OBJECTIVE — To identify factors related to lipid testing among patients with diabetes who receive diabetes care from primary care physicians.

RESEARCH DESIGN AND METHODS — North Carolina Medicare claims were used to identify individuals with diabetes who received diabetes care from primary care physicians. Lipid testing was related to sociodemographic characteristics, comorbid conditions, physician specialty, and mortality.

RESULTS — Based on Medicare claims from July 1997 through June 1999, 13,660 diabetic North Carolina residents with Medicare, 65–75 years of age, had received HbA1c testing from a single primary care physician during at least three of four consecutive 6-month time intervals. During these 2 years, 31% had no lipid profile and 24% had only one lipid profile. Caucasians were 1.6 times more likely to receive lipid profiles. Those not receiving state Medicare assistance were 1.4 times more likely to have a lipid profile than the presumably lower-income patients receiving assistance. Patients with stroke and heart failure were less likely to receive lipid profiles. Those with no lipid profile were almost twice as likely to die from cardiovascular disease than those with at least two lipid profiles.

CONCLUSIONS — Adherence to lipid testing recommendations by primary care physicians for elderly patients with diabetes has much room for improvement. The most vulnerable patients (African Americans, the economically disadvantaged, and the medically complex) are the least likely to receive lipid testing.

Diabetes Care 26:1369–1373, 2003

Diabetes is a major public health problem, especially among older individuals, African Americans, and those enrolled in Medicare (1–4). Individuals with diabetes are at high risk for dyslipidemia, cardiovascular disease (CVD), and mortality (5). Nevertheless, lipid testing rates among individuals with diabetes have been far less than ideal (3,7).

In this report, we evaluate adherence to lipid testing recommendations and identify factors associated with lipid undertesting in a population receiving outpatient medical care and routine determination of HbA1c levels. We conducted our analyses on individuals with documented routine use of outpatient services for diabetes in order to focus on characteristics of physicians and the patients they serve rather than factors related to poor access to outpatient medical services.

RESEARCH DESIGN AND METHODS — Medicare enrollees with diabetes, their medical care, and the physicians who treated them were identified using Medicare claims from July 1997 through June 1999. Diabetes was defined based on Medicare claims during the most recent year by 1) at least one acute diabetes encounter determined by an inpatient or emergency department claim representing a face-to-face physician-patient encounter with a principal or secondary diagnosis of diabetes or 2) at least two nonacute encounters occurring at least 7 days apart as determined from hospital outpatient, physician office, durable medical equipment, home health agency, or skilled nursing facility claims for face-to-face encounters with a diagnosis of diabetes. North Carolina residents 65–75 years of age, not enrolled in managed care, with continuous Medicare Part B (outpatient) coverage, and alive through June 1999 were included.

Physicians and their specialties were identified from unique physician identification numbers (UPIN) recorded on Medicare claims. Diabetes primary care physicians were defined as medical doctors specializing in family medicine, inter-
Lipid testing and diabetes

The objective of this study was to examine lipid testing among diabetic patients who receive good continuity of care for diabetes from primary care physicians. Our analyses were restricted only to patients receiving HbA1c testing from a single primary care physician in at least three of four consecutive semiannual (6-month) time periods, and at least one HbA1c test must have occurred in the first 6 months. These criteria approach the American Diabetes Association recommendation of a minimum of one HbA1c test every 6 months (8). HbA1c tests received from physicians in specialties other than primary care were not considered when determining patient inclusion into this study.

Lipid profiles were identified from coded information on Medicare claims and were counted regardless of whether the claim was associated with the diabetes primary care physician. Specifically, lipid profiles were identified by current procedural terminology (CPT) codes 80061 (lipid panel) alone or the presence of 82465 (total cholesterol), 83718 (HDL-Cholesterol), and 84478 (triglycerides) on the same date (9). Lipid profile was chosen as the appropriate indicator of diabetes care for consistency with American Diabetes Association clinical practice recommendations (5).

Comorbid conditions were identified using disease-specific diagnosis codes from inpatient and outpatient Medicare claims for services provided during the 2-year period. A positive medical history for each selected condition was conservatively defined as the presence of disease-specific diagnosis codes in one or more Medicare claims occurring in at least 3 months of the 24-month study period.

The Medicare denominator file provided demographic information including race, sex, and date of birth. Low-income Medicare beneficiaries are eligible to receive state assistance with Medicare Part B premiums. These individuals are commonly referred to as dual eligible and were identified in the Medicare denominator file. In this study, we considered dual eligible status to be a crude indicator of low socioeconomic status. Patients receiving state assistance with Medicare premiums during any month from 1997 through 1999 were defined as dual eligible.

North Carolina state death certificate data from the North Carolina Center for Health Statistics were linked to Medicare claims to identify the underlying cause of death for individuals who died during the 18-month time period from July 1999 through December 2000.

RESULTS — Meeting the above criteria were 13,660 North Carolina residents with Medicare and diabetes 65–75 years of age receiving relatively routine diabetes care and minimally adequate HbA1c testing from a primary care physician. Slightly over half were women (Table 1). Consistent with the demographic characteristics of older North Carolina residents, Caucasians and African Americans accounted for ~99% of the study population, with the latter representing almost a quarter. Approximately one-fifth of the overall population was dual eligible. Within 18 months following the measurement period, 7% had died. The percentages of individuals who were African American, dual eligible, or subsequently died were inversely related to the number of lipid profile claims. These diabetic patients experienced high rates of cardiovascular comorbid conditions, especially coronary heart disease and hypertension. Patients with two or more lipid profile claims were over twice as likely to have coronary heart disease than those with no lipid profile claims.

A total of 1,749 diabetes primary care physicians (not shown) provided care for these patients. Of these physicians, 51, 43, 9, and 3% practiced internal medicine, family medicine, general practice, and endocrinology, respectively. Some physicians practiced in more than one of these primary care specialties. These physicians treated from 1 to 135 of these patients. Of these physicians, 53% provided diabetes primary care to the African-American patients included in this study.

Most of the patients in this study received diabetes primary care from family medicine and internal medicine special-

| Table 1—Characteristics of diabetic North Carolina residents 65–75 years of age with Medicare receiving routine HbA1c testing from a single primary care physician for the entire population and stratified by the number of lipid profiles received* |
|-----------------|------------|---------|---------|---------|
| Population characteristics stratified by the number of lipid profile claims* |
| n               | None      | One     | Two or more |
| All             | 13,660    | 4,234   | 3,331    | 6,095   |
| Women           | 55        | 56      | 54       | 54      |
| African American| 22        | 30      | 22       | 17      |
| Caucasian       | 77        | 69      | 77       | 82      |
| Age 65–70 years | 47        | 44      | 48       | 49      |
| Dual eligible   | 21        | 27      | 20       | 17      |
| Died in 18 months| 7         | 9       | 6        | 5       |
| Comorbidities   |           |         |          |         |
| Coronary heart disease | 24    | 15      | 20       | 32      |
| Heart failure   | 12        | 12      | 10       | 13      |
| Stroke          | 9         | 9       | 8        | 8       |
| Hypertension    | 66        | 64      | 66       | 67      |
| Primary care specialty |     |         |          |         |
| Family medicine | 36        | 36      | 34       | 35      |
| Internal medicine | 58      | 57      | 59       | 59      |
| General practice | 9        | 9       | 9        | 9       |
| Endocrinology   | 7         | 7       | 7        | 7       |
| Medical care (mean)† |    |         |          |         |
| Nonacute diabetes encounters | 8.9     | 9.0     | 8.7      | 9.0     |
| Acute diabetes encounters | 0.9     | 1.0     | 0.8      | 0.8     |
| HbA1c tests     | 5.5       | 5.3     | 5.3      | 5.7     |

*All values are a percent of the column-specific n unless otherwise specified. †Mean number of months during this 24-month period with at least one nonacute face-to-face physician-patient encounter for diabetes, at least one acute face-to-face physician-patient encounter for diabetes, or at least one HbA1c test.
ties (Table 1). Nonacute physician-patient face-to-face encounters for diabetes were identified during 9 of the 24 months, and acute encounters for diabetes were identified during 1 of the 24 months, on average. The acute encounter rate for those without lipid profile claims was slightly higher than that for those with lipid profile claims. On average, patients had claims for HbA1c tests in ~5 of the 24 months. The average months with HbA1c claims was slightly higher for patients with the highest lipid testing rates than for those with no lipid testing.

Overall, lipid profiles were identified for ~69% of the patients. During these 2 years, 31% had no lipid profile and 24% had only one lipid profile. The 2-year lipid profile rate was consistently lower for African Americans compared with Caucasians, regardless of age or dual eligible status (Fig. 1). This rate was also lower for older (71–75 years) than for younger (65–70 years) age-groups and lower for dual eligible individuals than for those not so defined. Younger Caucasians who were not dual eligible had the highest 2-year lipid profile rate (75%), and older dual eligible African Americans had the lowest rate (52%).

Simultaneously controlling for sociodemographic characteristics, selected comorbid conditions, physician specialty, and indicators of medical care in logistic regression, characteristics associated with receiving at least one lipid profile claim during the 24-month measurement period are presented in Table 2. Women were ~15% more likely than men, and younger individuals (65–70 years) were ~22% more likely than the older individuals (71–75 years), to have claims for lipid profiles. Caucasians were 1.6 times more likely to have claims for a lipid profile compared with their African-American counterparts. Individuals not dual eligible were 1.4 times more likely to have lipid testing than dual eligible individuals. Individuals with coronary heart disease or hypertension were more likely to have a lipid profile than those without these conditions. In contrast, individuals with heart failure and stroke were less likely to have lipid profiles. Physician specialty was weakly or not at all related to lipid profiles. Internal medicine physicians were slightly more likely to provide lipid profiles than physicians of other primary care specialties. Lipid profiles were also directly related to fewer acute physician-patient encounters and more frequent HbA1c testing.

During the 18 months subsequent to the 24-month claims measurement period, individuals with a single lipid profile during the measurement period, compared with none, were less likely to die due to any cause, CVD, heart disease, and diabetes (Table 3). In contrast, a single lipid profile, compared with none, had negligible impact on the risk of cancer death. The risks of death due to any cause, CVD, and heart disease were reduced even further with additional lipid testing. Patients without a lipid profile were 2.3 times more likely to die from CVD and 2.0 times more likely to die from heart disease than patients with claims for two or more lipid profiles.

**CONCLUSIONS** — In this population of elderly patients receiving relatively good continuity of care for diabetes from a primary care physician, adherence to lipid testing recommendations was far from ideal. The failure to receive appropriate lipid testing in this setting is puzzling, considering that these patients received HbA1c testing at rates approaching recommended levels. The most vulnerable patients (i.e., African American, dual eligible, and medically complex) were the least likely to receive lipid testing. Presumably, lack of access to diabetes primary care can be ruled out as a barrier to lipid testing in this population. Given that these patients received at least minimally appropriate testing for hyperglycemia, what barriers may have prevented them from obtaining testing for dyslipidemia?

Our findings that race, socioeconomic status, and comorbid conditions...
are associated with lipid testing may provide some insight in addressing the above question. Racial and ethnic disparities in health and health care are well known and are thought to occur for a variety of reasons. Within the Medicare population, Chin et al. (10) found that African Americans with diabetes were more likely to receive care from emergency rooms and had fewer physician visits per year than Caucasians with diabetes. This may suggest that racial disparities in lipid testing can, at least partially, be explained by access barriers to effective outpatient diabetes primary care. Nevertheless, even after controlling for lack of access (through exclusion) and for the numbers of physician-patient encounters (through multivariate regression), we found that substantial racial disparities in lipid testing persist.

Gornick et al. (11) have shown that among individuals insured through Medicare, income was an important determinant in the use of medical services for both Caucasians and African Americans. This is consistent with our findings that economically disadvantaged dual eligible individuals were less likely to receive lipid testing. The substantial racial disparities that remain after controlling for dual eligible status may, in part, be due to the crude nature of dual eligibility as a socioeconomic indicator. Nevertheless, it is likely that the marked lipid undertesting of African Americans compared with Caucasians may be explained by multiple factors in addition to income.

Failure to provide lipid testing in the outpatient setting may be related to the absence of or deficiencies in office-based systems used to manage diabetic patients. Physician self-reported reasons for failure to adhere to diabetes care recommendations were classified by Mottur-Pilson et al. (12) into categories such as oversight, system issues, patient nonadherence, and conscious decision. The most common reason for failure to adhere to lipid testing guidelines was reported to be oversight. This is consistent with our findings that patients with complex comorbid conditions, such as stroke and heart failure, are less likely to receive lipid testing. That is, lipid testing may be more likely overlooked in the management of medically complex patients. This may partially explain undertesting among African Americans, who typically experience relatively high rates of diabetes complications compared with Caucasians (13). Multiple resource-intensive comorbid conditions may compete with lipid testing as a clinical priority for physicians treating these patients.

Effective office-based disease management systems focused on diabetes quality improvement may reduce the likelihood of lipid testing being simply overlooked. A number of quality improvement projects implemented in the outpatient setting have resulted in significant improvements in measures of diabetes care (14,15). Sidorov et al. (16) demonstrated within a health maintenance organization that patients participating in a diabetes disease-management program experienced higher rates of adherence to lipid testing recommendations and reduced health care costs than those not participating. Montori et al. (17) found that planned care and a diabetes electronic management system implemented as part of the Mayo Health System Diabetes Translation Project resulted in improved lipid management.

Thus, there are documented and proven techniques for improving diabetes care. The challenge is to disseminate these systematic approaches to quality improvement, while constantly monitoring and adapting them to the dynamic health care environment. The Centers for Medicare & Medicaid Service (CMS) includes diabetes quality improvement in its Health Care Quality Improvement Program (18). This program focuses on the Medicare population nationwide and is implemented at the state level by non-profit Quality Improvement Organizations. These organizations participate in a variety of quality improvement projects at the level of the patient, physician, hospital, and community in collaboration with other organizations sharing similar goals. Baseline findings during the late 1990s from the program revealed that lipid testing rates among diabetic individuals with Medicare had much room for improvement (3). CMS and its Quality Improvement Organizations also work together on state-specific projects to reduce disparities in health care, including those that specifically target diabetes (18).

A unique feature of this study was the linkage of Medicare claims to state death certificates. This enabled us to relate cause-specific mortality with lipid testing. To our knowledge, this has not been done in similar studies using Medicare claims.

Our findings of inverse relations between the number of lipid profiles and the risk of death may have multiple explanations. For example, these relationships may occur under circumstances where patients with severe and complex comorbid conditions are less likely to receive lipid testing than healthier patients. This explanation is consistent with our findings of reduced lipid testing among those experiencing relatively high cancer death rates. Another possible explanation is that lipid testing leads to lipid treatment, resulting in reduced mortality specific to CVD causes. This explanation is consistent with our finding of stronger associations between lipid testing and CVD-related mortality compared with associations between lipid testing and cancer mortality. A thorough evaluation of the specific pathways linking lipid testing to mortality was not feasible in our study due to the
limitations of Medicare claims data, which do not provide relevant intervening measures related to health and treatment such as lipid drug use and results from lipid or HbA1c tests.

Our use of Medicare claims in this study may be seen as both a strength and a limitation. The methods used to identify individuals with diabetes were consistent with those reported by Hebert et al. (19), who found that these yielded results in relatively good agreement with self-reported diabetes diagnoses from the Medicare Current Beneficiary Survey. Thus, misclassification of diabetes diagnoses has probably not importantly influenced our conclusions. Lipid testing rates from our findings were generally consistent with rates obtained from outpatient medical record reviews for Medicare patients with diabetes in other states and in the managed care environment in North Carolina (20). Thus, we believe that the identification of lipid testing from Medicare claims provides a relatively accurate measure of true testing rates. Medicare claims provide information related to multiple physicians treating patients at multiple practices. This broad patient-specific information is not typically available through medical record review and is an important strength in the use of Medicare claims when examining care for patients potentially seeing multiple physicians.

In conclusion, adherence to lipid testing recommendations by primary care physicians for Medicare-insured elderly patients with diabetes has much room for improvement. The patients most likely to suffer from the cardiovascular complications of diabetes (i.e., African Americans, the economically disadvantaged, and the medically complex) are the least likely to receive lipid testing. Systematic barriers to lipid testing in physician practices need to be better understood and removed, especially for these high-risk undertested patients.

The author assumes full responsibility for the accuracy and completeness of the ideas presented. This article is a direct result of the Health Care Quality Improvement Program initiated by the CMS, which has encouraged identification of quality improvement projects derived from analysis of patterns of care and therefore required no special funding on the part of this contractor. Ideas and contributions to the author concerning experience in engaging with issues presented are welcomed.

Cause-specific mortality data from death certificates were provided by Paul Buescher, PhD, of the North Carolina Center for Health Statistics.

References

Acknowledgments—The analyses upon which this publication is based were performed under contract no. 500-99-NC03, entitled “Utilization and Quality Control Peer Review Organization for the State of North Carolina,” sponsored by the CMS, Department of Health and Human Services.