Use of Cholesterol-Lowering Therapy by Elderly Adults After Myocardial Infarction

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Background: Use of cholesterol-lowering drugs reduces mortality and adverse cardiac events among people aged 65 to 75 years with coronary heart disease, but previous studies have shown that most patients have not received this treatment.

Methods: We conducted a telephone survey during 1999 and 2000 of 815 Medicare beneficiaries aged 65 to 74 years hospitalized for an acute myocardial infarction in California, Florida, Massachusetts, New York, or Pennsylvania during 1994 and 1995. Outcome measures included use of cholesterol-lowering drugs, beliefs about the importance of lowering cholesterol levels, and knowledge of personal cholesterol levels, adjusting for demographic and clinical factors using logistic regression.

Results: Among respondents, 59.4% reported taking a cholesterol-lowering drug, but most were not aware of potential adverse effects. In adjusted analyses, drug treatment was significantly more common among women, patients aged 65 to 69 years, and those who reported that a cardiologist was mainly responsible for their cholesterol management. Lowering cholesterol levels was viewed as “very important” by 77.2% of respondents, but significantly less often by men, older patients, and those with diabetes mellitus or congestive heart failure. Only 33.1% of respondents knew their cholesterol level, and this knowledge was significantly less common among black patients and those with diabetes mellitus or congestive heart failure.

Conclusions: Use of cholesterol-lowering drugs was much greater than in previous studies of elderly patients after myocardial infarction, demonstrating increased attention to secondary prevention. However, most patients were unaware of their cholesterol level or potential adverse effects of drug treatment, indicating that they may benefit from greater education about cholesterol testing and treatment.

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PATIENTS AND METHODS

STUDY POPULATION

The study population was identified from the Cooperative Cardiovascular Project (CCP), a national program conducted by the Health Care Financing Administration in collaboration with peer review organizations in each state to assess the quality of AMI care for approximately 225,000 elderly Medicare beneficiaries hospitalized during 1994 and 1995.11 Medicare patients hospitalized with a principal diagnosis of AMI within an 8-month period at each hospital were eligible for the CCP. Because Medicare beneficiaries enrolled in health maintenance organizations (HMOs) were underrepresented in the CCP, the US General Accounting Office (GAO) conducted a related project under the auspices of the CCP to evaluate the AMI care of an additional random sample of 8,476 Medicare HMO enrollees.13,14

We studied 3 geographically diverse regions—California, Florida, and the 3 northeastern states of Massachusetts, New York, and Pennsylvania—that had substantial numbers of Medicare patients receiving care from fee-for-service (FFS) and HMO providers. We focused on patients aged 65 to 74 years at the time of their AMI because randomized clinical trials4–7 have demonstrated the benefits of cholesterol-lowering therapy in this age range. Based on Health Care Financing Administration administrative records, we identified patients hospitalized for an AMI for at least 4 consecutive days between July 1, 1994, and June 30, 1995, who were alive as of July 1, 1998, and who were residing in the United States. From the CCP and GAO cohorts, we identified 9,835 FFS patients and 1,746 HMO patients aged 65 to 74 years who met these criteria. To obtain an initial sample of approximately 2,600 patients with equal numbers of FFS and HMO enrollees, we matched 1,297 patients from each group (FFS and HMO) by region (California, Florida, or Massachusetts/New York/Pennsylvania), sex, age (within 1 year), and month of AMI hospital admission (within 1 month) to control for demographic and temporal trends in AMI care.

All 2,594 patients were contacted about the survey with an initial letter of introduction in English and Spanish from the administrator of the Health Care Financing Administration describing the purpose and the voluntary, confidential nature of the survey. Patients subsequently received a letter from one of us (J.Z.A.) inviting their participation in the telephone interview, and nonrespondents received an additional letter reiterating this invitation. During administration of the survey, we excluded individuals who did not have valid address or telephone information, had mental or physical impairments that precluded participation in a telephone interview, did not speak English or Spanish, or were residing in a nursing home or outside the United States. The study protocol was approved by the Human Studies Committee of Harvard Medical School and as a federal Cooperative Research and Development Agreement between Harvard Medical School (Boston, Mass), Merck & Co Inc (Whitehouse Station, NJ), and the Agency for Healthcare Research and Quality (Rockville, Md).

PATIENT SURVEY

We designed a telephone survey to assess patients’ use of cholesterol-lowering drugs, dietary changes, and their beliefs about cholesterol management, including risks of drug therapy. The survey asked patients about their most recent total cholesterol measurement (“When was your blood last tested for the following types of cholesterol, if you can recall?”) and “What was the result of this blood test, if you can recall?” and how much information (a lot, some, a little, or none) they had received from multiple sources about dietary changes and drug therapy to lower their cholesterol level. Other survey questions elicited patients’ racial and ethnic background, income, education, marital status, employment status, current enrollment in an HMO or Medicaid, prescription drug benefits, current smoking status, and overall health.

RESULTS

PATIENT CHARACTERISTICS

In the matched random sample of 2,594 potentially eligible patients, 114 were deceased at the time of survey contact, 682 did not have valid address or telephone information in the Health Care Financing Administration records, 199 had mental or physical impairments that precluded interviewing, 31 did not speak English or Spanish, 18 were residing in a nursing home, and 3 were not residing in the United States. Of the remaining 1,547 patients eligible for our survey, 815 (52.7%) completed the telephone interview, 606 (39.2%) refused or terminated the interview, and 126 (8.1%) could not be interviewed despite multiple attempts.

Interviews were completed with 404 FFS patients and 411 HMO patients based on type of Medicare coverage during the month of their AMI, and the response rates were similar for each group (51.3% vs 53.9%; P = .30).

The median interval from AMI hospitalization to completion of the interview was 56.0 months for FFS patients and 56.6 months for HMO patients, with a range of 51 to 69 months for each group. Patients who responded to the telephone interview were slightly younger than nonrespondents at the time of their AMI (mean age, 69.4 vs 69.7 years; P = .05) and were less likely to have diabetes mellitus (20.6% vs 27.2%; P = .002) or cerebrovascular disease (5.2% vs 8.7%; P = .005). Respondents and nonrespondents did not differ significantly by sex, race, receipt of revascularization procedures, or proportions with hypertension or congestive heart failure (P > .10 for all).

Demographic and clinical characteristics of the 815 patients who responded are given in Table 1. Among these patients, 73.2% reported that they had been “diagnosed as having a high cholesterol level” by a physician, and 66.7% had changed their diet “some” or “a lot” to reduce their cholesterol level. Nearly three quarters of patients (71.6%) reported that the physician mainly responsible for their cardiac care explained test indica-
The telephone survey was administered in English or Spanish by trained interviewers from a professional survey firm between May 15, 1999, and May 9, 2000. Eligible patients provided oral consent at the start of the interview. Interviewers made at least 10 attempts during a 4-week period to contact patients, and patients could also call a toll-free number to participate. Survey supervisors periodically monitored telephone interviews to maintain the quality of data collection.

CLINICAL DATA

For the CCP and GAO, trained abstracters collected detailed clinical data from patients' medical records of their AMI hospitalizations, as previously described.13,14 These data included comorbid illnesses, severity and complications of the AMI, and use of coronary revascularization procedures (angioplasty or bypass surgery). Use of cholesterol-lowering drugs at hospital discharge was recorded for CCP patients in our cohort (n=604) but not for GAO patients. Cholesterol measurements were not abstracted from hospital records for the CCP or GAO. The quality of data from hospital records was monitored through random reabstractions. The interrater reliability of hospital data was very good, with agreement on clinical measures exceeding 90% (κ=0.72-0.88).15 Overall variable agreement averaged 95%.12

DATA ANALYSIS

We compared the demographic and clinical characteristics of respondents and nonrespondents to our telephone survey with CCP data using the t test for continuous variables and the Pearson χ² test for categorical variables. Based on standard clinical classifications, we categorized cholesterol-lowering drugs reported by survey respondents as statins or other agents ( bile acid sequestrants, clofibrate, niacin, or probucol). Awareness of personal cholesterol levels was demonstrated by respondents who reported that their total cholesterol level had been tested within the previous 2 years and that they could recall the result.

USE OF CHOLESTEROL-LOWERING DRUGS

Among survey respondents from the CCP, 11.8% were prescribed a cholesterol-lowering drug when discharged from the hospital after their AMI, and 58.9% reported taking a cholesterol-lowering drug when surveyed approximately 5 years later. Among all respondents, 59.4% reported taking a cholesterol-lowering drug when surveyed, including 48.3% taking a statin drug alone, 8.6% taking another agent, and 2.3% taking both a statin and another class of drug. Rates of cholesterol-lowering drug use were 73.1% among patients who reported that they had been diagnosed as having an elevated cholesterol level and 22.8% among those who did not report this diagnosis. In unadjusted analyses (Table 2), drug therapy was more common among women, patients aged 65 to 69 years, white patients, those with higher incomes or more education, those reporting better health, and those reporting that a cardiologist was responsible for their cholesterol management. Rates of cholesterol-lowering drug therapy were almost identical between patients receiving FFS care and those enrolled in an HMO at the time of our survey, as well as in the 3 regions we studied. In adjusted analyses (Table 3), drug therapy was significantly more common among women, patients aged 65 to 69 years, and patients who reported that a cardiologist was primarily responsible for their cholesterol management.

Sources of information about cholesterol-lowering drugs and diet are depicted in the Figure. Primary care physicians, cardiologists, and brochures or other read-
ing materials were the most common sources of information, followed by nurses, nutritionists, and advertisements. Computers and the Internet were rarely sources of information in this cohort. Only 23.7% of patients were aware that cholesterol-lowering drugs can cause hepatitis, and only 4.0% were aware that these drugs can cause muscle damage.

**BELIEFS ABOUT LOWERING CHOLESTEROL LEVELS**

Of all respondents, 77.2% believed that lowering cholesterol levels was very important after AMI to reduce the chance of experiencing another MI. In unadjusted analyses (Table 2), this belief was more common among women, patients aged 65 to 69 years, and those who did not have congestive heart failure or diabetes mellitus. Other demographic and clinical factors were not signifi-
cantly associated with the belief that lowering cholesterol levels was very important. In adjusted analyses (Table 3), men, patients aged 70 to 74 years, and those with diabetes mellitus or congestive heart failure were significantly less likely than other patients to report this belief.

**KNOWLEDGE OF PERSONAL CHOLESTEROL LEVELS**

Only one third of respondents (33.1%) knew the results of their own cholesterol test conducted within the previous 2 years. In unadjusted analyses (Table 2), awareness of personal cholesterol levels was higher among patients who were white, married, nonsmokers, or in better health; those without Medicaid coverage, diabetes mellitus, or congestive heart failure; and those with higher incomes, higher educational levels, or a cardiologist or other specialist responsible for their cholesterol management. There were no subgroups, however, in which at least half of the patients knew their cholesterol level. In adjusted analyses (Table 3), knowledge of personal cholesterol levels was less common among black patients, and those with diabetes mellitus or congestive heart failure relative to other patients.

### Table 3. Adjusted Predictors of Patients’ Use of Cholesterol-Lowering Drugs and Related Beliefs After Myocardial Infarction*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Taking a Cholesterol-Lowering Drug</th>
<th>View Cholesterol-Lowering as “Very Important”</th>
<th>Aware of Personal Cholesterol Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 65-69 y (vs 70-74 y)</td>
<td>1.4 (1.0-1.9)†</td>
<td>1.5 (1.1-2.1)†</td>
<td>1.2 (0.9-1.6)</td>
</tr>
<tr>
<td>Female (vs male)</td>
<td>1.8 (1.3-2.6)†</td>
<td>1.6 (1.0-2.5)†</td>
<td>1.3 (0.9-1.8)</td>
</tr>
<tr>
<td>Region of residence (vs Northeast)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>California</td>
<td>1.1 (0.8-1.6)</td>
<td>1.2 (0.8-1.9)</td>
<td>0.9 (0.6-1.3)</td>
</tr>
<tr>
<td>Florida</td>
<td>1.1 (0.7-1.6)</td>
<td>0.9 (0.6-1.4)</td>
<td>0.7 (0.5-1.1)</td>
</tr>
<tr>
<td>Race/ethnicity (vs white)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.5 (0.2-1.2)</td>
<td>2.9 (0.8-10.5)</td>
<td>0.1 (0.0-0.7)†</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.6 (0.2-1.3)</td>
<td>1.3 (0.5-3.2)</td>
<td>0.7 (0.3-1.6)</td>
</tr>
<tr>
<td>Other</td>
<td>0.6 (0.2-1.7)</td>
<td>0.5 (0.1-1.4)</td>
<td>0.6 (0.2-2.0)</td>
</tr>
<tr>
<td>Household income, $ (vs $25 000-$49 999)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;12 000</td>
<td>0.7 (0.4-1.2)</td>
<td>1.4 (0.7-2.6)</td>
<td>0.9 (0.5-1.6)</td>
</tr>
<tr>
<td>12 000-24 999</td>
<td>0.6 (0.4-1.0)</td>
<td>1.0 (0.6-1.7)</td>
<td>1.1 (0.7-1.8)</td>
</tr>
<tr>
<td>≥50 000</td>
<td>0.7 (0.4-1.2)</td>
<td>1.0 (0.5-1.8)</td>
<td>1.2 (0.7-1.9)</td>
</tr>
<tr>
<td>Education (vs college graduate)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not a high school graduate</td>
<td>0.7 (0.4-1.2)</td>
<td>1.4 (0.8-2.7)</td>
<td>0.6 (0.3-1.0)</td>
</tr>
<tr>
<td>High school graduate</td>
<td>0.9 (0.6-1.4)</td>
<td>1.0 (0.6-1.6)</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Married (vs not married)</td>
<td>1.3 (0.9-1.9)</td>
<td>1.2 (0.8-1.9)</td>
<td>1.4 (1.0-2.1)</td>
</tr>
<tr>
<td>Employed (vs not employed)</td>
<td>1.2 (0.7-2.1)</td>
<td>0.9 (0.5-1.7)</td>
<td>0.8 (0.5-1.3)</td>
</tr>
<tr>
<td>Current smoker (vs former smoker or nonsmoker)</td>
<td>0.8 (0.4-1.7)</td>
<td>0.5 (0.2-1.1)</td>
<td>0.6 (0.2-1.5)</td>
</tr>
<tr>
<td>Fair or poor health (vs excellent, very good, or good)</td>
<td>0.8 (0.6-1.1)</td>
<td>0.8 (0.6-1.2)</td>
<td>0.9 (0.7-1.3)</td>
</tr>
<tr>
<td>Coronary revascularization procedure at time of myocardial infarction (vs no procedure)</td>
<td>1.1 (0.8-1.5)</td>
<td>0.9 (0.6-1.3)</td>
<td>1.2 (0.9-1.7)</td>
</tr>
<tr>
<td>Physician responsible for cholesterol management (vs internist/family physician)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiologist</td>
<td>1.5 (1.1-2.2)†</td>
<td>1.2 (0.8-1.9)</td>
<td>1.3 (0.9-1.9)</td>
</tr>
<tr>
<td>Other specialist</td>
<td>0.8 (0.3-2.2)</td>
<td>5.6 (0.7-43.1)</td>
<td>1.6 (0.6-4.3)</td>
</tr>
<tr>
<td>Health maintenance organization enrollee</td>
<td>1.1 (0.8-1.6)</td>
<td>0.9 (0.6-1.3)</td>
<td>1.2 (0.8-1.7)</td>
</tr>
<tr>
<td>Medicaid enrollee</td>
<td>0.9 (0.6-1.3)</td>
<td>1.3 (0.8-2.2)</td>
<td>0.7 (0.4-1.2)</td>
</tr>
<tr>
<td>Prescription drug benefit</td>
<td>1.2 (0.7-1.8)</td>
<td>1.0 (0.6-1.7)</td>
<td>0.8 (0.5-1.3)</td>
</tr>
<tr>
<td>Comorbid conditions (present vs not present)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>0.9 (0.6-1.3)</td>
<td>0.6 (0.4-1.0)†</td>
<td>0.5 (0.3-0.8)†</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.1 (0.8-1.4)</td>
<td>1.2 (0.8-1.7)</td>
<td>1.2 (0.9-1.7)</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.0 (0.7-1.4)</td>
<td>0.6 (0.4-0.9)†</td>
<td>0.7 (0.4-1.0)†</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>1.2 (0.6-2.3)</td>
<td>0.9 (0.4-1.9)</td>
<td>1.0 (0.5-2.1)</td>
</tr>
</tbody>
</table>

*Three separate logistic regression models were used to simultaneously adjust for all listed variables in predicting the dependent variable specified at the top of each column. CI indicates confidence interval.
†P =< .05.
In this survey of elderly patients who had survived an MI in 3 different areas of the United States, nearly 60% were taking a cholesterol-lowering drug approximately 5 years later. This proportion using drug therapy in 1999 and 2000 was substantially higher than the 12% in our cohort prescribed a cholesterol-lowering drug at discharge in 1994 and 1995, or the 29% using cholesterol-lowering drug therapy (37% for those aged 65-74 years and 17% for those aged 75-84 years) in another cohort of elderly patients after AMI from the same geographic areas surveyed in 1996. This rate was also much higher than in the 4 communities of the Cardiovascular Health Study, in which only 18% of adults aged 67 to 75 years with coronary heart disease were using a cholesterol-lowering drug during 1995 and 1996. Similar increases in the use of cholesterol-lowering drugs have been reported after AMI for patients 70 years and younger in 9 European countries, increasing from 31% in 1995-1996 to 64% in 1999-2000. Together, these findings suggest that promotional efforts since 1996, such as AMI guidelines for physicians, public and professional educational campaigns, and advertisements, have been effective in substantially increasing the use of cholesterol-lowering drugs among elderly patients after AMI.

Although we did not have access to patients’ actual cholesterol measurements in our study, the proportion of patients undergoing drug therapy was similar to the approximately 60% who had elevated low-density lipoprotein cholesterol levels (≥130 mg/dL, ≥3.36 mmol/L) among people aged 65 to 74 years with coronary heart disease in the Third National Health and Nutrition Examination Survey. Other investigators have also suggested a target rate of 60% for use of cholesterol-lowering statin drugs among elderly patients after AMI. Thus, a reasonably appropriate proportion of respondents to our survey reported using cholesterol-lowering drugs during 1999. Future studies should assess whether elderly patients using these drugs and those who are not undergoing drug therapy have achieved target low-density lipoprotein cholesterol levels of less than 100 mg/dL (<2.59 mmol/L) as recommended by the NCEP.

A somewhat surprising finding in our survey was that women were more likely than men to report use of cholesterol-lowering drugs, in contrast to previous studies that have demonstrated greater use of invasive procedures among men with coronary heart disease or AMI. Our finding may reflect higher serum cholesterol levels among elderly women than men or greater awareness about the importance of lowering cholesterol levels among women, as we found in our survey.

More than three quarters of the elderly patients in our survey viewed lowering their cholesterol level as very important. Patients tended to receive information about dietary changes and drugs to lower cholesterol levels from a range of sources, particularly primary care physicians, cardiologists, and brochures or other written materials. Advertisements provided some or a lot of information about drug treatment for one quarter of the patients, reflecting the increasing role of direct consumer advertising by pharmaceutical companies and educational campaigns by other organizations such as the NCEP. In our elderly cohort surveyed during 1999 and 2000, computers and the Internet were not yet major sources of information about lowering cholesterol levels, but their role may increase in coming years.

One concerning finding was that only one third of the patients had knowledge of their cholesterol level from a test conducted within the previous 2 years. The NCEP has recommended that Americans know their cholesterol levels, and this awareness may promote greater adherence to cholesterol-lowering diets and drug therapy. Very few black patients, in particular, were aware of their cholesterol level, and patients with diabetes mellitus or congestive heart failure were less likely than other patients to be aware of their cholesterol level or to recognize the importance of lowering their cholesterol level. Most patients were also unaware of the potential adverse hepatic or muscle effects of cholesterol-lowering drugs, and only about half of the patients reported that their physician explained the benefits and adverse effects of drugs very well. These findings indicate ample opportunities for more effective counseling of patients by physicians, nurses, and pharmacists regarding cholesterol management.

A strength of our study was that we assessed a representative sample of Medicare patients who were receiving FFS or HMO care in 3 distinct geographic regions of the United States, thereby enabling us to evaluate variations in cholesterol management by type of insurance and region. A previous study demonstrated differences between FFS and HMO care in the use of coronary angiography during the initial hospitalization of Medicare patients for AMI. However, we found no difference in the proportions of FFS or HMO patients who were taking a cholesterol-lowering drug, viewed cholesterol lowering as very important, or were aware of their personal cholesterol level. We also found no significant difference in the use of cholesterol-lowering drugs in the 3 regions we studied, in contrast to a previous study in which elderly post-AMI patients in California were more likely than those in Massachusetts, New York, and Pennsylvania to be receiving cholesterol-lowering drugs during 1996.

Our study has several limitations. Patients who responded to our survey were slightly younger and less likely to have diabetes mellitus or cerebrovascular disease than were nonrespondents, and respondents may have been more interested in cholesterol-lowering therapy. We did not have access to patients’ actual cholesterol test results, so we could not evaluate whether they had achieved low-density lipoprotein cholesterol levels less than 100 mg/dL (<2.59 mmol/L), consistent with NCEP guidelines. Many patients receiving cholesterol-lowering drugs may not be achieving these targets. Most patients could not recall their personal cholesterol level, but some may have known whether it was elevated or not and incorporated this perception into their decisions about cholesterol-lowering diets and drug therapy.

In conclusion, the results of our study demonstrate that use of cholesterol-lowering drugs among elderly adults who have survived an AMI has substantially increased in recent years. Although most patients recog-
nized the importance of cholesterol-lowering therapy, many patients were not aware of their personal cholesterol levels or of the risks of taking cholesterol-lowering drugs. We found no difference in the use of cholesterol-lowering drugs for Medicare beneficiaries under FFS or managed care or in 3 regions of the United States, but these drugs were used more often by patients who reported that a cardiologist was responsible for their cholesterol management. Future studies should assess these and other health system characteristics that promote the appropriate use of cholesterol-lowering drugs for elderly patients who are likely to benefit from them.

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