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## Assessment of Antihyperlipidemic Therapy in US Patients With Coronary Heart Disease

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**Context:** Knowledge of the trends and possible differences in the use of antihyperlipidemic medications in US patients with coronary heart disease (CHD) is vital in order to stimulate a positive change in the health of society.

**Objective:** To assess, in the ambulatory setting, the frequency of antihyperlipidemic medication use in US patients with CHD.

**Design:** Retrospective, national, cross-sectional study using data from the 2004 National Ambulatory Medical Care Survey (NAMCS).

**Methods:** Ambulatory medical visits surveyed by the 2004 NAMCS associated with select ICD-9-CM CHD-related diagnoses were included. Use of antihyperlipidemic medications was captured by searching the database for drug names. Demographics assessed for association with antihyperlipidemic therapy included region of the country in which care was provided; patient age group, sex, ethnicity, and race; physician medical degree; and payment type. Statistical analyses used sample weights to determine national estimates.

**Results:** A weighted national estimate of nearly 16 million ambulatory medical care visits was made in the United States in 2004 of patients with one of the selected CHD diagnoses. Use of any form of lipid-lowering therapy was associated with 40.4% of the CHD patients seeking ambulatory-based medical care in 2004. Non-Hispanic/Latino patients with

CHD were more than 4.5 times more likely to be receiving lipid-lowering therapy (odds ratio [OR], 4.59; 95% CI, 1.28-16.37). Patients with CHD who had Medicare as their form of payment for healthcare were less likely to be receiving lipid-lowering therapy (OR, 0.50; 95% CI, 0.28-0.91), as were those receiving medical care in the South region of the United States (OR, 0.36; 95% CI, 0.14-0.89). Similar differences in medication use were noted with the statin medication class.

**Conclusion:** In 2004, less than half of the ambulatory medical visits by US patients with CHD were associated with antihyperlipidemic treatment, and most of these patients were treated with one medication (a statin). A CHD patient's reported ethnicity, primary method of payment, and area of the United States in which care was received all demonstrated differences. On the basis of the growing evidence-based medical literature, it is imperative to continue this research to assess changes in future trends and to work with healthcare and policy advocates to strike a positive change for all patients.

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Coronary heart disease (CHD) is a major cause of morbidity and mortality in the United States, accounting for up to 40% of all deaths and approximately 6 million hospitalizations annually. It has been estimated that every 25 seconds an American has a CHD-related event, and every minute an American dies of a CHD-related event.<sup>1</sup> It is known that hyperlipidemia is a major yet modifiable risk factor for the development of CHD. Additionally, the 3-hydroxy-3-methyl-glutaryl coenzyme A (HMG-CoA) reductase inhibitors, also known as statins, are a frequently used therapy for hyperlipidemia and its associated endpoints of CHD.<sup>2,3</sup> Statin medications have been shown to reduce cholesterol levels and C-reactive protein levels, as well as cardiovascular-related mortality and morbidity.<sup>4-6</sup> However, other antihyperlipidemic therapies are also currently available, and whether they are similarly or equitably used in patients with existing CHD is still in question.<sup>2-6</sup>

Previous studies have shown that a variety of patient characteristics including race, payment source, and age influence whether a patient with CHD is treated with a lipid-lowering therapy. Mann and colleagues,<sup>7</sup> using data from the 1999-2000, the 2001-2002, and the 2003-2004 National Health

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## ORIGINAL CONTRIBUTION

and Nutrition Examination Surveys, found that among subjects with an elevated low-density lipoprotein-cholesterol (LDL-C) level, non-Hispanic blacks were 39% less likely than non-Hispanic whites to be treated with a statin medication. Additionally, persons with private insurance or government health insurance were more likely than those without insurance to receive therapy with a statin medication. Lastly, persons younger than 40 years were less likely than those aged 75 years or older to receive a statin medication despite having a high LDL-C level.<sup>7</sup>

In a similar study, Ma and colleagues used data from the 1999-2002 study years of the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) to quantify the frequency with which statin therapy was prescribed and compared the frequency with an investigator-assigned CHD risk category.<sup>8</sup> Specifically, high risk was categorized by the investigators as either the presence of CHD, the existence of other atherosclerosis-related disease, or a diagnosis of diabetes mellitus. This study revealed that African American race and a younger patient age were associated with decreased odds of receiving therapy with a statin medication. Additionally, Ma et al<sup>8</sup> reported that female sex was also associated with lower odds of receiving a statin. This study evaluated the use of only statin therapy rather than all classes of antihyperlipidemic agents. Finally, other studies have revealed that African Americans and Mexican Americans were less likely than whites to report having undergone cholesterol screening and, if medication was indicated, were less likely to be taking a cholesterol-lowering medication or to reach the recommended therapeutic goals.<sup>9,10</sup>

While some studies have evaluated the use of lipid therapy in the setting of high cholesterol level and high CHD risk, we wanted to assess all classes of antihyperlipidemic therapy on a national, outpatient basis in patients known to have CHD. The primary purpose of this study was to evaluate, irrespective of lipid profile and on a national, outpatient basis, the frequency of antihyperlipidemic medication use in patients with existing CHD. Additionally, by using more current national data, we wanted to assess for possible differences in the use of all antihyperlipidemic therapies based on select patient-based and physician-based demographics.

### Methods

#### NAMCS

The present study analyzed ambulatory-based medical care visits in the United States by using data from the 2004 NAMCS. The NAMCS is a national, multistage, clustered sample survey of US office-based physician visits and is conducted annually by the National Center for Health Statistics (NCHS), a division of the Centers for Disease Control and Prevention (CDC). The survey samples ambulatory medical care visits to nonfederal, office-based physicians involved primarily with the provision of direct patient care (excluding the medical specialties of

pathology, anesthesiology, and radiology). Sampled ambulatory medical visits are weighted by the NCHS based on the multistage probabilities of visit selection to generate annual national estimates of the provision of ambulatory medical care in the United States. Additional detailed information concerning the specifics of the annual survey methods used by the NCHS for the NAMCS can be found on the NCHS Web site.<sup>11</sup>

This study was approved by the Institutional Review Board of Kansas City University of Medicine and Biosciences.

#### Study Population

The study population consisted of all US patients with one or more of the selected CHD-related diagnoses whose ambulatory-based medical care visits were included in the survey. Study patients were specifically identified by using the International Classification of Diseases, 9th revision, Clinical Modification<sup>12</sup> (ICD-9-CM) codes for the selected CHD-related diagnoses (Figure 1). Surrogate markers or risk-equivalent conditions were not selected for the current study.

#### Medications

Use of antihyperlipidemic therapy was revealed by searching each ambulatory visit record for individual medication names (both generic and trade names) for single-entity and combination products. Medication names were obtained from the current medication list and included any medications initiated at the time of the surveyed visit. These drug entries were then grouped into commonly used pharmacologic classifications (Figure 2). Because more than one antihyperlipidemic medication could be documented for an ambulatory medical care visit, the individual pharmacologic classifications were also combined into a single, dichotomous variable (any lipid-lowering treatment vs no lipid-lowering treatment) for all study patients. This became the primary variable of analysis in the present study. A secondary assessment involved the specific pharmacologic class of statins administered and allowed us to evaluate differences in the use of this group of medications in various patient demographics. This pharmacologic class was selected because of its high frequency of use in patients with

Description of Diagnosis	Diagnosis Code
Acute myocardial infarction	410.xx
Other acute or subacute forms of ischemic heart disease	411.xx
Previous myocardial infarction	412.xx
Angina pectoris	413.xx
Other forms of chronic ischemic heart diseases	414.xx
Atherosclerosis	440.xx
Atheroembolism (including cholesterol embolism)	445.xx

**Figure 1.** Selected ICD-9-CM medical diagnoses associated with coronary heart disease that were used to identify patients for the study.

#### ■ HMG-CoA Reductase Inhibitors

- Atorvastatin calcium
- Fluvastatin sodium
- Lovastatin
- Pravastatin sodium
- Rosuvastatin calcium
- Simvastatin

#### ■ Bile Acid Sequestrants

- Cholestyramine
- Colesevelam hydrochloride
- Colestipol hydrochloride

#### ■ Fibrin Acid Derivatives

- Fenofibrate
- Gemfibrozil

#### ■ Cholesterol Absorption Inhibitors

- Ezetimibe

#### ■ Niacin Derivatives

- Niacin
- Nicotinic acid

**Figure 2.** Pharmacologic classes and names of antihyperlipidemic medications used by study patients.

hyperlipidemia and CHD and for comparison with findings from previous research projects that also evaluated this class of medications.

### Demographics

The patient-based and physician-based characteristics selected for assessment were sex, age group (44 years or younger, 45-64 years, 65-74 years, and 75 years or older), race (white, black/African American, and other races including Asian, Native Hawaiian/other Pacific Islander, American Indian/Alaska Native, and those individuals indicating more than one race), ethnicity (Hispanic/Latino, non-Hispanic/non-Latino), payment source (private insurance, Medicare, Medicaid/State Children's Health Insurance Program, self-pay, and other payment sources including worker's compensation, no charge, and the NCHS-defined "other" payment source), geographic region of the country in which the surveyed medical care visit occurred (Northeast, Midwest, South, West), and the physician's medical degree (allopathic [MD], osteopathic [DO]). The physician's medical specialty was not evaluated, because we chose to evaluate patient visits associated with lipid-lowering therapy regardless of whether the therapy was previously initiated or prescribed at the time of the surveyed visit.

All variables containing an "other" category were generated, or added to, by combining those demographic strata with limited frequencies (fewer than 30 visits each), as recommended by the NCHS. The combining of one or more of the categories from the payment form and age group variables was necessary because of limited frequencies. Also, because not every ambulatory-based medical care visit by a study-selected patient included a corresponding lipid panel assessment at the time of the surveyed office visit, lipid status of the study population was not included in this study.

### Statistical Analysis

Descriptive statistical analysis, performed with both unweighted and weighted data, was performed for all variables. Initially, univariate analysis was performed on the primary outcome variable of treatment with antihyperlipidemic therapy (yes or no) and all demographic variables through use of the  $\chi^2$  test. Subsequently, sequential and systematic stratified univariate and multivariate logistic regression analyses of all independent variables were performed to assess for statistical significance. All variables and combinations of variables were assessed for confounding and interaction. Any variables found to be a confounder or to be involved in an interaction were included in the final logistic regression model. Weighted data were used for all statistical analyses, which allowed for the generation of national estimates. The unit of analysis for the NAMCS is the patient medical visit. Odds ratios (ORs) and 95% confidence intervals (CIs) were determined, and all tests for significance were two tailed with an a priori level of .05 ( $P < .05$ ). The Stata statistical software package (SE version 9.2; Stata, College Station, Texas) was used for all analyses.

### Results

#### Descriptive Statistics

**Study Population**—During 2004 in the United States, the NAMCS generated a weighted national estimate of 910,857,160 ambulatory-based medical care office visits (Table 1). From these surveyed visits, the NAMCS determined that CHD-related diagnoses were associated with a weighted national estimate of 15,761,682 visits. This latter population (ie, the 15,761,682 visits) was used as the study group in the present report (Table 2). Of the nearly 16 million ambulatory-based office visits associated with a CHD-related diagnosis, a minority (6,365,084 visits [40.4%]) were associated with one or more antihyperlipidemic medications. However, the converse of this descriptive statistic is that 9,396,598 (59.6%) ambulatory-medical-care visits by patients with a concurrent diagnosis of CHD were not associated with treatment with an antihyperlipidemic agent. Figure 3 shows the percentage of surveyed US ambulatory medical visits by patients with a CHD-related diagnosis who were being treated with either no or 1 to 3 antihyperlipidemic medications. No patients received 4 lipid-lowering medications. Of those CHD patients who were being

**Table 1**  
Select Information From the 2004 National Ambulatory Medical Care Survey

Survey Item	Result
Physicians randomly selected to participate, No.	3,000
Physicians randomly selected to participate, MD/DO ratio	2,770/230
Physicians deemed in scope for participation, No. (%)*	1,961 (65.4)
Physicians participating from in-scope group, No. (%)	1,372 (70.0)
Office visits captured by in-scope participating physicians, No.	25,286
Representative ambulatory-based medical care office visits in the United States, weighted No.	910,857,160

\*Physicians were deemed out of scope (ie, ineligible for survey participation) if one or more of the following applied: retired, no patients seen during the selected survey week, or employed in teaching, research, or administration and having no direct patient care responsibilities.

**Abbreviations:** DO, osteopathic physician; MD, allopathic physician.  
**Source:** US Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), National Center for Health Statistics. Ambulatory Health Care Data. <http://www.cdc.gov/nchs/ahcd.htm>. Accessed June 10, 2010.

treated with at least 1 antihyperlipidemic agent, the vast majority (5,245,032 visits [82.4%]) were being treated with only a single agent (most commonly a statin).

Descriptive statistical evaluation (Table 2) revealed that 62.9% of the CHD study population comprised men, the age group associated with the highest percentage of medical visits was in patients aged 75 years or older (41.1%), and the region of the country with the highest percentage of medical visits was the South (39.5%). Additionally, 87.1% of people in the study population were white, and 95.9% were non-Hispanic/Latino. The most frequent payment source for patients' medical care was Medicare (65.9%).

**Classes of Medication**—Figure 4 shows the weighted number of office visits by the CHD study population with respect to the classification of their antihyperlipidemic medications, if prescribed. The total cumulative percentage is greater than 100% because a small percentage of patients were receiving more than one antihyperlipidemic medication. Among the lipid-lowering agents, statins were the most commonly used class of medications; these accounted for 76.1% of all prescribed treatments and were used in a weighted total of 5,885,329 CHD patient visits. In nearly all of the patients who were receiving therapy with more than a single agent, therapy included an agent from the statin medication class. The second most frequently cited drug class was fibric acid derivatives (777,307 weighted CHD patient visits [10.0%]), closely fol-

**Table 2**  
Demographics of Patients With Coronary Heart Disease

Patient Demographic	Weighted No. (%)
<b>■ Sex</b>	
□ Women	5,841,688 (37.1)
□ Men	9,919,994 (62.9)
<b>■ Age, y</b>	
□ ≤44	516,429 (3.3)
□ 45-64	4,396,904 (27.9)
□ 65-74	4,363,834 (27.7)
□ ≥75	6,484,515 (41.1)
<b>■ Race</b>	
□ White	13,736,098 (87.1)
□ Black/African American	1,505,069 (9.6)
□ Other*	520,515 (3.3)
<b>■ Ethnicity</b>	
□ Hispanic/Latino	643,475 (4.1)
□ Non-Hispanic/Latino	15,118,207 (95.9)
<b>■ Payment Sources</b>	
□ Private insurance	4,416,391 (28.0)
□ Medicare	10,381,781 (65.9)
□ Other†	963,510 (6.1)
<b>■ Region</b>	
□ Northeast	2,403,971 (15.3)
□ Midwest	4,120,254 (26.1)
□ South	6,227,408 (39.5)
□ West	3,010,049 (19.1)
<b>■ Physician Degree</b>	
□ Allopathic (MD)	14,705,649 (93.3)
□ Osteopathic (DO)	1,056,033 (6.7)
<b>■ No. of Antihyperlipidemic Agents Cited per CHD Patient Visit</b>	
□ 0	9,396,598 (59.6)
□ 1	5,245,032 (33.3)
□ 2	853,730 (5.4)
□ 3	266,322 (1.7)
<b>■ Total</b>	<b>15,761,682 (100)</b>

\* Includes the categories Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, and those individuals indicating more than one race.

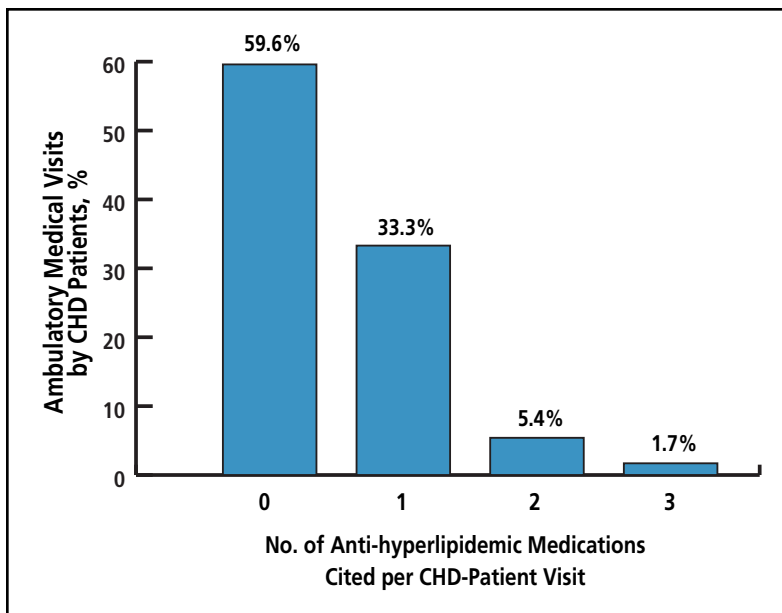
† Includes the categories Medicaid, worker's compensation, self-pay, no charge/charity, other, and unknown.

lowed by the cholesterol absorption inhibitor ezetimibe (555,686 weighted CHD patient visits [7.2%]) and niacin (485,648 weighted CHD patient visits [6.3%]).

**Multivariable Statistical Analyses**

**Antihyperlipidemic Agents**—Table 3 reports the multivariable analysis using the primary treatment variable (any lipid-lowering treatment vs no lipid-lowering treatment). While controlling for all other independent variables included in the





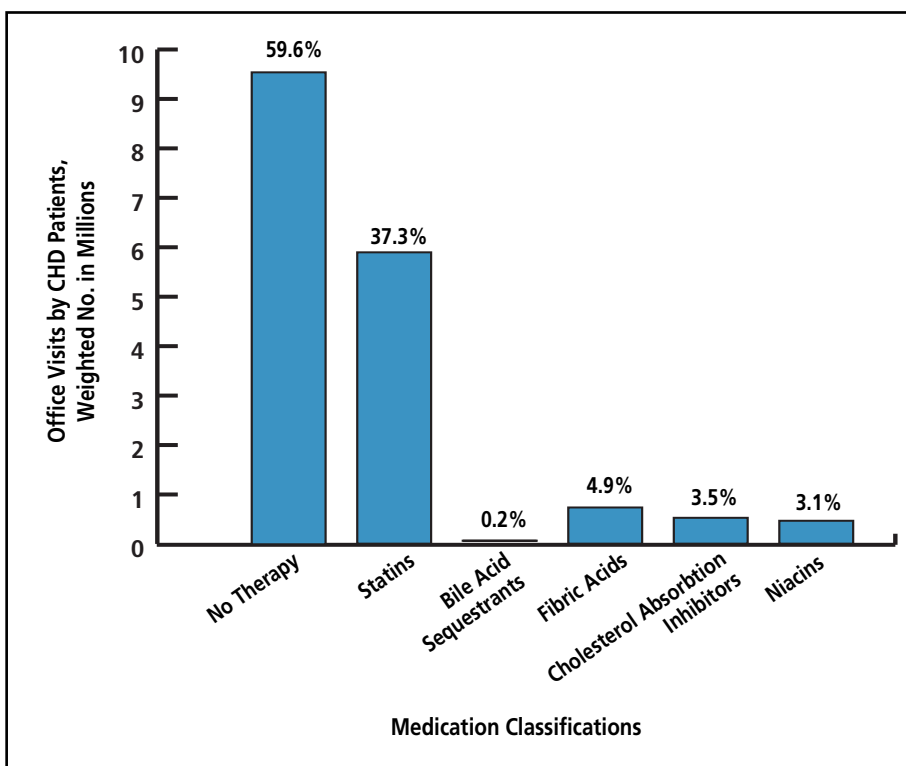
**Figure 3.** Percentage of surveyed US ambulatory medical visits by patients with a diagnosis related to coronary heart disease (CHD) that involved treatment with either no or 1 to 3 lipid-lowering medications.

model (see Table 3), we found that compared with CHD patients receiving ambulatory medical care in the Northeast region of the United States, CHD patients receiving care in the South were 64% less likely (OR, 0.36; 95% CI, 0.14-0.89;  $P=.028$ ) to be receiving antihyperlipidemic therapy. There was no statistically significant difference in the use of antihyperlipidemic therapy between the CHD patients in the Northeast region and those in the remaining two regions (Midwest and West) ( $P>.05$ ).

the other forms of payment combined, between CHD patients whose physician was an MD and those whose physician was a DO, between CHD patients of different races, between CHD patients in the various age groups, and between CHD male patients and female CHD patients ( $P>.05$ ).

### Statin Medication Class

We also evaluated the specific class of statin medication for differences in its use; this resulted in a few intriguing and statistically significant differences. Use of this medication class was considered acceptable due to the high frequency of its use in current medical practice. Patients who received a different form of antihyperlipidemic treatment were not similarly assessed because of the limited use of this treatment within these groups in the study. Table 4 displays the statistical analysis of the statin medication class-specific assessment.



**Figure 4.** Weighted number of office visits by study patients with coronary heart disease (CHD) with respect to the classification of their antihyperlipidemic medications, if prescribed. The percentage is also provided for each medication classification. The total cumulative percentage is greater than 100% because a small percentage of patients were receiving more than one antihyperlipidemic medication.

**Table 3**  
**Unadjusted and Adjusted Odds Ratios (ORs) for Nonstratified and Stratified Independent Variables Using Any Treatment as Dependent Variable\***

Patient Demographic	Unadjusted OR (95% CI)	P Value	Adjusted OR† (95% CI)	P Value
■ Sex	1.17 (0.67, 2.05)	.580	1.13 (0.64, 1.99)	.672
□ Women	Reference		Reference	
□ Men	1.17 (0.67, 2.05)	.580	1.13 (0.64, 1.99)	.672
■ Age, y	0.93 (0.75, 1.17)	.552	0.95 (0.76, 1.19)	.681
□ ≤44	Reference		Reference	
□ 45-64	0.86 (0.54, 1.37)	.528	0.70 (0.19, 2.60)	.594
□ 65-74	1.39 (0.77, 2.49)	.270	1.00 (0.24, 4.18)	.998
□ ≥75	0.81 (0.47, 1.38)	.428	0.68 (0.17, 2.67)	.579
■ Race	0.90 (0.46, 1.78)	.769	0.94 (0.47, 1.86)	.850
□ White	Reference		Reference	
□ Black/African American	0.55 (0.17, 1.74)	.303	0.57 (0.17, 1.92)	.360
□ Other‡	1.55 (0.30, 7.91)	.594	1.62 (0.32, 8.32)	.556
■ Ethnicity	4.21 (1.23, 14.39)	.023	4.59 (1.28, 16.37)	.020
□ Hispanic/Latino	Reference		Reference	
□ Non-Hispanic/Latino	4.21 (1.23, 14.39)	.023	4.59 (1.28, 16.37)	.020
■ Payment Source	0.84 (0.68, 1.03)	.091	0.84 (0.68, 1.03)	.092
□ Private insurance	Reference		Reference	
□ Medicare	0.70 (0.42, 1.15)	.156	0.50 (0.28, 0.91)	.023
□ Other§	0.53 (0.19, 1.47)	.219	0.33 (0.11, 1.01)	.052
■ Physician Degree	0.85 (0.33, 2.19)	.732	0.91 (0.36, 2.25)	.831
□ Allopathic (MD)	Reference		Reference	
□ Osteopathic (DO)	0.85 (0.33, 2.19)	.732	0.91 (0.36, 2.25)	.831
■ Region	0.98 (0.66, 1.45)	.913	1.02 (0.68, 1.53)	.935
□ Northeast	Reference		Reference	
□ Midwest	0.71 (0.36, 1.40)	.314	0.40 (0.16, 1.03)	.059
□ South	0.54 (0.28, 1.03)	.060	0.36 (0.14, 0.89)	.028
□ West	2.04 (0.85, 4.92)	.110	1.08 (0.36, 3.21)	.890

\* Logistic regression modeling with dichotomous-formatted variable for any treatment (yes/no) as the dependent variable.  
† Full model included all independent variables listed.  
‡ Includes the categories Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, and those individuals indicating more than one race.  
§ Includes the categories Medicaid, worker's compensation, self-pay, no charge/charity, other, and unknown.

While controlling for all other independent variables included in the model, we found that CHD patients who reported their ethnicity as non-Hispanic/Latino were 5.34 times more likely than those who reported their ethnicity as Hispanic/Latino to receive statin pharmacotherapy (OR, 5.34; 95% CI, 1.62-17.69;  $P=.007$ ). Compared with CHD patients with private medical insurance, CHD patients with Medicare coverage were 59% less likely to receive statin therapy (OR, 0.41; 95% CI, 0.23-0.72;  $P=.002$ ). There was no statistically significant difference in receipt of statin therapy between CHD patients with private medical insurance and those who used other methods of payment.

Finally, compared with those receiving care in the Northeast region of the United States, CHD patients receiving care in the Midwest region were 66% less likely to receive therapy

with a statin medication (OR, 0.34; 95% CI, 0.13-0.85;  $P=.022$ ), and those receiving care in the South were 69% less likely (OR, 0.31; 95% CI, 0.13-0.78;  $P=.013$ ). There was no statistically significant difference in findings between patients in the Northeast region and those in the West region and no significant differences in physician's medical degree, race, age group, or sex ( $P>.050$ ).

**Comment**

This national, retrospective, cross-sectional study enabled us to establish the frequency of use of various classes of antihyperlipidemic medications in US patients with existing CHD in 2004. We found that during 2004, irrespective of lipid status, only 40.4% of US CHD patients seeking ambulatory-based medical care were receiving lipid-lowering therapy. The

**Table 4**  
**Unadjusted and Adjusted Odds Ratios (ORs)**  
**for Nonstratified and Stratified Independent Variables Using Treatment**  
**With Statin Therapy as Dependent Variable\***

Patient Demographic	Unadjusted OR (95% CI)	P Value	Adjusted OR <sup>†</sup> (95% CI)	P Value
■ <b>Sex</b>	1.03 (0.57, 1.89)	.913	1.03 (0.56, 1.90)	.921
□ Female	Reference		Reference	
□ Male	1.03 (0.57, 1.89)	.913	1.03 (0.56, 1.90)	.921
■ <b>Age, y</b>	1.05 (0.82, 1.33)	.707	1.06 (0.84, 1.34)	.601
□ <44	Reference		Reference	
□ 45-64	1.27 (0.31, 5.22)	.741	1.50 (0.37, 6.10)	.566
□ 65-74	1.73 (0.39, 7.81)	.468	2.08 (0.49, 8.91)	.319
□ ≥75	1.35 (0.31, 5.81)	.685	1.57 (0.38, 6.55)	.529
■ <b>Race</b>	0.97 (0.49, 1.94)	.937	1.02 (0.51, 2.07)	.950
□ White	Reference		Reference	
□ Black/African American	0.59 (0.17, 2.01)	.397	0.61 (0.17, 2.11)	.426
□ Other <sup>‡</sup>	1.69 (0.33, 8.69)	.527	2.00 (0.38, 10.45)	.408
■ <b>Ethnicity</b>	5.22 (1.62, 16.85)	.006	5.34 (1.62, 17.69)	.007
□ Hispanic/Latino	Reference		Reference	
□ Non-Hispanic/Latino	5.22 (1.62, 16.85)	.006	5.34 (1.62, 17.69)	.007
■ <b>Payment Source</b>	0.86 (0.70, 1.05)	.146	0.84 (0.68, 1.05)	.126
□ Private insurance	Reference		Reference	
□ Medicare	0.60 (0.36, 1.02)	.059	0.41 (0.23, 0.72)	.002
□ Others <sup>§</sup>	0.43 (0.15, 1.25)	.120	0.34 (0.11, 1.04)	.058
■ <b>Physician Degree</b>	0.97 (0.37, 2.56)	.956	1.01 (0.40, 2.53)	.981
□ Allopathic (MD)	Reference		Reference	
□ Osteopathic (DO)	0.97 (0.37, 2.56)	.956	1.01 (0.40, 2.53)	.981
■ <b>Region</b>	0.94 (0.62, 1.42)	.760	0.97 (0.64, 1.48)	.888
□ Northeast	Reference		Reference	
□ Midwest	0.34 (0.14, 0.83)	.019	0.34 (0.13, 0.85)	.022
□ South	0.32 (0.13, 0.78)	.014	0.31 (0.13, 0.78)	.013
□ West	0.79 (0.27, 2.29)	.659	0.89 (0.31, 2.61)	.837

\* Logistic regression modeling with dichotomous-formatted variable for the statins as dependent variable.  
<sup>†</sup> Full model included all independent variables listed.  
<sup>‡</sup> Includes the categories Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, and those individuals indicating more than one race.  
<sup>§</sup> Includes the categories Medicaid, worker's compensation, self-pay, no charge/charity, other, and unknown.

majority of those CHD patients who were receiving antihyperlipidemic therapy were being treated with a single agent, most commonly an agent from the statin medication class. Specific agents within each class were not a focus of this particular study and therefore were not assessed. Interestingly, this percentage from our study is higher than that previously reported, in which only 19% of patients with CHD or an investigator-assigned risk equivalent condition received a statin.<sup>8</sup> This finding may be due in part to inclusion in the previous study of more historical medication-use data (back to 1999), the ever-growing evidence-based literature on the use of antihyperlipidemic therapy in CHD patients, and the other study's inclusion of the NHAMCS (hospital) data.

An interesting finding from the current study is that CHD patients whose medical care was covered by private insurance received different lipid-lowering therapy than did CHD patients whose reported form of payment was Medicare. Alternative to this result of our study were the findings reported by Ma and colleagues<sup>8</sup>; in their study, CHD patients and those with an investigator-assigned risk equivalent, all of whom were either privately insured or covered by government health insurance, were both more likely than those who were not insured to receive statin therapy.<sup>8</sup> Our finding is also supplemental to findings in a study conducted by Varma and colleagues that compared medication use with form of payment in a slightly different fashion. They compared LDL-C levels in



## ORIGINAL CONTRIBUTION

patients with congestive heart disease, diabetes mellitus, or atherosclerotic vessel disease who were receiving medical care in select university health clinics. Their findings revealed that only 42% of Medicare or self-pay patients had LDL-C levels less than 100 mg/dL, while 79% of those with private insurance or Medicaid had reached this lipid goal.<sup>13</sup> This finding might be due, in part, to differences in overall medical care provided to the patients on the basis of payment forms, as well as potential differences in patient populations due to study location (university clinics).

Previous studies have also revealed that non-whites received inferior lipid management compared with whites, regardless of heart health.<sup>9,10</sup> Therefore, although not directly related to race but rather related to the global concept of medication use disparities, our findings underline the continuing relevance of this important medical issue. While several physician- and clinical-based factors could be at the root of this issue, patient and societal factors could also provide some additional explanation. The CDC has reported that differences may exist in a variety of assessments of health status due to factors such as ethnic-based health practices, socioeconomic status (by race, ethnicity, and region of the United States), psychosocial stress, environmental exposures, and access to health care and related resources.<sup>14</sup>

Additionally, our comparison of whites to African Americans revealed that the latter group did not experience a significantly reduced frequency of lipid-lowering therapy in the setting of heart disease, as a previous study that used data from earlier NAMCS and NHAMCS surveys had concluded.<sup>8</sup> Moreover, this prior study also reported that a younger patient age and female sex were associated with decreased likelihood of receiving a statin medication in the setting of CHD, a CHD risk equivalent, or hyperlipidemia. We did not find a difference in continued medication use among these patient demographics. We speculate this could have been brought about in 2004 when results of lipid- and CHD-related studies on the efficacy of lipid-lowering therapy, specifically statins, were released and resulted in a modification in physician practice, patient adherence, or both.

Finally, we found that CHD patients in some regions of the country were disproportionately associated with lower rates of lipid-lowering therapy. Compared with the CHD patients receiving care in the Northeast region of the United States, CHD patients receiving care in the South region were significantly less likely to receive a medication from one of the classes of medications that make up the lipid-lowering therapeutic area. However, we found no significant difference between CHD patients in the Northeast region and those in the West region in terms of the likelihood of receiving lipid-lowering therapy. Furthermore, CHD patients living in the South or the Midwest regions were less likely to be specifically treated with a statin medication. The etiology of this difference is unknown, although some researchers have reported that socioeconomic status and access to care, particularly in rural

settings, may account for these results.<sup>14</sup>

Strengths associated with our study include the national perspective of the NAMCS, which is conducted annually by the NCHS/CDC, and the use of more current data rather than data from past studies. We included all patients with select, physician-defined, CHD-related diagnoses, including those with and those without a known lipid profile abnormality, all age and sex groups, all survey-captured race and ethnicity data, numerous forms of payment, all regions of the United States, and both types of physicians. All diagnoses were captured through use of standardized ICD-9-CM coding. We also included all forms of lipid-lowering therapy and then additionally evaluated differences in the use of the most commonly used therapy, the statins.

With regard to limitations of the study, the NAMCS does not sample visits from federally funded settings. Therefore, our findings cannot be generalized to patients with CHD managed exclusively in these settings. It is also possible that the medical diagnosis of CHD or its pharmacotherapy with one or more lipid-lowering medications was inadvertently not documented during the surveyed medical visit. Poor documentation would have underrepresented these diagnoses and the medication use in our study population.

In addition, lipid panel data and the level of cardiometabolic disease risk were not universally acquired for each CHD patient at each office visit surveyed by the NAMCS. Adherence is another aspect of each medical visit that is not possible to evaluate through use of the NAMCS. Furthermore, no specific data are collected by the NAMCS that would suggest which CHD patients might have had a contraindication or past medication-specific adverse event (eg, myopathy), thereby preventing the use of one or more of the lipid-lowering agents.

And finally, although this study included data from only a single year (2004), the data from this single year was purposefully selected as a baseline for future comparisons. It was also preselected based on the then-recent release of the updated recommendations from the National Cholesterol Education Program Adult Treatment Panel III.<sup>3</sup>

Future studies are planned utilizing more recent survey years to further evaluate anticipated changes in the frequency of use of these therapies based on these Adult Treatment Panel III recommendations and more recent evidence-based publications.

### Conclusion

On the basis of the data captured by the 2004 NAMCS, when selecting out those office visits in an ambulatory care setting by patients with a diagnosis of CHD, the likelihood of being prescribed antihyperlipidemic therapy is significantly associated with the patient's reported ethnicity, method of payment, and region of the United States in which the medical care is provided. While we can only speculate about justification for such findings, it is our hope that increased awareness of both

such disparities and of the beneficial effects of lipid-lowering therapy in this patient population will lead to better health for all.

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### Public Registration of Clinical Trials

To be considered for publication in *JAOA—The Journal of the American Osteopathic Association*, phase 3 clinical trials must be registered with at least one public registry. This requirement also applies to other trials involving human subjects, including pilot studies, if they have at least one prospectively assigned concurrent control or comparison group.

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