Variations in Cholesterol Management Practices of U.S. Physicians

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Objectives. This study sought to evaluate national cholesterol management practices of U.S. physicians.

Background. Past studies show that nonclinical factors affect physician practices. We tested the hypothesis that physician and patient characteristics influence cholesterol management.

Methods. We used a stratified, random sample of 2,332 office-based physicians providing 56,215 visits to adults in the 1991–1992 National Ambulatory Medical Care Surveys. We investigated physicians' reporting of cholesterol-related screening, counseling or medications during office visits and used multiple logistic regression to assess independent predictors.

Results. An estimated 1.12 billion adult office visits occurred in 1991 and 1992 (95% confidence interval 1.06 to 1.18 billion). For the 1.03 billion visits by patients without reported hyperlipidemia, cholesterol screening (2.8% of visits) and counseling (1.2%) were not frequent. The likelihood of screening increased with older age, cardiovascular disease risk factors, white race and private insurance. We estimate that only 1 in 12 adults received cholesterol

screening annually. In the 85 million visits by patients with hyperlipidemia, cholesterol testing was reported in 22.9%, cholesterol counseling in 34.4% and lipid-lowering medications in 23.1%. Testing was more likely in diabetic and nonobese patients. Counseling was more likely with younger age, cardiovascular disease and private insurance. Medications use was associated with cardiovascular disease, Northeast region of the United States, nonobese patients and visits to internists. Physician practices did not differ by patient gender.

Conclusions. Although clinical conditions strongly influence cholesterol management, the appropriateness of variations noted by payment source, geographic region and physician specialty deserve further evaluation. These variations and the low estimated volume of services suggest that physicians have not fully adopted recommended cholesterol management practices.

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In the United States, cardiovascular disease accounts for 945,000 annual deaths (41% of all deaths) (1) and contributes to substantial morbidity, including 6 million hospital admissions annually (2). Hyperlipidemia continues to represent an important modifiable risk factor for the development and progression of cardiovascular disease (3–6). An estimated 29% of Americans have lipid abnormalities sufficient to warrant treatment with at least dietary modifications (7).

Great effort has been expended in developing and promoting clinical guidelines for the screening and treatment of lipid abnormalities (8–10). Before the first 1988 National Cholesterol Education Program (NCEP) recommendations, a trend toward more aggressive management of hyperlipidemia had already been noted in this country (11). Specific guidelines for cholesterol testing, dietary counseling and pharmacologic treatment have emphasized activities provided both to patients

without known cardiovascular disease (primary prevention) and to those already diagnosed with cardiovascular disease (secondary prevention). However, despite considerable efforts at encouraging appropriate cholesterol management, little is known about how U.S. physicians actually practice. Several small studies suggest inadequate adherence to existing guidelines (12–14). Information on current practices is essential for identifying obstacles to optimal preventive practices.

Several factors have been shown in past studies to influence cholesterol management services. Internists and cardiologists provide more counseling than other specialties (15,16). The data of Cherkin et al. (17) from 1976 to 1977 indicated that general internists were more likely than family physicians to order cholesterol testing. The 1990 National Health Interview Survey (18) found that patients of higher socioeconomic status reported a higher likelihood of cholesterol testing, with college education and white race associated with higher rates of any past testing. Although these studies suggest a role for nonclinical factors in cholesterol-related physician practices, they fail to provide definitive, national data that are physician based and adjusted for potential confounders.

The current study uses data from the National Ambulatory Medical Care Surveys (NAMCS) to investigate patterns of cholesterol management by U.S. physicians. In particular, we evaluate the independent influence of gender, race, age, clinical diagnoses and physician specialty on testing, counseling

Abbreviations and Acronyms	
CI	= confidence interval
NAMCS	= National Ambulatory Medical Care Survey
NCEP	= National Cholesterol Education Program
NHANES III	= National Health and Nutrition Examination Survey, Third Survey
OR	= odds ratio

and medication practices in patients with and without known lipid abnormalities. A key hypothesis of this study is that factors other than clinical condition exert an influence on cholesterol management and may represent modifiable barriers to appropriate practices.

Methods

Data source. Data for this study come from the 1991 and 1992 NAMCS conducted by the National Center for Health Statistics (19–22). These ongoing, annual surveys of U.S. physicians select office-based, patient-care medical doctors and doctors of osteopathy from the American Medical Association and American Osteopathic Association listings of all practicing physicians in the United States. From these lists, office-based, patient-care physicians were selected by random, stratified sampling by geographic area and specialty. In 1991 and 1992, a total of 2,912 physicians of 4,029 selected (72%) agreed to participate in the study. For each participating physician, a random week during each year was selected for systematic sampling of 20% to 100% of their patient visits. Information on 68,401 visits was available through these surveys. The sample of physicians seeing adults consisted of 2,332 physicians reporting on 56,215 visits.

For each patient visit, physicians or their office staff completed encounter forms detailing the specific clinical services provided during the visit, as well as patient demographics, diagnoses, current medications, physician characteristics and visit characteristics. The NAMCS was designed to provide a sample of patient visits from which national estimates can be derived. With each visit record, the National Center for Health Statistics provides a visit weight calculated from the physician and visit sampling rates, adjusted for nonresponse. Statistical aggregation using these visit weights allows national volumes of clinical activities to be estimated among the universe of U.S. office-based, patient-care physicians. To reflect the uncertainty associated with these estimates, 95% confidence intervals were derived from National Center for Health Statistics relative standard error estimates (21,22). Validation studies performed in earlier years have confirmed the general accuracy of the NAMCS data (23). Missing data are limited to ~5% of most data fields (22). The data exclude outpatient care provided in health centers, some hospital outpatient departments, emergency rooms and by nonphysician providers.

The NAMCS includes information on diagnostic testing, medications, counseling and procedures. Among other services,

physicians specifically indicated whether they had provided "counseling/education: cholesterol reduction" and "diagnostic/screening services: cholesterol measure" (22). Cholesterol counseling includes any advice related to cholesterol, including dietary advice, although general dietary advice was assessed through a separate indicator. Cholesterol measurement encompasses laboratory tests for either a cholesterol panel or total cholesterol alone. We analyzed the use of services related to cholesterol management, including counseling and screening in patients without known hyperlipidemia and counseling, monitoring and lipid-lowering medication use in hyperlipidemic patients. Patterns for patients without known hyperlipidemia were based on 52,598 visits, whereas those for hyperlipidemic patients were based on 3,617 visits.

The presence of hyperlipidemia, atherosclerotic cardiovascular disease, hypertension, obesity, diabetes and smoking were coded if any one of the following indicators were recorded on visit records: a specific NAMCS patient problem code (for smoking, hyperlipidemia, obesity and hypotension); an appropriate NAMCS "reason for visit" code (24) (for atherosclerosis, smoking, obesity, diabetes mellitus and hypertension); or an appropriate International Classification of Disease (ICD-9-CM) diagnostic code (25) (for atherosclerosis, smoking, hypertension, obesity and hyperlipidemia). In the absence of other indicators, patients also were defined as having hyperlipidemia if reported to be taking lipid-lowering medications. American Medical Association primary physician specialty designations (22) were used to categorize physicians as cardiologists, other internists, family physicians and general practitioners and all other physicians. Geographic area was defined by the four U.S. Census regions of West, South, Northeast and Midwest. Private insurance was defined as private or health maintenance organization coverage.

Statistical methods. We separately analyzed national cholesterol management practices for patients with and without known hyperlipidemia. A first step was to calculate national estimates of the volume of cholesterol-related services provided. These estimates made use of the visit weights assigned to each visit record. To test our hypotheses regarding practice patterns, we investigated the independent predictors of the likelihood of these services being provided at a given visit.

Using multiple logistic regression, we determined the influence of a set of independent predictor variables on the odds that patients received cholesterol management services. Analysis was carried out using the SAS LOGISTIC procedure, version 6.10 (26,27). Independent variables included physician specialty, patient gender, patient age, patient race, presence of cardiovascular disease and its risk factors (smoking, obesity, hypertension and diabetes), expected payment source and census region. As an alternative statistical approach, physician-level regression models also were developed using the SAS GLM procedure, version 6.10 (26). These models accounted for the lack of independence among visits to individual physicians by predicting the natural logarithm of the odds of a particular physician providing a prevention service as a function of the above series of independent variables each defined

Table 1. U.S. Office Visits With Cholesterol Testing, Cholesterol Counseling and Lipid-Lowering Medications: National Ambulatory Medical Care Survey, 1991 and 1992

	All Patient Visits		Visits With Cholesterol Testing Ordered		Visits With Cholesterol Counseling Provided		Visits With Lipid-Lowering Medications	
	No. (millions)	%	No. (millions)	Rate of Testing (%)	No. (millions)	Rate of Counseling (%)	No. (millions)	Rate of Medication Use (%)
No known hyperlipidemia								
Without CVD	998	89.4	27.4	2.7	10.6	1.1		
With CVD	33	2.9	2.0	5.9	1.7	5.3		
Total	1,031	92.3	29.4	2.8	12.3	1.2		
With hyperlipidemia								
Without CVD	72	6.5	16.3	22.6	23.4	32.4	14.6	20.2
With CVD	13	1.2	3.2	24.5	6.0	45.0	5.1	38.9
Total	85	7.7	19.5	22.9	29.4	34.4	19.7	23.1
Total								
Without CVD	1,070	95.9	43.7	4.1	34.0	3.2	14.6	1.4
With CVD	46	4.1	5.2	11.3	7.7	16.7	5.1	11.2
Grand total	1,116	100.0	48.9	4.4	41.7	3.7	19.7	1.8

CVD = cardiovascular disease.

at the physician level (e.g., proportion of a physician's visits that were by women) (28). Results of these alternative models were consistent with visit-level logistic regression models and are not presented.

The NAMCS provides a cross-sectional description of physician practices that does not allow the longitudinal experience of patients to be assessed. The unit of analysis is the patient visit, rather than the patient. Patients visiting physicians more frequently may have a lower likelihood of receiving testing or counseling at any given visit. For these patients, visit-based rates of services may understate their actual use of preventive services. We evaluated this potential bias by analyzing practices in two types of visits: first visits to physicians and general medical examinations. Because they are unlikely to be repeated on the same individual in a given year, these types of visits are more likely to represent self-contained episodes of care. Analysis of these visits provides a method of validating patterns observed for the entire sample.

Although the NAMCS provides national data on the volume of cholesterol management services, it lacks denominator information needed to assess how extensively these services are being provided to the general population of individuals with and without known hyperlipidemia. To extend the usefulness of the NAMCS data, we combined it with other data sources that allow estimation of the number of Americans with and without known hyperlipidemia. The third National Health and Nutrition Examination Survey (NHANES III) (7) estimates that 29% of adults in the United States have lipid abnormalities. To derive a national estimate of adults with known lipid abnormalities, we used the estimate from the Atherosclerosis Risk in Communities (ARIC) study (29) that only 42% of those with lipid abnormalities are aware of their condition. We thus estimated that of 188 million adults in the United States in 1991 (30), there were 23 million American adults with known lipid abnormalities and 165 million without known lipid

abnormalities. Combining NAMCS numerator estimates with these population denominators allows calculation of 1) annual screening rates for Americans without known hyperlipidemia, and 2) annual screening and counseling rates for Americans with hyperlipidemia. Although combining data from NAMCS and NHANES II has potential hazards, cautious use of this strategy allows several critical aspects of national cholesterol management practices to be assessed.

Results

Of the 1.12 billion estimated visits to U.S. office-based physicians in 1991 and 1992 (95% confidence interval [CI] 1.07 to 1.16 billion), 42 million included cholesterol counseling (95% CI 40 to 45 million, 3.7%), and 49 million included cholesterol tests (95% CI 46 to 52 million, 4.4%). In addition, 20 million visits (95% CI 18 to 22 million, 1.8%) were made by patients taking lipid-lowering medications. Although cholesterol management services were concentrated among the 85 million visits (95% CI 81 to 89 million) by patients with lipid abnormalities (8% of total visits), services also were provided to patients without identified hyperlipidemia. As expected, patients with cardiovascular disease (4% of all visits) also received a larger than proportional share of cholesterol-related testing, counseling and medications (Table 1).

Patients without reported hyperlipidemia. Cholesterol-related services provided during the 1.03 billion visits (95% CI 0.99 to 1.07 billion) to patients without known hyperlipidemia in 1991 and 1992 focused on cholesterol screening. In this population, 29 million cholesterol tests were ordered (95% CI 27 to 32 million, 2.8% of these visits). Cholesterol counseling in the absence of known lipid abnormalities was not frequent (12 million episodes, 95% CI 10 to 14 million, 1.2% of visits), although it accounted for 29% of all reported episodes of counseling.

Table 2. Likelihood of Cholesterol Services in Adults Without Known Hyperlipidemia: National Ambulatory Medical Care Survey, 1991 and 1992

	Percent of Visits Without Hyperlipidemia	Cholesterol Testing: Adjusted Odds Ratio* (95% CI)	Cholesterol Counseling: Adjusted Odds Ratio* (95% CI)
Male gender	36.7	0.78 (0.70–0.87)	1.12 (0.95–1.32)
Age (yr)			
<35	28.5	0.73 (0.61–0.88)	0.75 (0.53–1.07)
35–49	26.2	1.00 (0.85–1.18)	2.39 (1.85–3.09)
50–69	25.8	1.14 (0.98–1.32)	2.01 (1.59–2.54)
70+	20.2	1.00 (reference)	1.00 (reference)
White race	82.8	1.37 (1.18–1.59)	0.76 (0.63–0.92)
CVD	3.2	1.25 (0.99–1.57)	2.68 (2.05–3.51)
Diabetes	3.6	1.79 (1.49–2.15)	1.17 (0.88–1.56)
Obesity	8.6	1.58 (1.36–1.83)	2.21 (1.82–2.69)
Hypertension	14.7	1.33 (1.16–1.51)	2.57 (2.15–3.07)
Smoking	12.8	1.14 (0.98–1.32)	1.10 (0.88–1.37)
Private insurance	52.0	1.45 (1.30–1.62)	0.96 (0.81–1.13)
Specialty			
Cardiology	1.8	1.35 (1.00–1.83)	2.15 (1.55–2.97)
Internal medicine	22.0	1.69 (1.49–1.92)	1.02 (0.84–1.24)
Other specialties	49.7	0.33 (0.28–0.38)	0.29 (0.23–0.37)
FP/GP	26.3	1.00 (reference)	1.00 (reference)
Region			
South	29.9	0.60 (0.51–0.70)	0.80 (0.63–1.01)
Midwest	23.9	0.83 (0.72–0.95)	0.71 (0.57–0.89)
West	23.6	0.77 (0.66–0.89)	1.10 (0.88–1.38)
Northeast	22.6	1.00 (reference)	1.00 (reference)

*Independent effect of each variable controlling for all other variables listed, estimated by multiple logistic regression. CVD = cardiovascular disease; CI = confidence interval; FP/GP = family physicians and general practitioners.

Specific patient and physician characteristics made cholesterol screening more likely. Cholesterol screening was more likely in visits by patients >35 years old (3.3%) than in younger patients (1.8%, $p < 0.001$). White patients (2.9%) were slightly more likely to be screened than nonwhites (2.5%, $p = 0.034$). Cardiovascular disease and its risk factors made screening more likely. In particular, diabetes (7.9%, $p < 0.001$), cardiovascular disease (5.9%, $p < 0.001$) and obesity (5.5%, $p < 0.001$) made screening more likely. Cholesterol screening also was more common in patients with (3.1%) than without private insurance (2.6%, $p < 0.001$). Cholesterol screening was more likely in the Northeast region of the country (3.8%) than in other regions (2.5%, $p < 0.001$). Physician specialty also affected screening patterns, with cardiologists (5.5%) and other internists (6.1%) reporting more screening than family physicians and general practitioners (3.3%) and all other physicians (1.5%, $p < 0.001$). The impact of each of these variables on the likelihood of cholesterol screening was statistically significant within a multiple logistic regression analysis controlling for gender, age, race, region, cardiovascular disease and its risk factors, payment source and physician specialty (Table 2).

Among patients without hyperlipidemia, patient age and clinical condition were the strongest predictors of cholesterol counseling. The youngest (0.4%) and oldest (1.1%) patients were less likely to be counseled than patients 35 to 69 years old

(1.7%, $p < 0.001$). Cardiovascular disease was associated with a 5.3% rate of counseling compared with 1.1% in those without it ($p < 0.001$). In addition, the presence of obesity (3.4%, $p < 0.001$), diabetes (3.0%, $p < 0.001$) and hypertension (3.5%, $p < 0.001$) made counseling more likely. In contrast to patterns of cholesterol screening, nonwhites were more likely to receive cholesterol counseling (1.7%) than whites (1.0%, $p < 0.001$). Visits to cardiologists were five times more likely to involve counseling (6.1%) than visits to other physicians (1.1%, $p < 0.001$). These effects persisted and were statistically significant with multivariate adjustment for potential confounders (Table 2).

We estimated annual cholesterol screening rates by combining the above NAMCS volume estimates with population estimates derived from NHANES III and other sources. As described above, we estimated a 1991 population of 23 million adults with and 165 million adults without known hyperlipidemia. Applying our NAMCS estimate of 29 million cholesterol tests to those without known lipid abnormalities in 2 years to this 165 million denominator implies an average annual screening rate of only 8.8%/year in this population.

Patients with reported hyperlipidemia. Although visits by patients with reported lipid abnormalities comprised only 8% of all visits in 1991 and 1992, 71% of all cholesterol counseling and 40% of all cholesterol testing took place during these visits. Cholesterol testing occurred during 20 million visits

Table 3. Likelihood of Cholesterol Services in Adults With Hyperlipidemia: National Ambulatory Medical Care Survey, 1991 and 1992

	Percent of Visits With Hyperlipidemia	Cholesterol Testing: Adjusted Odds Ratio* (95% CI)	Cholesterol Counseling: Adjusted Odds Ratio* (95% CI)	Lipid-Lowering Medications: Adjusted Odds Ratio* (95% CI)
Male gender	38.4	1.09 (0.93–1.27)	1.08 (0.94–1.24)	1.20 (1.02–1.39)
Age (yr)				
<35	3.9	1.58 (1.08–2.32)	2.04 (1.45–2.88)	0.53 (0.32–0.89
35–49	16.7	1.18 (0.94–1.49)	1.45 (1.17–1.78)	0.90 (0.70–1.15)
50–69	46.6	1.03 (0.86–1.22)	1.20 (1.03–1.40)	1.28 (1.08–1.52)
70+	32.6	1.00 (reference)	1.00 (reference)	1.00 (reference)
White race	82.3	0.91 (0.75–1.11)	0.61 (0.51–0.73)	1.07 (0.87–1.31)
CVD	15.5	1.04 (0.84–1.28)	1.74 (1.45–2.09)	1.99 (1.65–2.41)
Diabetes mellitus	12.8	1.51 (1.22–1.87)	1.27 (1.05–1.54)	0.97 (0.77–1.22)
Obesity	31.3	0.56 (0.47–0.67)	1.47 (1.28–1.70)	0.62 (0.52–0.73)
Hypertension	54.7	0.93 (0.80–1.09)	1.20 (1.05–1.38)	0.82 (0.70–0.95)
Smoking	13.8	0.82 (0.66–1.02)	0.78 (0.64–0.95)	1.14 (0.92–1.41)
Private insurance	47.7	1.31 (1.12–1.53)	1.20 (1.04–1.38)	1.17 (1.00–1.37)
Specialty				
Cardiology	7.4	0.75 (0.55–1.04)	0.84 (0.64–1.10)	1.72 (1.29–2.27)
Internal medicine	39.9	1.23 (1.04–1.45)	1.08 (0.93–1.25)	1.53 (1.29–1.81)
Other specialties	14.1	0.38 (0.29–0.51)	0.36 (0.28–0.46)	0.70 (0.54–0.91)
FP/GP	38.3	1.00 (reference)	1.00 (reference)	1.00 (reference)
Region				
South	31.3	0.57 (0.46–0.70)	0.78 (0.65–0.94)	0.60 (0.48–0.74)
Midwest	24.6	0.80 (0.66–0.97)	0.68 (0.57–0.82)	0.61 (0.50–0.75)
West	20.4	0.47 (0.38–0.60)	0.62 (0.50–0.76)	0.83 (0.67–1.03)
Northeast	23.4	1.00 (reference)	1.00 (reference)	1.00 (reference)

*Independent effect of each variable controlling for all other variables listed, estimated by multiple logistic regression. Abbreviations as in Table 2.

(95% CI 18.2 to 21.8, 22.9%). Cholesterol counseling was provided during 29 million visits (95% CI 27.0 to 31.0, 34.4%). In addition, 20 million visits were made by patients reported to be taking lipid-lowering medications (95% CI 18.1 to 21.9, 23.1%).

Cholesterol testing in patients with hyperlipidemia was less strongly influenced by patient characteristics than cholesterol screening in those without known hyperlipidemia. The presence of diabetes made testing more likely (28.1%, p = 0.002), although the presence of obesity (17.5%, p < 0.001) made testing less likely. Surprisingly, cardiovascular disease itself did not increase the likelihood of testing. Private insurance made testing more likely (24.6% vs. 21.3% without private insurance, p = 0.012), and patients in the Northeast were the most likely to be tested (30.0% vs. 20.7% other regions, p < 0.001). Family physicians and general practitioners (22.2%) and cardiologists (18.9%) were less likely to monitor cholesterol levels than internists (28.5%, p < 0.001). These patterns of cholesterol testing persisted and were statistically significant within a multiple logistic regression model accounting for potential confounders (Table 3).

Cholesterol counseling during visits by patients with lipid abnormalities was more likely in patients <35 years old (42.9% vs. 34.0% >35 years old, p = 0.016). Counseling also was more

likely in the presence of cardiovascular disease (45.0%, p < 0.001), diabetes (44.8%, p < 0.001), hypertension (37.2%, p < 0.001) and obesity (41.8%, p < 0.001). As with patients without hyperlipidemia, nonwhites were more likely to be counseled (43.3%) than whites (32.4%, p < 0.001). Privately insured patients showed a nonsignificant tendency to be counseled (35.6%) more than those without private insurance (33.2%, p = 0.089). Counseling was more likely in the Northeast (40.0%) than in other regions (32.6%, p < 0.001). Internists (38.7%), cardiologists (35.3%) and family physicians and general practitioners (36.4%) were more likely to counsel their patients than other physicians (16.2%, p < 0.001). These effects were confirmed to be statistically significant by multiple logistic regression, including the association of private insurance with an increased likelihood of cholesterol counseling (Table 3).

Lipid-lowering medications were more likely to be reported for patients with cardiovascular disease (38.9% vs. 20.2% without, p < 0.001). Obese patients were considerably less likely to be receiving medications (16.2%) than the nonobese (26.3%, p < 0.001). Privately insured patients (25.5%) were more likely to be taking medications than patients without private insurance (20.9%, p < 0.001). Physicians in the Northeast were more likely to use medications (30.3%) than those in

other regions (20.9%, p < 0.001). Cardiologists (37.7%) and internists (28.5%) were more likely to report lipid-lowering medications than general practitioners and family physicians (17.6%) and other physicians (15.0%, p < 0.001). These patterns persisted and were statistically significant when multiple potential confounders were accounted for by logistic regression (Table 3).

3-Hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase inhibitors (or statins) were the most commonly used lipid-lowering medication (49.5% of visits by patients taking medications), followed by fibrates (33.7%), resins (12.6%), niacin (11.4%) and probucol (1.6%). Of patients taking medications, 8.3% were taking more than one agent. Multivariate analysis suggested that statin use was more common in patients with cardiovascular disease (adjusted odds ratio [OR] 1.66, 95% CI 1.20 to 2.28), whereas fibrate use was more common in diabetic patients (adjusted OR 1.61, 95% CI 1.05 to 2.45).

For patients with reported hyperlipidemia, we estimated national, population-based rates of screening, counseling and pharmacologic treatment. On the basis of our estimate of 23 million adults with known hyperlipidemia in the United States, we calculate that in this population, cholesterol testing averages 0.42 times per person per year. Cholesterol counseling averages 0.64 episodes per person per year. As described above, lipid-lowering medications are reported in 23.1% of visits by patients with known hyperlipidemia.

New visits and general medical examinations. Analysis of visits for general medical examinations and first visits was undertaken because these visits are more likely to represent self-contained episodes of care. These visits constituted 5.1% of all visits in the United States in 1991 and 1992. For patients without hyperlipidemia, 12.3% of visits had cholesterol screening, and 2.1% received cholesterol counseling. The most consistent predictors of screening and counseling were cardiovascular disease risk factors, private insurance and age 35 to 59 years. For visits by patients with hyperlipidemia, 42% had cholesterol testing, 47% received cholesterol counseling, and 25% were taking lipid-lowering medications. Testing was positively associated with white race and age <35 years. Counseling was associated with nonwhite race, obesity and family physician/general practitioner visits. Lipid-lowering medications were associated with private insurance, hypertension and internist/cardiologist visits. These findings are generally similar to those noted above for all patient visits.

Discussion

Tasks related to cholesterol management play a substantial role in the clinical work of American physicians. Practices relating to cholesterol testing, cholesterol counseling and lipid-lowering medications are influenced by a wide range of clinical and nonclinical factors.

Of >1 billion office visits in 1991 and 1992, 8% involved testing for cholesterol, advice about cholesterol or lipid-lowering medications. These visits imply the investment of substantial resources of physician work, laboratory expenses

and medication costs. However, our estimate that only 1 in 12 patients without known hyperlipidemia is screened annually for cholesterol is well below the 1 in 5 rate expected from the NCEP's guideline of screening every 5 years (9). In addition, our data suggest that patients with hyperlipidemia are counseled about cholesterol reduction at a mean rate of only 34% annually, or once every 3 years. These results suggest that physicians have not fully adopted widely recommended cholesterol management practices. More aggressive screening, counseling and medication treatment for hyperlipidemia would be expected to have substantial benefits in the primary (31) and secondary prevention (32) of cardiovascular disease.

Cholesterol management practices contrast with the more aggressive practices undertaken for hypertension. Data from the 1991 NAMCS indicate that blood pressure measurement was performed in 51% of all physician office visits and that 53% of hypertensive patients were treated with antihypertensive medications (33).

Clinical and demographic determinants of practices. Clinical and demographic factors strongly influence patterns of cholesterol management. As expected, cardiovascular disease or risk factors for cardiovascular disease led to more aggressive practices, consistent with published guidelines (8,9). The presence of cardiovascular disease, diabetes, hypertension and obesity was frequently associated with a greater likelihood of cholesterol management services. However, even with cardiovascular disease, screening and counseling were relatively infrequent.

A surprising finding was that obese patients with hyperlipidemia were less likely to receive cholesterol monitoring and lipid-lowering medications. The 1988 NCEP guidelines (8) (although not the 1993 guidelines [9]) include obesity as a risk factor that should prompt more aggressive therapy. One explanation for the less aggressive treatment of obese patients may be that physicians rely on weight loss, rather than medications, as a primary management strategy. Consistent with this explanation, we found obese hyperlipidemic patients more likely to receive cholesterol counseling than nonobese patients. Smoking had an unexpected lack of association with cholesterol management practices. This pattern suggests that physicians may fail to appreciate the powerful synergistic effect of multiple risk factors and the need for intensive risk factor modification in patients with more than one risk factor (3).

The youngest patients were less aggressively screened. Once diagnosed with hyperlipidemia they were more likely to be counseled but less likely to receive medications. This finding is consistent with reservations expressed regarding the net benefits of long-term medication treatment in younger patients (5). Practices in patients 50 to 69 and >70 years old were similar, although cholesterol management in the elderly remains controversial (34). Gender differences noted in this study were small.

Nonclinical determinants of practices. Variations in cholesterol management practices by payment source, geographic region and physician specialty also raise concerns. Such variations in clinical practice are often assumed to exist but have not

been substantiated on a national basis with adjustment for potential confounders. Most strikingly, we observed that patients with private insurance received more aggressive cholesterol management than patients without private insurance. This finding is consistent with past reports linking lower socioeconomic status to less aggressive management, particularly for costly services (18).

Patients visiting physicians in the Northeast region of the nation also received more aggressive cholesterol management than patients elsewhere. Pilote et al. (35) demonstrated a similar pattern of higher rates of appropriate medication use after myocardial infarction in New England. Internists in the NAMCS sample practiced more aggressively than general practitioners and family physicians, confirming and augmenting a pattern observed for cholesterol testing by Cherkin et al. (17). Possible explanations for these identified variations in clinical practice deserve further attention.

Patterns by race were inconsistent. After controlling for insurance coverage and other potential confounders, whites were more likely to be screened for hyperlipidemia, but nonwhites were more likely to receive cholesterol counseling. Although race did not consistently affect the aggressiveness of cholesterol management, different patterns of care may exist for whites and nonwhites.

Use of statins or fibrates were reported in 83.2% of the visits by patients taking lipid-lowering medications. However, the 1988 NCEP lists resins and niacin as the drugs of first choice (8). Current guidelines (9) continue to favor resins and niacin, although less strongly. Patterns of medication use may reflect both physician prescribing behavior as well as differential rates of medication discontinuation (36).

Study limitations. The NAMCS data have several limitations. Although this analysis is based on a representative, national sample of office-based practices, it is not possible to determine appropriateness or specific content of these practices. In particular, the nature of reported cholesterol counseling may vary between patients or physicians. As a cross-sectional survey, screening and counseling services have been evaluated on the basis of visits rather than for patients over time. Although patients seen more frequently may be less likely to receive services in any single visit, our analysis of visits by new patients and visits for general medical examinations suggests that this bias is unlikely to alter our findings substantially. The observed prevalence of several cardiovascular disease risk factors is lower than that reported elsewhere, suggesting that physicians are either unaware of their presence or incompletely report them. Combining NAMCS and NHANES III data also has potential drawbacks. Our estimated screening and counseling rates may underestimate actual rates, because nonphysician and community services are not included in NAMCS. However, the importance of physicians in coordinating cardiovascular disease prevention suggests the validity of focusing on physician office-based services.

Conclusions. The critical importance of cardiovascular disease demands that effective prevention strategies be utilized uniformly. Primary and secondary prevention of cardiovascular

disease through screening and treatment of hyperlipidemia is a crucial but underutilized clinical approach. These national data on cholesterol management suggest that appropriate clinical and demographic factors play a role in shaping physician practices. However, our analysis simultaneously raises concerns about the role of nonclinical factors, particularly payment source, geographic region and physician specialty. Variations in these factors reflect potential barriers to the adoption of recommended practices and warrant further investigation and explanation.

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