

# Statins for Secondary Cardiovascular Disease Prevention for Older Primary Care Patients

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**Disclosure:** The views presented in this article are those of the authors and do not necessarily reflect those of the Centers for Disease Control and Prevention, the US Department of Health and Human Services, or its officials.

**Objectives:** To examine statin prescribing for secondary cardiovascular disease prevention at primary care visits by older patients in 2005-2006.

**Design:** The National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey are cross-sectional, using a multistage random sample (112 primary sampling units, physicians and hospitals, patient visits). Characteristics from 4964 primary care visits were abstracted from medical records.  $\chi^2$  and logistic regression were performed to investigate associations with statin prescribing.

**Setting:** US nonfederal physician offices and hospital outpatient departments.

**Participants:** Visits by patients aged 55 to 80 years with cerebrovascular, ischemic heart or peripheral vascular disease, aortic aneurysm, atherosclerosis, diabetes mellitus, or any 2 risk factors (hyperlipidemia, hypertension, or smoking).

**Measurements:** The dependent variable was statin prescribing. Independent variables were age, sex, ethnicity, primary payment source, number of comorbidities, metropolitan statistical area, geographic region, and clinical setting.

**Results:** Statins were prescribed at 37.7% of visits. Logistic regression negative predictors for statin prescribing included non-Hispanic black ethnicity and Medicaid coverage. Number of comorbidities was a positive predictor.

**Conclusion:** Statins are prescribed at much fewer visits by higher-risk older patients, especially non-Hispanic black patients and Medicaid beneficiaries, than would be expected from their comorbidities.

**Keywords:** cholesterol ■ statins ■ cardiovascular ■ prevention

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## INTRODUCTION

In 2004 coronary heart disease was the leading cause of death in the United States for both men and women. Stroke was the third leading cause of death and is a leading cause of severe, long-term disability among adults in the United States.<sup>1</sup> The American Heart Association (AHA) has disseminated and updated many recommendations on cardiovascular disease prevention over the past few years. In 1999 the AHA recommended treatment of hyperlipidemia for secondary stroke prevention among patients who had already had a stroke or transient ischemic attack, including lipid-lowering medications if dietary modifications and exercise had not been successful in lowering cholesterol.<sup>2</sup> In 2001 the National Cholesterol Education Panel recommended maintaining low-density lipoprotein cholesterol (LDL-C) levels at less than 100 mg/dl in people who have coronary heart disease; coronary heart disease risk equivalents such as noncoronary atherosclerosis; stroke or transient ischemic attack; peripheral arterial disease; abdominal aortic aneurysm or diabetes mellitus; or 2 or more cardiovascular risk factors for atherosclerosis such as hyperlipidemia, smoking, hypertension, and age 45 years and older for men or 55 years and older for women. Less-stringent goals were recommended for patients with fewer than 2 cardiovascular risk factors.<sup>3</sup> The AHA and the American Stroke Association updated their stroke prevention guidelines in 2006 to recommend statins for stroke prevention for patients with ischemic stroke or transient ischemic attack with elevated cholesterol or coronary artery disease. Statins were also recommended as reasonable choices in patients with ischemic stroke or transient ischemic attack without hypercholesterolemia, coronary artery disease, or atherosclerosis.<sup>4</sup>

Little is known about the recent practice across the nation of prescribing statins to prevent cardiovascular disease following recent updates of these professional recommendations and guidelines. A 1997 paper examined cholesterol management among patients with hyperlipidemia only.<sup>5</sup> Statin use was examined among patients with hyperlipidemia between 1992 and 2002.<sup>6</sup> Our study provides a current and nationally representative picture of the prescribing of statins for secondary cardiovascular disease prevention among older outpa-

tients. First, national estimates were made for the prescribing of statins at visits by patients at moderate to high risk of ischemic stroke or coronary artery disease in US physicians' offices and hospital outpatient departments during 2005-2006. Then demographic and clinical factors associated with prescribing statins in these settings were investigated.

## METHODS

### Data Sources

The National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS) are approved yearly by the ethics review board of the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC).

### Sampling Design

The surveys use a multistage random sampling design that includes 112 primary sampling units, then nonfederal office-based physicians (NAMCS) and general hospital outpatient departments (NHAMCS) within those units, and, finally, patient visits to those providers. The 112 primary sampling units are US counties, parishes, cities, or towns comprising a probability subsample from the primary sampling units used in the National Health Interview Survey. The office-based physicians are sampled from the master files of the AMA and American Osteopathic Association. The hospitals are sampled from the Verispan Hospital Database, and those with outpatient departments are identified from the survey induction questionnaire. Although the NHAMCS samples hospitals with emergency as well as outpatient departments, this study excludes visits to emergency departments. The patient visits are sampled from a randomly assigned 1-week reporting period for NAMCS, or a 4-week reporting period for NHAMCS.<sup>7,8</sup> Because the surveys are visit based, it is possible for individual patients to have more than 1 visit. However, it is not possible to link visits by the same patient due to confidentiality safeguards built into the survey protocol.

Sample weights are assigned based on the inverse probability of selection, with a nonresponse adjustment. The tables show unweighted sample sizes; and the percentages represent weighted national estimates.

### Variable Definitions

NAMCS and NHAMCS patient visit characteristics, diagnoses, and interventions in 2005-2006 were studied. Up to 3 reasons for the visit (RFVs) were recorded and coded according to the National Center for Health Statistics RFV Classification.<sup>9,10</sup> Up to 3 diagnoses were recorded for each visit and coded according to the *International Classification of Diseases-9th Revision-Clinical Modification (ICD-9)*.<sup>11</sup> Up to 8 medications could

be recorded. All prescription and over-the-counter medications that were ordered, supplied, administered, or continued during the visit were recorded.

The patient record forms were abstracted from original medical records by the physician or other clinician, office or hospital staff, or a US Census field representative. All primary care provider visit records were included in the analysis, comprising 4964 visits (weighted national estimate of 68.5 million annual visits) by patients who were aged 55 to 80 years and were at moderate to high risk of cardiovascular diseases such as stroke or myocardial infarction, who thus had indications for statins for secondary cardiovascular disease prevention.<sup>12</sup> Primary care was defined as a yes response to the question, "Are you the patient's primary care physician/provider?" Statin indications (or comorbidities) included a history of atherosclerosis; coronary heart disease; cerebrovascular disease; aortic aneurysm; peripheral arterial disease; diabetes mellitus; or any 2 of these risk factors: hyperlipidemia, hypertension, or tobacco use.

Coronary artery disease was defined as any listed diagnosis of myocardial infarction (acute or old), ischemic heart disease (acute, subacute, or chronic) or angina pectoris (*ICD-9* 410-414), or a chronic disease check box response for ischemic heart disease on the abstracted patient record form. Cerebrovascular disease was defined as any listed diagnosis of cerebral or precerebral occlusion or stenosis, ischemic stroke, transient ischemic attack (*ICD-9* 433-437), amaurosis fugax (*ICD-9* 362.34), or a chronic disease check box response for cerebrovascular disease. Other comorbidities included atherosclerosis (*ICD-9* 440); aortic aneurysm (*ICD-9* 441); peripheral arterial disease (*ICD-9* 443); diabetes mellitus (*ICD-9* 250, RFV 22050, RFV 61000 or a chronic disease check box response); hyperlipidemia (*ICD-9* 272.0-272.4, RFV 61050, or a chronic disease checkbox response); hypertension (*ICD-9* 401-405, RFV 25050, RFV 25100, or a chronic disease check box response); and tobacco use (*ICD-9* 305.1 or a yes response on the tobacco use questionnaire item).

### Dependent and Independent Variables

The dependent variable was whether or not a statin was prescribed or continued, including atorvastatin, cerivastatin, fluvastatin, lovastatin, pravastatin, rosuvastatin, or simvastatin. The independent variables included age in years (55-64, 65-80); sex; ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other); primary payment source (private, Medicare, Medicaid, uninsured); number of comorbidities; metropolitan statistical area (urban, rural); geographic region (northeast, midwest, south, west); and clinical setting (physician's office, hospital outpatient department). Since age becomes a risk factor for men and women at different points in life, this study was limited to age 55 to 80 years

to hold this risk factor constant for all patients.<sup>3</sup> For payment source, the uninsured category included workers' compensation, self-pay, no charge, charity, and unknown. Comorbidities included coronary heart disease; cerebrovascular disease; other atherosclerotic disease (atherosclerosis, aortic aneurysm, peripheral arterial disease); diabetes mellitus; hyperlipidemia; hypertension; and tobacco use.

## Analytic and Statistical Approach

$\chi^2$  Tests examined bivariate associations between the independent variables and whether a statin was prescribed or continued. A logistic regression model was built to identify significant associations between each independent variable and statin prescribing, controlling

for all other covariates (age, sex, ethnicity, payment source, comorbidities, metropolitan statistical area, region, and clinical setting). These multivariate associations were expressed as odds ratios (ORs) with 95% confidence intervals (CIs) with respect to the likelihood of having statins prescribed or continued. Analyses were performed using SUDAAN, release 9.0.1 (Research Triangle Institute, Research Triangle Park, North Carolina) to account for the multistage sampling design and weights described above.

## RESULTS

During 2005 and 2006, there were about 68.5 million annual outpatient visits to primary care providers by adults aged 55 to 80 with cerebrovascular disease, coro-

**Table 1.** Percentage of Visits to Primary Care Providers by Older Patients at Which Statins Were Prescribed or Continued for Secondary Cardiovascular Disease Prevention, by Patient Visit Characteristics—United States, 2005-2006<sup>a</sup>

Characteristics	N	Percentage	95% CI	P
All visits	4964	37.7	35.1-40.5	
Age				
55-64	2215	37.0	33.2-41.0	.63
65-80	2749	38.2	34.9-41.7	
Sex				
Female	2794	35.1	31.8-38.4	.01
Male	2170	40.8	37.3-44.5	
Ethnicity				
Non-Hispanic white	3168	39.8	36.8-42.8	<.01
Non-Hispanic black	854	26.4	20.1-33.7	
Hispanic	539	30.1	22.9-38.4	
Other	403	42.3	30.0-55.6	
Primary payment source				
Private	1164	41.2	36.8-45.8	.03
Medicare	2159	38.2	34.5-42.0	
Medicaid	1015	28.9	23.3-35.3	
Uninsured	626	34.7	27.6-42.4	
Number of comorbidities				
1	499	13.1	9.3-18.1	<.01
2	2699	36.8	33.6-40.2	
≥3	1766	46.5	42.0-51.2	
Metropolitan statistical area				
Urban	3950	38.1	35.2-41.1	.64
Rural	1014	36.2	29.7-43.4	
Geographic region				
Northeast	1243	41.0	34.8-47.5	.70
Midwest	1387	37.7	33.7-42.0	
South	1466	36.2	31.8-40.9	
West	868	37.4	30.1-45.4	
Clinical setting				
Physician's office	2856	37.9	35.0-40.8	.52
Hospital outpatient department	2108	36.3	32.0-40.7	

Abbreviation: CI, confidence interval.

<sup>a</sup> The unweighted sample size (N) corresponds to the raw number of visits. Percentages are weighted national estimates representing about 68.5 million annual visits.  $\chi^2$  P values of < .05 were taken to represent significant differences among the percentages for each category of the independent variable. Comorbidities include coronary heart disease, cerebrovascular disease, other atherosclerotic disease (atherosclerosis, aortic aneurysm, peripheral arterial disease), diabetes mellitus, hyperlipidemia, hypertension, and tobacco use.

nary heart disease equivalents, or more than 1 major cardiovascular risk factor. Statins were prescribed or continued at 37.7% of these visits.

There were significant bivariate differences in statin prescribing by sex, ethnicity, primary payment source, and number of comorbidities (Table 1). Multivariate results adjusting for all independent variables confirm that statins were significantly less likely to be prescribed at visits by non-Hispanic black patients (OR, 0.60; 95% CI, 0.41-0.89) than by non-Hispanic white patients, and at visits by Medicaid (OR, 0.64; 95% CI, 0.43-0.95) patients than by those with private insurance (Table 2). Although women were prescribed statins significantly less than men in a preliminary multivariate analysis excluding comorbidities, this difference disappeared in the full model that included the number of comorbidities.

Compared to visits by patients with only 1 comorbidity, statins were significantly more likely to be prescribed to patients with 2 comorbidities (OR, 3.74; 95% CI, 2.51-5.58) and 3 or more comorbidities (OR, 5.45; 95% CI, 3.72-7.97).

## DISCUSSION

This paper provides a current and nationally representative estimate of the prevalence of statin prescribing and associated factors in the implementation of statins as a secondary protective measure against cardiovascular disease among older primary care patients in 2005-2006. Statins were prescribed to 36.9% of patients with hyperlipidemia nationally during 2002, which was significantly improved over 10 years earlier (9.6%).<sup>6</sup> Our study found a similar percentage 4 years later, which is

**Table 2.** Multivariate Logistic Regression Model for Likelihood of Being Prescribed a Statin for Secondary Cardiovascular Disease Prevention at Visits to Primary Care Providers by Older Patients, by Patient Visit Characteristics: United States, 2005-2006

Characteristics	OR	95% CI
Age		
55-64	1.00	1.00
65-80	1.11	.85-1.44
Sex		
Female	0.85	.70-1.02
Male	1.00	1.00
Ethnicity		
Non-Hispanic white	1.00	1.00
Non-Hispanic black	0.60	.41-.89
Hispanic	0.76	.51-1.13
Other	1.23	.70-2.15
Primary payment source		
Private	1.00	1.00
Medicare	0.84	.63-1.12
Medicaid	0.64	.43-.95
Uninsured	0.77	.53-1.14
Number of comorbidities		
1	1.00	1.00
2	3.74	2.51-5.58
≥3	5.45	3.72-7.97
Metropolitan statistical area		
Urban	1.00	1.00
Rural	0.96	.70-1.31
Geographic region		
Northeast	1.00	1.00
Midwest	0.84	.61-1.15
South	0.86	.61-1.21
West	0.82	.54-1.22
Clinical setting		
Physician's office	1.00	1.00
Hospital outpatient department	1.04	.85-1.27

Abbreviations: CI, confidence interval; OR, adjusted odds ratio.

° Sample size (N = 4964) is unweighted and represents a weighted national estimate of about 68.5 million annual visits. Comorbidities include coronary heart disease, cerebrovascular disease, other atherosclerotic disease (atherosclerosis, aortic aneurysm, peripheral arterial disease), diabetes mellitus, hyperlipidemia, hypertension, and tobacco use.

of concern since our sample of moderate to high cardiovascular risk patients excluded those who had only hyperlipidemia.

In an aging society, older adults have the highest prevalence of stroke. The CDC reported that 8.1% of adults aged 65 years or older had a history of stroke in 2005, compared with only 0.8% of younger adults.<sup>13</sup> There has been a trend towards an increase in the use of cholesterol-lowering agents,<sup>14</sup> which may be tied to the decrease in total cholesterol levels among older US adults.<sup>15</sup> But our results clearly show that fewer than 40% of visits by older patients (even those over 65 years old) result in a prescription for a statin when indicated. Since there remains some concern about giving statins to older patients, the findings may simply reflect this. But recent literature that includes patients up to 82 years of age has lent increasing support to using statins in elderly patients. As more clinical trials that include patients in extreme old age are published, future research should monitor trends in prescribing statins in this group.

This study found that women at risk for cardiovascular disease were less likely to be prescribed statins than men when patient sex was examined independently, supporting other recent research findings that women of any age are less likely than men to have their cholesterol controlled.<sup>16,17</sup> However, adjustment for other factors (especially number of comorbidities) caused patient sex to become not significant. Future studies are needed to focus on gender disparities in cardiovascular disease prevention among at-risk US outpatients.

In 2005 the CDC found that the prevalence of stroke among black adults (4.0%) was higher than that among white adults (2.3%), although stroke prevalences were similar to white adults for Hispanic and Asian adults.<sup>13</sup> A review of 47 representative studies showed that certain cardiovascular risk factors were associated with ethnicity. These studies consistently showed a greater burden of disease, greater mortality from strokes, and greater severity of strokes for black people than for white people.<sup>18</sup> Between 1995 and 2002, there was no significant difference in statin use for hyperlipidemia among Hispanic and non-Hispanic white and black patients.<sup>6</sup> However, our study found a disparity in prescribing statins to non-Hispanic black patients for secondary prevention despite the higher risk sample. This was particularly interesting because the ethnic disparity persisted despite adjustment for the number of comorbidities. Also, although Medicaid beneficiaries were less likely to be prescribed statins than privately insured patients, this was independent of ethnic background, metropolitan statistical area, or geographic region in the adjusted model. Future studies are needed to identify barriers to practicing appropriate preventive measures against cardiovascular disease among minority outpatients in the United States, as well as Medicaid beneficiaries.

## Limitations

It was not possible to examine visits by American Indian, Alaska Native, Pacific Islander, or multiracial patients due to their limited sample sizes. Making national estimates for these groups would require oversampling with appropriate weighting, or adding additional years of data in the future.

Since this study is cross-sectional, it is not known if the patients not getting statins are still in the lifestyle modification phase of their medical management or if some of them are in the category of lower high-density lipoprotein cholesterol (HDL-C) for which they might reasonably be prescribed nonstatin agents such as gemfibrozil or niacin.<sup>4</sup> Another limitation may be lack of documentation by clinicians of medications that were not newly prescribed but continued from previous visits, although the survey protocol attempts to capture both types of prescribing. However, if the visit was included in the sample by virtue of a particular diagnosis, then it would be reasonable to expect that interventions related to that diagnosis would be documented. The NAMCS and NHAMCS collect data on whether medications were prescribed or continued but do not measure patient compliance with either filling the prescription or taking the medication. Thus, this study is only able to answer questions about the behavior of clinicians, not that of patients.

This study used ORs from logistic regression to identify predictors of statin prescribing that were adjusted for other covariates. Since ORs may overestimate the magnitude of significant differences in likelihoods compared to relative risks, we have presented them simply as evidence that the significant differences exist rather than using the ORs as precise quantifiers of likelihood.

## CONCLUSIONS

Despite these limitations, these results provide a current nationally representative picture of statin prescribing for secondary cardiovascular disease prevention among ambulatory primary care patients aged 55 to 80. The multivariate models confirmed factors that are associated with the implementation of cardiovascular prevention measures in these settings. Since statins were prescribed at fewer than four-tenths of visits by patients at moderate to high risk of cardiovascular disease in US outpatient settings during 2005-2006, the results suggest that recommended interventions could be done at more visits than is currently the case, given both recent and more time-tested guidelines for stroke prevention. Cardiovascular disease should be considered as eminently preventable because the treatments are well understood and widely available. Further studies are needed to identify any barriers to practicing appropriate preventive measures for older outpatients, non-Hispanic black patients, and patients who are on Medicaid. Republication of guidelines and supporting research in review articles for primary care clinicians may be more effective.

tive for busy clinicians than attempting to read exhaustive primary references.<sup>19</sup>

## REFERENCES

1. Heart disease and stroke statistics—2008 update. Dallas, TX: American Heart Association; 2008.
2. Wolf PA, Clagett GP, Easton D, et al. Preventing ischemic stroke in patients with prior stroke and transient ischemic attack: a statement for healthcare professionals from the Stroke Council of the American Heart Association. *Stroke*. 1999;30:1991-1994.
3. Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). *JAMA*. 2001;285:2486-2497.
4. Sacco RL, Adams R, Albers G, et al. Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attack: a statement for healthcare professionals from the American Heart Association/American Stroke Association Council on Stroke. *Stroke*. 2006;37:577-617.
5. Stafford RS, Blumenthal D, Pasternak RC. Variations in cholesterol management practices of US physicians. *J Am Coll Cardiol*. 1997;29:139-146.
6. Ma J, Stafford RS. Quality of US outpatient care: temporal changes and racial/ethnic disparities. *Arch Intern Med*. 2005;165:1354-1361.
7. Cherry DK, Hing E, Woodwell DA, Rechtsteiner EA. National Ambulatory Medical Care Survey: 2006 summary. National Health Statistics Reports; no. 3. Hyattsville, MD: National Center for Health Statistics; 2008.
8. Hing E, Hall MJ, Xu J. National Hospital Ambulatory Medical Care Survey: 2006 outpatient department summary. National Health Statistics Reports; no. 4. Hyattsville, MD: National Center for Health Statistics; 2008.
9. Public use data file documentation: 2005 National Ambulatory Medical Care Survey. Hyattsville, MD: National Center for Health Statistics; 2007.
10. Public use data file documentation: 2005 National Hospital Ambulatory Medical Care Survey. Hyattsville, MD: National Center for Health Statistics; 2007.
11. International classification of diseases, ninth revision, clinical modification, sixth edition. Washington, DC: Public Health Service; 1998.
12. Grundy SM, Cleeman JI, Merz CNB, et al. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *Circulation*. 2004;110:227-239.
13. Neyer JR, Greenlund KJ, Denny CH, et al. Prevalence of stroke – United States, 2005. *MMWR*. 2007;56:469-474.
14. Carroll MD, Lacher DA, Sorlie PD, et al. Trends in serum lipids and lipoproteins of adults, 1960-2002. *JAMA*. 2005;294:1773-1781.
15. Johnson CL, Rifkind BM, Sempos CT, et al. Declining serum cholesterol levels among US adults: The National Health and Nutrition Examination Surveys. *JAMA*. 1993;269:3002-3008.
16. Bird CE, Fremont AM, Bierman AS, et al. Does quality of care for cardiovascular disease and diabetes differ by gender for enrollees in managed care plans? *Women's Health Issues*. 2007;17:131-138.
17. Chou AF, Scholle SH, Weisman CS, et al. Gender disparities in the quality of cardiovascular disease care in private managed care plans. *Women's Health Issues*. 2007;17:120-130.
18. Stansbury JP, Jia H, Williams LS, et al. Ethnic disparities in stroke: epidemiology, acute care, and postacute outcomes. *Stroke*. 2005;36:374-387.
19. Dickerson LM, Carek PJ, Quattlebaum RG. Prevention of recurrent ischemic stroke. *Am Fam Physician*. 2007;76:382-389. ■