IRB Inc. (Cincinnati, OH) prior to patient recruitment. A list of 37,234 physicians [obtained with permission from IMS Health (Westport, CT)] was generated, representing the top 26% of prescribers of 3-hydroxy-3-methylglutaryl coenzyme A (HMG CoA) reductase inhibitors (statins) in 2002. These physicians were responsible for ~ 55% of all prescriptions for lipid-altering drugs written that year. From this list, a sample of 18,286 physicians (13,555 primary care and 4,731 subspecialists) was randomly selected after stratification by region and specialty. The country was divided into 8 regions and physicians were first classified as primary care (family practice, general practice, and internal medicine) or subspecialist (cardiology and endocrinology) and then invited to participate in the study. Of these, 1,441 (77% primary care, 23% subspecialists) expressed interest, and 401 (83% primary care, 17% subspecialists) completed investigator training and obtained IRB approval.

Eligibility for physician investigators was based on: (1) ability to upload data to the central database by the internet, (2) ability to use the designated central IRB, and (3) availability to attend an investigator meeting for training purposes. The main reason for lack of participation among those who ex-

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pressed interest was inability to attend one of the 8 regional investigator meetings.

Physicians were asked to enroll 10 consecutive patients who were undergoing treatment for dyslipidemia. Subsequently, because fewer investigators had been recruited than the 500 originally projected, a randomly selected subset of 158 physicians was asked to enroll an additional 10 consecutive patients in order to insure an adequate sample for analysis.

Patient Enrollment

All patients were recruited from the existing practices of participating physicians during a regularly scheduled visit. Patients were selected according to the following criteria: (1) men and women 20 to 75 years of age with dyslipidemia, (2) treatment with diet and/or drug therapy (stable dose) for at least 3 months, and (3) availability of a recent (within 3 months) fasting lipoprotein profile that, in the physician's judgment, was representative of the patient's current status. Patients were excluded for any of the following: a recent history (within the past 3 months) of major trauma, surgery requiring anesthesia, or myocardial infarction; acute infection within the past month requiring antibiotic therapy; a recent (within the past month) or sudden change in their usual diet; women who were pregnant, lactating, or had been pregnant within the previous 6 months; and any secondary cause of dyslipidemia or other condition the physician believed would interfere with evaluation of the patient.

Data Collection

After signing an informed consent form, patients provided a medical history to study personnel, which was entered into a hand-held, personal digital assistant (PDA, Palm Tungsten T; Palm Inc., Milpitas, CA) using a NEPTUNE II data collection program (developed for use in this survey). Specific training on how to ascertain risk factor variables based on the NCEP Third Adult Treatment Panel (ATP III) definitions was provided to all study physicians at regional training meetings. Additional data for CHD risk stratification and assessment of current lipid management were collected at the visit and/or from the patient's chart.

Low-density lipoprotein cholesterol treatment goals were determined for each patient based on the NCEP ATP III definitions: <4.14 mmol/L (160 mg/dL) for patients with 0 to 1 risk factor in the absence of CHD or risk equivalents, <3.37 mmol/L (130 mg/dL) for patients with ≥ 2 risk factors in the absence of CHD or risk equivalents, and <2.59 mmol/L (100 mg/dL) for patients with CHD or CHD risk equivalents (CHD RE). Major CHD risk factors were defined according to the ATP III guidelines: cigarette smoking; hypertension (blood pressure $\geq 140/90$ mm Hg or on antihypertensive medication); family history of premature CHD; age (men ≥ 45 years, women ≥ 55 years); and low high-density lipoprotein cholesterol (HDL-C) (<1.04 mmol/L [40 mg/dL]). HDL-C ≥ 1.55 mmol/L (60 mg/dL) was counted as a "negative" risk factor.

One LDL-C measurement was used to determine whether a patient's LDL-C treatment goal was achieved. This level was assessed either at the clinic visit when the patient's other CHD risk factor information was collected (immediately prior to or up to 2 weeks afterward), or at a previous visit that occurred within 3 months of that clinic visit.

Statistical Analyses

SAS[®] version 8.2 (SAS Institute, Cary, NC) was used for all analyses. Means and standard deviations are used to describe continuous variables. Frequency counts and percentages are presented for categorical data. *P*-values $\leq .05$ were used to designate statistical significance.

Pearson's χ^2 test was used to assess differences between AA and NHW patients in the prevalence of risk factors and frequencies of goal achievement for each risk category and overall. Two-way analysis of variance (ethnicity and risk category) was used to assess differences for continuous variables and *t*-tests were used to compare values within risk categories.

Multivariate logistic regression was used to produce adjusted odds ratios and 95% confidence intervals for treatment success in AA versus NHW patients. Models included terms for risk category, ethnicity (AA vs NHW [referent]) and other predictors of treatment success. Interaction terms were included in the initial models to investigate whether other predictors modified the relationship between ethnicity and goal achievement. Where no interaction was present at the 5% level of significance, the interaction term was dropped from the model.

RESULTS

Investigator Characteristics

Investigators (*n*=401) were eligible to recruit patients after having received IRB approval, of which 376 (94%) provided evaluable data. Forty-two percent of the investigators were in general or family practice, 40% in internal medicine, 15% were in cardiology, and 2% in endocrinology. Investigators were primarily male (90%), and most were board certified (90%). Nearly all practices were office based (99%), and the average number of patients seen per week was 129. The mean investigator age was 49 years, and the average number of years in practice was 18. There were no significant differences in age, gender, specialty, and familiarity with the PDA, board certification, years practicing, or the number of patients seen per week between the physicians who recruited additional patients and those who did not (data not shown).

Patient Characteristics

A total of 4,885 patients were evaluated. The present analysis is limited to 4,301 who were NHW (*n*=3,893) or AA (*n*=408). The numbers in other ethnic groups were too small to allow meaningful analysis. Patients were classified according to NCEP ATP III risk category. The distribution of patients across risk factor categories differed according to ethnicity (Table 1). African-American patients were overrepresented in the CHD+CHD RE category (54.6% NHW vs 62.3% AA, *P*=.003) and underrepresented in the 2+ risk factor category (28.3% NHW vs 21.1% AA, *P*=.002).

Values for age, body mass index (BMI), and fasting lipid parameters by ethnicity and risk category are shown in Table 1. The mean age was significantly lower in AA patients overall and in the 0 to 1 risk factor and CHD+CHD RE categories, while BMI among AA patients was significantly higher in all risk categories. Total cholesterol and LDL-C concentrations were higher among AA patients overall, and differences were most pronounced in those with CHD+CHD RE. In contrast, AA

Table 1. Characteristics of Patients According to Ethnicity and Risk Category

	Ethnicity	0 to 1 Risk Factor	2+ Risk Factors	CHD+CHD RE	Total
Number of patients (%)	NHW	668 (17.2)	1,100 (28.3)	2,125 (54.6)	3,893 (100.0)
	AA	68 (16.7)	86 (21.1)	254 (62.3)	408 (100.0)
	P-value*	.80	.002	.003	.04
Mean (standard deviation) Age (y)	NHW	54.8 (11.5)	58.7 (9.3)	61.8 (9.4)	59.7 (10.1)
	AA	51.8 (10.9)	57.5 (9.9)	58.6 (9.7)	57.3 (10.2)
	P-value†	.04	.24	<.001	<.001
Body mass index (kg/m ²)	NHW	29.0 (5.7)	29.9 (5.3)	31.5 (6.7)	30.6 (6.2)
	AA	31.3 (7.2)	32.4 (7.2)	33.0 (6.8)	32.6 (7.0)
	P-value†	.002	<.001	<.001	<.001
Total cholesterol (mmol/L)	NHW	5.3 (1.0)	4.9 (0.9)	4.6 (1.0)	4.8 (1.0)
	AA	5.3 (1.0)	5.1 (0.9)	4.8 (1.1)	4.9 (1.0)
	P-value†	.80	.12	<.001	.02
LDL-C (mmol/L)	NHW	3.0 (0.8)	2.8 (0.8)	2.5 (0.8)	2.7 (0.8)
	AA	3.1 (1.0)	3.1 (0.8)	2.9 (0.9)	3.0 (0.9)
	P-value†	.48	.002	<.001	<.001
HDL-C (mmol/L)	NHW	1.5 (0.4)	1.3 (0.3)	1.2 (0.4)	1.3 (0.4)
	AA	1.6 (0.5)	1.4 (0.3)	1.3 (0.3)	1.4 (0.4)
	P-value†	.06	.003	<.001	<.001
Triglycerides (mmol/L)	NHW	1.7 (1.1)	1.9 (1.1)	2.0 (1.6)	1.9 (1.4)
	AA	1.3 (0.8)	1.4 (0.9)	1.5 (0.9)	1.4 (0.9)
	P-value†	.01	<.001	<.001	<.001

*The P-value for the "Total" column obtained from a $3 \times 2 \chi^2$ test. P-values for each risk category obtained from $2 \times 2 \chi^2$ tests.

†P-values for risk categories derived from analysis of variance models data within each risk category. P-values in the "Total" column are for the ethnicity term in models containing terms for ethnicity, risk category and, where significant, ethnicity by risk category interaction. The risk category term showed statistical significance with $P < .01$ in all models.

CHD RE, coronary heart disease risk equivalents; NHW, non-Hispanic white; AA, African American.

patients had more favorable mean values for HDL-C (higher) and triglycerides (lower).

Prevalence of Major CHD Risk Factors

The distribution of major CHD risk factors according to ethnicity and risk category is shown in Table 2. African-American

patients had a lower overall prevalence of age ≥ 45 (men) or ≥ 55 (women) years and current smoking, although the difference for smoking reached statistical significance only in the CHD+CHD RE category. Hypertension was markedly more common among AAs in all risk categories. A family history of premature CHD was lower in AA patients overall, although this difference appeared to be mainly attributable to a lower

Table 2. Distribution of Major Coronary Heart Disease Risk Factors According to Ethnicity and Risk Category

	Ethnicity	Prevalence (%)			
		0 to 1 Risk Factor	2+ Risk Factors	CHD+CHD RE	Total
Age ≥ 45 (males) or ≥ 55 (females)	NHW	54.6	85.7	87.8	81.5
	AA	33.8	75.6	74.0	67.6
	P-value	.001	.01	<.001	<.001
Current smoker	NHW	6.0	17.1	17.5	15.4
	AA	4.4	14.0	12.2	11.3
	P-value	.60	.45	.04	.03
Hypertension	NHW	25.1	69.5	76.7	65.8
	AA	51.5	94.2	83.5	80.4
	P-value	<.001	<.001	.01	<.001
Family history*	NHW	15.0	53.0	50.7	45.2
	AA	10.3	52.3	35.0	34.6
	P-value	.30	.90	<.001	<.001
Low HDL-C (< 1.04 mmol/L)	NHW	3.6	32.5	35.2	29.0
	AA	1.5	14.0	22.8	17.4
	P-value	.36	<.001	<.001	<.001
High HDL-C (≥ 1.55 mmol/L)†	NHW	40.4	7.6	9.7	14.4
	AA	45.6	14.0	14.6	19.6
	P-value	.41	.04	.02	.005
≥ 3 Major risk factors	NHW	0	42.6	53.6	41.3
	AA	0	33.7	35.4	29.2
	P-value	–	0.11	<.001	<.001

*Coronary heart disease in male first-degree relative < 55 years or female first-degree relative < 65 years.

†High HDL-C is a negative risk factor.

CHD RE, coronary heart disease risk equivalents; NHW, non-Hispanic white; AA, African American.

FIGURE 1. National Cholesterol Education Program Adult Treatment Panel III low-density lipoprotein cholesterol goal achievement by risk category in non-Hispanic white (white bars) and African-American patients (black bars). CHD RE, coronary heart disease risk equivalents.

prevalence in the CHD+CHD RE group. Consistent with the higher mean values for HDL-C, the prevalence of HDL-C < 1.04 mmol/L was lower, and that of HDL-C ≥ 1.55 mmol/L was higher among AA patients overall and in the 2+ risk factor and CHD+CHD RE categories. The presence of 3 or more major CHD risk factors was more common among NHW than AA patients overall and in the CHD+CHD RE category (both $P < .001$).

Achievement of LDL-C Treatment Goals

Frequencies of ATP III LDL-C treatment goal achievement according to ethnicity and risk category are shown in Figure 1. African-American patients were significantly less likely to have achieved their treatment goal overall and within each risk category.

Other Predictors of LDL-C Goal Achievement

A previous analysis of the full NEPTUNE II dataset identified a number of predictors of treatment success.¹³ In these analyses, female gender, obesity, hypertriglyceridemia, and diabetes mellitus were associated with a lower likelihood of LDL-C treatment success in at least 1 risk category. Physician-judged compliance with diet therapy, use of a lipid-altering drug, use of a high-efficacy statin, and treatment by a subspecialist were associated with greater likelihood of treatment success. The prevalence of each of these factors according to ethnicity and risk category is shown in Table 3.

African-American patients were more likely to be female and obese. Despite lower mean triglycerides, the prevalence of hypertriglyceridemia (≥ 2.26 mmol/L) was higher among AA than NHW patients. Diabetes mellitus was also more common among AA patients. Physician-judged dietary compliance did not differ between AA and NHW patients. However, use of lipid drug therapy, use of high-efficacy statins (atorvastatin and

Table 3. Prevalence (%) of Selected Predictors of Low-Density Lipoprotein Cholesterol Goal Achievement According to Ethnicity and Risk Category

Ethnicity		Prevalence (%)			
		0 to 1 Risk Factor	2+ Risk Factors	CHD+CHD RE	Total
Female gender	NHW	57.8	43.9	35.8	41.8
	AA	73.5	57.0	49.2	54.9
	P-value*	.01	.02	<.001	<.001
Body mass index ≥ 30 kg/m ²	NHW	34.9	43.6	53.4	47.4
	AA	44.1	54.7	63.8	58.6
	P-value*	.13	.05	.002	<.001
Triglycerides ≥ 2.26 mmol/L	NHW	19.2	26.8	28.0	26.1
	AA	13.2	8.1	14.2	12.7
	P-value*	.23	<.001	<.001	<.001
Diabetes mellitus	NHW	0	0	50.9	27.8
	AA	0	0	75.6	47.1
	P-value*	—	—	<.001	<.001
Receipt of diet recommendations	NHW	79.3	81.5	81.5	81.1
	AA	86.8	80.2	79.9	81.1
	P-value*	.15	.76	.54	.99
Compliant with diet therapy [†]	NHW	69.2	72.4	67.8	69.3
	AA	72.1	76.7	68.1	70.6
	P-value*	.62	.38	.92	.60
Lipid drug therapy	NHW	75.7	86.4	92.2	87.7
	AA	70.6	87.2	86.6	84.1
	P-value*	.35	.83	.002	.03
High-efficacy statin therapy [‡]	NHW	54.8	62.1	67.3	63.7
	AA	45.6	54.7	62.2	57.8
	P-value*	.21	.02	.14	.007
Treatment by a subspecialist	NHW	5.1	8.3	25.7	17.3
	AA	1.5	5.8	9.1	7.1
	P-value*	.18	.43	<.001	<.001

*P-values for risk categories derived from logistic regression models for each risk category. P-values in the "Total" column are for the ethnicity term in models containing terms for ethnicity, risk category and, where significant, ethnicity by risk category interaction.

[†]Received diet instruction and compliant according to physician judgment.

[‡]Atorvastatin and simvastatin (rosuvastatin was not yet cleared for marketing at the time this survey was completed) were operationally defined as high-efficacy statins. Lovastatin, fluvastatin and pravastatin are considered lower-efficacy statins. CHD RE, coronary heart disease risk equivalents; NHW, non-Hispanic white; AA, African American.

Table 4. Adjusted Odds Ratios for Achievement of Low-Density Lipoprotein Cholesterol Treatment Goals in African Americans Relative to Non-Hispanic White Patients

Model Adjusted for Risk Category Plus Each of the Following Variables	Odds Ratio (95% Confidence Interval) for LDL-C Goal Achievement in African American vs. Non-Hispanic White (Referent) Patients	P-Value for Ethnicity
No additional factors	0.53 (0.42, 0.66)	<.001
Age (male ≥ 45 y, female ≥ 55 y)	0.56 (0.45, 0.70)	<.001
Gender	0.55 (0.44, 0.68)	<.001
Smoking status (current vs nonsmoker)	0.52 (0.42, 0.64)	<.001
Family history of premature CHD	0.53 (0.42, 0.65)	<.001
Hypertension	0.51 (0.41, 0.64)	<.001
HDL-C < 1.04 mmol/L	0.53 (0.43, 0.66)	<.001
HDL-C ≥ 1.55 mmol/L	0.53 (0.42, 0.65)	<.001
Triglycerides ≥ 2.26 mmol/L	0.50 (0.40, 0.62)	<.001
Obesity (body mass index ≥ 30 kg/m ²)	0.53 (0.43, 0.66)	<.001
Diabetes mellitus	0.54 (0.42, 0.71)	<.001
Drug therapy vs. no drug therapy	0.54 (0.43, 0.68)	<.001
Statin monotherapy vs. other monotherapy	0.50 (0.39, 0.65)	<.001
Statin monotherapy vs. no drug	0.50 (0.39, 0.63)	<.001
Statin monotherapy vs. combination therapy	0.49 (0.38, 0.62)	<.001
High efficacy statin vs. lower efficacy statin*	0.49 (0.38, 0.63)	<.001
Receipt of diet recommendations	0.53 (0.42, 0.66)	<.001
Primary care vs. subspecialties	0.57 (0.45, 0.70)	<.001
Multivariate model†	0.48 (0.39, 0.60)	<.001

*High efficacy statins included atorvastatin and simvastatin (rosuvastatin was not yet cleared for marketing at the time this survey was completed). Lower efficacy statins included lovastatin, pravastatin, and fluvastatin.

†The odds ratio from the multivariate model is adjusted for age category, gender, smoking status, family history, hypertension, high-density lipoprotein cholesterol category, hypertriglyceridemia, obesity, use of lipid drug therapy, receipt of diet recommendations and physician specialty. The -2 log likelihood of the fully adjusted model was 5,215.4 without ethnicity and 5,174.1 with ethnicity included.

CHD RE, coronary heart disease risk equivalents; HDL-C, high-density lipoprotein cholesterol.

simvastatin), and treatment by a subspecialist were all significantly less frequent overall and in at least 1 risk category among AA as compared with NHW patients.

Subgroup analyses were completed to assess whether ethnic disparities were present among patients under subspecialty care and receiving high-efficacy statins. The sample of AA patients treated by subspecialists was too small to subdivide according to high- versus low-efficacy statin use. Among all patients taking statins, the frequencies of goal achievement among AA patients were 56.5% and 56.3% for those treated by subspecialists and primary care physicians, respectively. The corresponding numbers among NHW patients were 73.5% and 72.5%, respectively. Notably, among those patients taking statins, no differences in goal achievement were observed according to physician specialty, but the effect of ethnicity was clearly apparent ($P < .001$).

Further subsetting was completed for subjects taking statins and treated by primary care physicians to assess the influence of high- versus lower-efficacy statin use on frequency

of goal achievement. Among those taking lower-efficacy statins, the LDL-C goal was achieved by 55.7% of AA patients and 65.4% of NHW patients (P for ethnicity = .094). For those taking high-efficacy statins, the corresponding frequencies were 56.5% and 74.4% for AA and NHW patients, respectively (P for ethnicity $< .001$). Thus, even among the subset of those treated with statins, and particularly high-efficacy statins, reduced frequencies of goal achievement were observed among AA patients relative to NHW patients.

Multivariate Analyses

Odds ratios and 95% confidence intervals for LDL-C goal achievement in AA compared with NHW patients are shown in Table 4. In the model that contained only risk category and ethnicity, the odds ratio was 0.53 (95% confidence interval 0.42, 0.66). Adjustment for other predictors of treatment success individually did not substantially alter the odds ratio. In a multivariate model generated by backward stepwise regression, the adjusted odds ratio was further reduced to 0.48 (0.39, 0.60), indicating that AA remained a highly significant inverse predictor of LDL-C goal achievement after adjustment for numerous potential confounders.

DISCUSSION

The NCEP ATP III treatment goals are based on a compelling body of evidence that supports the efficacy of interventions for dyslipidemia to reduce cardiovascular events and mortality.^{7,14} The results of the present survey are consistent with those of prior investigations that have shown lower frequencies of goal achievement in AA compared with NHW patients receiving treatment for dyslipidemia.^{8,15} Suboptimal control of dyslipidemia may therefore contribute to the higher rates of cardiovascular death and morbidity in AA patients.

The explanations for the disparity in goal achievement between AA and NHW patients are not immediately apparent. All participants were receiving lipid management by their physicians, so the results cannot be explained by differences in diagnosis or access to health care. AA patients were less likely than NHW patients to be taking lipid drugs and to be using high-efficacy statins. They also received treatment from subspecialists less frequently. Thus, less aggressive management appeared to contribute to lower rates of goal achievement. Nevertheless, a highly significant effect of AA ethnicity was present after adjustment for these differences. Similarly, adjustment for other characteristics that predicted treatment success in multivariate analyses did not diminish the strength of the inverse association between AA ethnicity and goal achievement.

Data from clinical trials of lipid-altering drug therapies suggest that AA and NHW subjects exhibit similar physiological responses.⁹⁻¹² Thus, reduced responsiveness to available therapies is an unlikely explanation for the lower frequency of treatment success. It is more likely that differential compliance contributes to this difference. Noncompliance with statin therapy has previously been identified as a major factor explaining failure to achieve LDL-C treatment goals.¹⁶ In a study that showed significant ethnic disparities in adherence to 3 widely prescribed cardiac medications (angiotensin-converting enzyme inhibitors, calcium channel blockers, and statins), 74.1% of NHW patients were at least 80% compliant with statins, compared with only 59.9% of AA patients ($P < 0.001$).¹⁷

Thus, ethnic differences in compliance may be the primary explanation for the observed differences in goal achievement between AA and NHW patients, as has been suggested in other studies.¹⁵ This issue could not be directly addressed with data from the current survey. However, our findings from analyses of the subset of those treated with statins, particularly high-efficacy statins, further support the view that suboptimal compliance with physician recommendations may have contributed to the lower frequencies of LDL-C goal achievement among AA patients.

It is likely that the explanation for the lower frequencies of treatment goal achievement among AA patients for lipids and other therapies is multifactorial. In prior surveys, socioeconomic status,¹⁸ education level,⁸ and type of medical and prescription drug coverage¹⁹ predicted treatment success. Unfortunately, data on these variables were not collected in NEPTUNE II, so their potential relationships with goal achievement could not be assessed.

Several differences were present in the CHD risk factor profiles of NHW and AA patients. African-American patients had higher frequencies of obesity, diabetes mellitus, and hypertension. African-American patients were less likely to be current smokers or to have low HDL-C concentrations, particularly among those with CHD+CHD RE. Despite lower mean levels of triglycerides in AA participants, the prevalence of hypertriglyceridemia was increased, which may be related to the higher frequencies of obesity and diabetes among AA patients, as both conditions are associated with hypertriglyceridemia.¹⁴ Data from NEPTUNE II are in general agreement with those from U.S. population-based surveys regarding the relative prevalence of CHD and risk markers in AA compared with NHW.

It should be noted that the generalizability of the findings from NEPTUNE II remains uncertain. All participants in NEPTUNE II were receiving active lipid management by a physician. Therefore, the results of the present analysis may be biased toward overestimation of the frequency of goal achievement in clinical practice and do not address the issues of undiagnosed and untreated dyslipidemia in the community. The physician sample was drawn from high prescribers of lipid-altering drugs and the requirement that investigators attend a day-long training session likely resulted in oversampling of "enthusiasts" who may manage lipids more aggressively than average. This would tend to produce overestimates of the frequencies of treatment success in both AA and NHW patients. In addition, the percentage of primary care physicians invited who participated in NEPTUNE II was larger (2% vs 1%) than that for subspecialists. Therefore, caution is warranted in the interpretation of comparisons for goal achievement between patients of primary care and subspecialty providers.

CONCLUSIONS

African-American ethnicity was strongly inversely associated with LDL-C goal achievement in this survey. Although AA patients were less likely to be under the care of a subspecialist and showed lower frequencies of lipid drug therapy and high-efficacy statin use, adjustment for these variables and other predictors of treatment success did not attenuate the strong relationship between AA ethnicity and reduced treatment success. Additional research is warranted to evaluate potential explanations for this disparity, and to evaluate strategies for

improving goal achievement among AA patients receiving therapy for dyslipidemia.

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