

Prevalence and Care of Diabetes Mellitus in the Medicare Population of North Carolina

Baseline Findings from the Medicare Healthcare Quality Improvement Program

Mark W. Massing, MD, PhD; Nancy Henley, MPH MD; David Biggs, BS; Anna Schenck, PhD; Ross J. Simpson, Jr., MD, PhD

Abstract

Objective: To describe diabetes and its care in the Medicare population of North Carolina.

Study Design: Cross-sectional

Data Source/Study Setting: Medicare claims for North Carolina residents 18 to 75 years of age were reviewed to characterize diabetes prevalence during the late 1990s and to evaluate adherence to diabetes clinical practice recommendations.

Principal Findings: Almost 84,000 persons with diabetes and Medicare were identified. Diabetes prevalence was 15.0% overall, 22.9% among African Americans, and 12.9% among Caucasians. A "diabetes belt" of relatively high prevalence was noted in the eastern coastal plain. Glycated hemoglobin testing, lipid testing, and retinopathy screening were performed at about half the recommended rate. Diabetes care rates were lower for African Americans than for Caucasians.

Conclusions: Diabetes is a common and under-treated condition in the Medicare population of North Carolina, especially among African Americans.

Relevance: There is much room for improvement in diabetes care within one of North Carolina's most vulnerable populations, the disabled and elderly enrolled in Medicare. Substantial public health opportunities exist in the identification and removal of barriers to diabetes care.

DIABETES MELLITUS IS A MAJOR public health problem in the United States that will only worsen as the population ages and obesity rates increase.¹ About 389,000 (6.4%) adult North Carolina residents had been diagnosed with diabetes as of 2000, and diabetes-related complications contribute substantially to statewide rates of hospitalization and death.² The prevalence of diabetes is especially high among African Americans and the elderly—population groups that are well represented in North Carolina.² Although many of the complications of diabetes are avoidable through screening and treatment, previous reports have suggested that adherence to evidence-based preventive care guidelines is far from ideal.³

The Centers for Medicare & Medicaid Services (CMS) established a national Medicare Healthcare Quality Improvement Program (HCQIP) to reduce the human and economic costs of the major preventable causes of morbidity and mortality afflicting the Medicare population.^{4,5} One

component of HCQIP focuses on projects to reduce diabetes complications and mortality in the Medicare population by measuring and improving diabetes care. These national projects are implemented at the state level by nonprofit Quality Improvement Organizations (QIO) under contract with CMS.⁶ This is a report of HCQIP findings from the North Carolina QIO, Medical Review of North Carolina, describing diabetes prevalence and its care among North Carolina's Medicare population in the late 1990s.

Material and Methods

North Carolina residents with diabetes and Medicare were identified according to criteria established by CMS for HCQIP.⁵ Persons with diabetes were identified within the population of North Carolina residents with Medicare, 18 to 75 years of age, not enrolled in managed care, and with

All authors are affiliated with Medical Review of North Carolina, Inc. Address correspondence to Dr. Massing at Medical Review of North Carolina, Inc., PO Box 37309, Raleigh, NC 27627. Telephone: 919/851-2955. Fax: 919/851-8457. Email: mmassing@mrnc.org.

Table 1. Characteristics of North Carolina residents meeting the Medicare Healthcare Quality Improvement Program inclusion criteria.

	<i>State Residents meeting HCQIP inclusion criteria (n=551,112)*</i>	<i>State Residents meeting HCQIP inclusion criteria with Diabetes (n=83,913)*</i>
Women	54.4	55.5
Caucasian	77.5	67.3
African-American	20.0	31.0
Mean Age (Years)†	65.8	66.6
Age 18 – 54 years†	13.8	10.3
Age 55 – 64 years†	9.8	14.6
Age 65 – 70 years†	37.6	36.2
Age 71 – 75 years†	38.7	38.9

*All values are percents of the column-specific total unless otherwise specified.

†Age as of the end of the measurement period (June 30, 1999).

Table 2. Diabetes prevalence by race, gender, and age among North Carolina residents meeting the Medicare Healthcare Quality Improvement Program inclusion criteria.*

	<i>Overall (n=551,112)†</i>		<i>African-American (n=110,154)†</i>		<i>Caucasian (n=427,105)†</i>	
	%	(n)	%	(n)	%	(n)
Women	15.2	(299,787)	26.9	(61,102)	12.1	(230,531)
Age 18 – 54 years	13.0	(33,780)	17.6	(11,799)	10.3	(20,330)
Age 55 – 64 years	24.5	(26,610)	34.9	(8,416)	19.3	(17,288)
Age 65 – 70 years	14.2	(115,525)	28.2	(20,001)	11.1	(92,202)
Age 71 – 75 years	14.7	(123,872)	27.6	(20,886)	12.0	(100,711)
Men	14.7	(251,325)	18.1	(49,052)	13.9	(196,574)
Age 18 – 54 years	9.9	(42,266)	11.0	(15,048)	9.1	(25,238)
Age 55 – 64 years	20.2	(27,606)	23.6	(7,730)	18.8	(19,011)
Age 65 – 70 years	14.7	(91,909)	20.5	(13,711)	13.7	(76,271)
Age 71 – 75 years	15.4	(89,544)	20.4	(12,563)	14.5	(76,054)

*For North Carolina residents with diabetes included in HCQIP (n=83,913) excluding 1,385 individuals with invalid, missing, or unidentifiable values for key variables. Age was determined as of the end of the measurement period (June 30, 1999).

†Diabetes prevalence is shown as the percent of the stratum-specific population with diabetes. The stratum-specific numbers of individuals meeting the HCQIP inclusion criteria are in parentheses.

no more than one month break in Medicare Part B enrollment during each two-year measurement period. The populations described in this report included only individuals with access to Medicare reimbursement for inpatient and outpatient fee-for-service medical care.

Diabetes and its care were identified in a manner consistent with methods described elsewhere from Part A and Part B Medicare claims filed by physicians, hospitals, skilled nursing facilities, home health agencies, and durable medical equipment suppliers.⁷ A diagnosis of diabetes was determined from diagnosis codes recorded on Medicare claims.

To distinguish diabetes screening from diagnosis, individuals with Medicare claims containing diabetes diagnosis codes were *not* considered to have diabetes if claims were only for a single outpatient encounter or for multiple outpatient encounters within a time interval of less than 7 days. Only claims drawn from the most recent year of the two-year measurement period were used to identify a diabetes diagnosis.

The objective of HCQIP was to monitor and improve rates for three indicators of diabetes care: glycated hemoglobin (HbA1c) testing,⁸ lipid profile testing,⁹ and screen-

ing for diabetic retinopathy.¹⁰ These quality indicators were chosen because they were evidence-based, cost-effective, and measurable from Medicare claims. Also measurable from claims data, but not specifically the focus of HCQIP fee-for-service diabetes quality improvement projects, were other diabetes quality indicators including nephropathy screening¹¹ and vaccinations for influenza and pneumococcus.¹² Medicare claims during the HCQIP two-year baseline measurement period (July 1997 - June 1999) were reviewed for the presence of these quality indicators as determined from diagnosis codes, procedure codes, and other coded identifiers. Predictors of diabetes care were evaluated in logistic regression analyses.

Results

Almost 1.2 million North Carolina residents were enrolled in the Medicare program during the final 12 months of the two-year HCQIP baseline measurement period. Persons excluded according to HCQIP criteria were those who were less than 18 years or more than 75 years of age (37%), who died prior to the end of the measurement period (9%), who were not continuously enrolled in Medicare Part B (10%), or who were enrolled in managed care (4%). Of the remaining 551,112 state residents, 83,913 had diabetes. Compared to the total population meeting the general HCQIP inclusion criteria, those with diabetes were substantially more likely to be African Americans and from 55 to 64 years of age (Table 1). Almost a third of the diabetic population was African-American. About a fourth of the population was less than 65 years of age. These younger individuals qualify for Medicare due to disabilities.

The statewide prevalence of diabetes among Medicare beneficiaries meeting the HCQIP inclusion criteria was 15.0% overall, 22.9% for African Americans, and 12.9% for Caucasians. Diabetes prevalence rates varied widely by race, gender, and age (Table 2) from 9.1% for Caucasian men 18-54 years of age to 34.9% for African-American women 55 to 64 years of age. Age- and gender-specific diabetes prevalence rates were consistently higher among African Americans compared to Caucasians.

There was substantial variation in the county-level geographic distribution of diabetes prevalence (Figure). County-level population sizes for those meeting the inclusion criteria ranged from 219 to 23,470 for Caucasian populations and from 0 to 8,055 for African-American populations. Among the 100 counties, county-level diabetes prevalence averaged 16.0% overall and 14.0% for Caucasian populations. Excluding 17 counties with African-American HCQIP populations of fewer than 100 persons, the average county-level diabetes prevalence among African Americans was 24.6%. A "diabetes belt" characterized by relatively high diabetes prevalence rates is apparent in the eastern coastal plain of the state for both African-American and Caucasian

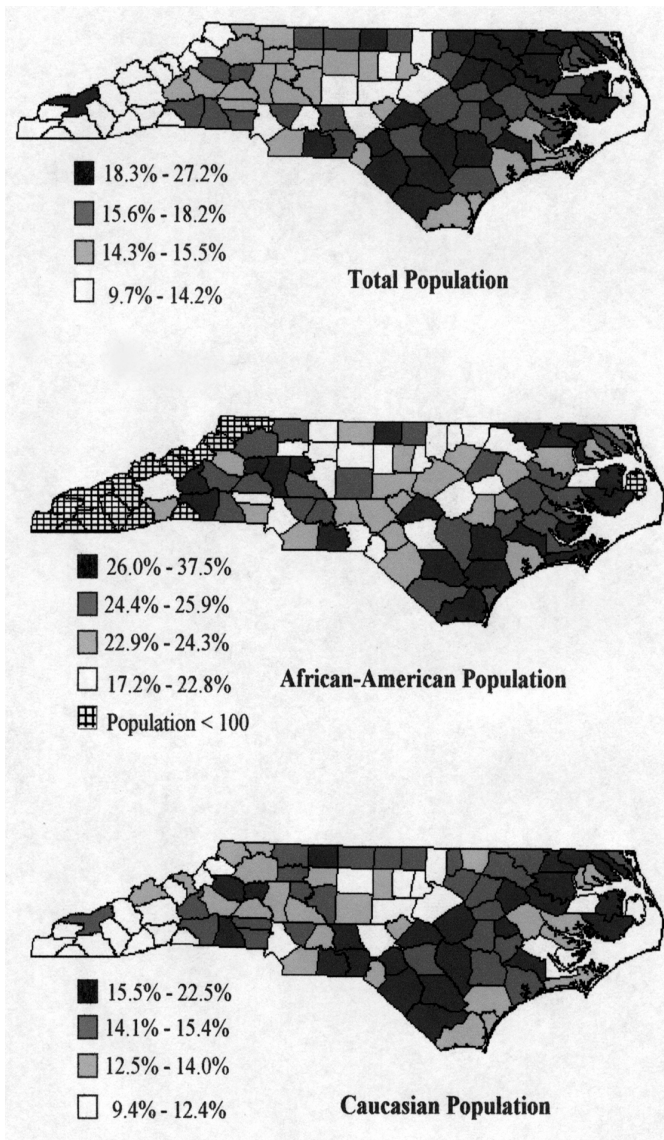


Figure. Overall and race-specific county-level prevalence of diabetes among North Carolina residents included in the Medicare Healthcare Quality Improvement Program.

populations. Also, a cluster of relatively high diabetes prevalence in western Piedmont counties is apparent. These geographic patterns persisted and county-level diabetes prevalence rankings changed little after adjusting for age (not shown).

Rates for each of the diabetes quality indicators were far from ideal (Table 3). The rates shown are percents of the diabetic population with at least one Medicare claim for the specified diabetes care indicators within a 6-, 12-, or 24-month time interval ending June 1999. Slightly more than half of these Medicare-insured diabetic patients received the recommended minimum semiannual HbA1c test. Even after two years, over 20% had no Medicare claims for HbA1c testing. Lipid profile rates were even lower. Half or fewer

Table 3. Semiannual, annual, and biennial rates for diabetes quality indicators from July 1997 through June 1999, overall and by race among included North Carolina Medicare beneficiaries .*

Quality indicator	Percent receiving the indicator during each time interval ending June 1999								
	6 months			12 months			24 months		
	All	AfrAm	Caucasian	All	AfrAm	Caucasian	All	AfrAm	Caucasian
HbA1c	56	52	58	70	66	72	77	75	79
Lipid profile	33	25	36	46	37	51	53	44	58
Dilated eye exam	38	40	38	56	55	56	70	68	70
Influenza vaccine	1	1	1	47	33	54	58	44	65
Pneumococcal vaccine									
All	1	1	1	7	6	8	15	12	17
Aged 65 years [†]	1	1	1	8	6	9	18	14	20
Urinalysis/Microalbumin									
All	35	33	36	53	49	54	69	66	71
Screening only [‡]	35	33	35	52	49	53	68	65	70

*For North Carolina residents with diabetes included in HCQIP (n=83,913) excluding 1,385 individuals with invalid, missing, or unidentifiable values for key variables.

[†]Among individuals 65 years of age during the two-year measurement period (n=10,249).

[‡]Among individuals without claims related to diabetic nephropathy during the two-year measurement period (n=69,861).

had claims for the recommended annual lipid profile, and this increased only slightly over an additional year. Similarly, about half or fewer had claims for the recommended annual screening exam for diabetic retinopathy or the influenza vaccination. Among the 85% without evidence of diagnosed nephropathy, claims for urinalysis or microralbuminuria tests were identified for only about half of these diabetic patients within the most recent 12 months. Clinical guidelines recommend a one-time pneumococcal revaccination for individuals with diabetes >64 years of age previously immunized when they were <65 years of age, if the vaccine was administered more than 5 years ago.¹² The use of Medicare claims to evaluate adherence to this recommendation is limited. Nevertheless, only 20% or fewer of those who were 65 at some point during the two-year measurement period received a pneumococcal vaccination, suggesting substantial room for improvement. The markedly higher vaccination rates in the 12- and 24-month intervals compared to the 6-month interval were due to the fact that the 6-month interval (January 1999 - June 1999) did not include an entire influenza season. There were marked racial disparities for most indicators, with African-American populations typically receiving care at lower levels than Caucasian populations. This was especially striking for lipid profiles and influenza vaccinations.

The associations of age, gender, and race with these diabetes quality indicators were investigated in multivariate logistic regression analyses (Table 4). Confidence limits and

tests of significance are omitted because results describe the entire population rather than a sample. Odds ratios from logistic regression approximate relative risk only where the event of interest is relatively rare. This was not the case for these commonly performed indicators of care. Therefore, these logistic regression results should be interpreted with caution as estimates of relative risk. In general, the odds for women receiving each indicator were higher than for men. Women were substantially more likely to receive an eye exam compared to men. African-American populations were less likely to receive appropriate diabetes care than were Caucasians. The greatest racial disparities favoring Caucasians were noted for lipid testing and vaccinations. The disabled Medicare population less than 65 years of age was markedly less likely to receive each indicator compared to older Medicare beneficiaries, a population that is predominantly nondisabled.

Discussion

The prevalence of diabetes in North Carolina's Medicare population is high and geographically heterogeneous. The African-American population experiences a disproportionately high burden of diabetes with prevalence rates as much as twice those of the Caucasian population. In this large group of Medicare insured patients, diabetes care is far from ideal. From July 1997 through June 1999, evidence-based laboratory tests, procedures, and examinations proven to help prevent the most severe complications of diabetes were not

Table 4. Predictors of diabetes care among North Carolina Medicare beneficiaries in the Healthcare Quality Improvement Program from logistic regression analyses.*

	Age (years)					
	Women	AfrAm	18-54	55-64	65-70	71-75
Annual HbA1c	1.11	0.76	0.69	0.80	1	0.97
Biennial lipid profile	1.09	0.58	0.61	0.80	1	0.90
Biennial dilated eye exam	1.53	0.93	0.50	0.70	1	1.23
Annual influenza vaccine	1.02	0.45	0.49	0.73	1	1.20
Pneumococcal vaccine	1.02	0.68	0.58	0.76	1	0.92
Nephropathy screening†	1.08	0.83	0.94	0.90	1	1.06

*Odds ratios from logistic regression analyses (n=82,528) for receiving each diabetes care indicator relative to the referent groups (i.e., men, Caucasian, and age 65 to 70 years).

†Annual urinalysis or microalbumin test among individuals without diagnosed nephropathy during the two-year measurement period (n=69,861).

performed as recommended for a substantial proportion of these people. Adherence to diabetes care recommendations was especially poor for African Americans and the disabled younger Medicare beneficiaries.

The American Diabetes Association (ADA) has established clinical practice recommendations that are regularly updated. The recommendations for 2002 are for semianual HbA1c test,⁸ annual lipid profile,⁹ annual screening for retinopathy,¹⁰ annual influenza vaccination,¹² and annual microalbuminuria screening for nephropathy.¹¹ Immunization against *Streptococcus pneumoniae* is generally recommended for adults with diabetes.¹² A one-time pneumococcal revaccination is recommended for persons more than 64 years of age who were immunized prior to 65 if the vaccine was administered more than 5 years earlier. We have shown that adherence to these guidelines was far from optimal in the North Carolina Medicare population receiving medical care in the fee-for-service setting. Some recommendations have changed over time, but since the beginning of the HCQIP diabetes baseline measurement period in 1997, recommendations for HbA_{1c} and lipid testing and for retinopathy screening were unchanged. In the year 2000, the ADA added immunization guidelines and revised nephropathy screening guidelines recommending annual microalbuminuria testing in place of routine urinalysis in the absence of previously diagnosed proteinuria.¹³

There are limitations in the use of Medicare claims data to identify diabetes cases and measure diabetes care. Distinguishing patients screened for diabetes from those actually diagnosed may be problematic. For example, it is possible that HCQIP criteria have falsely assigned diabetes diagnoses to individuals without diabetes. Hebert et al. have used methods similar to HCQIP to identify diabetes diagnoses from Medicare claims and have found relatively good agreement with self-reported diabetes from the Medicare Current Beneficiary Survey.⁷ Thus, it is unlikely that misclassification of diabetes diagnoses substantially accounts for our findings.

Indicator rates may also be inaccurately low if healthcare providers failed to file Medicare claims for these tests and examinations. In this case, we might expect that results from Medicare claims may differ substantially from information recorded in patient medical records. It is often difficult to obtain complete medical record information, especially since patients with diabetes are often seen by multiple healthcare providers who maintain separate, independent records. Nevertheless, outpatient medical record reviews for Medicare patients with diabetes in other states and in the managed care environment in North Carolina have revealed quality indicator rates consistent with the present findings from Medicare claims.^{14,15}

Although our results do not identify specific barriers to diabetes care, several have been suggested in the literature. These may operate at the level of the community, the healthcare system, the physician or medical practice, and the patient. In surveys of primary care physicians treating Medicare beneficiaries with diabetes reported by Drass et al., the most common physician-reported barrier to care was patient nonadherence to treatment regimens.¹⁶ However, the quality indicators presented in our findings are not typically subject to patient nonadherence unless patients refuse these tests and examinations or fail to schedule or appear for visits with healthcare providers. Among diabetic patients who routinely visit primary care providers and generally submit to suggested care, multiple factors may explain failure to deliver care consistent with guidelines. Mottur-Pilson et al. classified physician self-reported reasons for failure to comply with diabetes care guidelines into the categories of oversight, system issues, patient nonadherence, conscious decision, and other.¹⁷ They found that reasons for noncompliance varied by quality indicator. For example, failure to comply with nephropathy screening was mostly the physician's conscious decision based on factors such as medical history. In contrast, oversight was found to be the most common reason for not performing lipid profiles.

The striking racial disparities in diabetes care in North Carolina are cause for concern and may at least partially explain racial disparities in diabetes complications such as heart disease, stroke, and end-stage renal disease. Causes for these disparities are no doubt multiple. Chin et al. have shown that African Americans with diabetes and Medicare had worse health perceptions and lower quality of care than their Caucasian counterparts.¹⁸ African Americans were more likely to receive care from emergency rooms and had fewer physician visits per year. Thus, the inability to access and consistently use primary care medical services, a potential barrier for all races, may be especially problematic for the African-American population. Barriers in access to and use of health services may have a substantial socioeconomic component. Gornick et al. have shown that both race and income influence use of Medicare services.¹⁹ That is, even among a population insured through Medicare, income was an important determinant for both Caucasians and African Americans for the use of medical services such as influenza vaccination.

The geographic distribution of diabetes prevalence in North Carolina is consistent with the well-known "stroke belt," a region of high stroke mortality located in the southeastern United States.²⁰ The North Carolina coastal plain is characterized by a long history of adverse socioenvironmental conditions, populations of low socioeconomic status, and proportionately large populations residing in rural settings. These and multiple other factors may be related to levels of stroke, diabetes, and other maladies in this region.

The fact that the highest diabetes prevalence rates for each race-gender group occurred in the 55-64 year age range is consistent with a peculiar characteristic of the Medicare population. That is, persons less than 65 years of age enrolled in Medicare are typically mentally or physically disabled. Diabetes may be a cause or result of their disabilities.

A number of diabetes quality improvement projects are under way in North Carolina. Many of these operate in collaboration with the North Carolina State Diabetes Advisory Council and the Diabetes Prevention and Control Unit of the Department of Health and Human Services (www.ncdiabetes.org). As the federally designated Quality Improvement Organization for North Carolina, Medical Review of North Carolina (MRNC) is continuously implementing diabetes quality improvement projects oriented to the Medicare population. During the next three years, MRNC will be working in collaboration with hundreds of primary care providers throughout the state to initiate and enhance office-based systems designed to improve outpatient care. Under special arrangement with CMS, physicians participating in quality improvement projects may be able to earn Continuing Medical Education (CME) credits for their efforts. MRNC is currently identifying a limited number of medical practices to participate in these collaborative quality improvement projects. Interested primary care providers are encouraged to contact MRNC (www.mrnc.org) for additional information.

Conclusion/Relevance

Despite the world-class healthcare available in North Carolina, outpatient management of diabetes is far from optimal. Adherence to guidelines will become even more necessary as the prevalence of diabetes and its complications rises in a state with an aging and increasingly obese population. The mismatch between diabetes care and the burden of disease is striking with respect to African Americans who simultaneously experience higher levels of diabetes and lower levels of diabetes care.

Substantial public health opportunities exist in the identification and removal of barriers to diabetes care. The challenge for the future is to develop and widely disseminate effective medical systems in the outpatient setting for the management of chronic diseases such as diabetes.

Acknowledgments. The analyses upon which this publication is based were performed under Contract No. 500-99-NC03, "Utilization and Quality Control Peer Review Organization for the State of North Carolina," sponsored by the Centers for Medicare & Medicaid Services, Department of Health and Human Services. The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services, nor does mention of trade names, commercial products, or organizations imply endorsement by the US Government.

The authors assume full responsibility for the accuracy and completeness of the ideas presented. This article is a direct result of the Healthcare Quality Improvement Program initiated by the Centers for Medicare & Medicaid Services, 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 the issues presented are welcomed.

REFERENCES

- 1 Mokdad AH, Ford ES, Bowman BA, et al. Diabetes trends in the US: 1990-1998. *Diabetes Care* 2000; 23(9):1278-1283
- 2 Valeriano E, Reaves J, Porterfield D, et al. Diabetes in North Carolina: a summary report—2002. Diabetes Prevention and Control Branch, Division of Public Health, NC Department of Health and Human Services, Raleigh, NC. Available at: http://www.ncdiabetes.org/Facts_Figures/pdf/NCSummaryreport.pdf. Accessed: February 19, 2003.
- 3 Beckles GL, Engelgau MM, Narayan KM, et al. Population-based assessment of the level of care among adults with diabetes in the US. *Diabetes Care* 1998;21:1432-8.
- 4 Centers for Medicare & Medicaid Services. Health Care Quality Improvement Program. Available from <http://>

- www.hcqip.com/. Accessed: February 19, 2003.
- 5 Jencks SF, Cuerdon T, Burwen DR, et al. Quality of medical care delivered to Medicare beneficiaries: a profile at state and national levels. *JAMA* 2000;284:1670-6.
 - 6 Centers for Medicare & Medicaid Services. Quality Improvement Organizations (QIOs). Available at: <http://www.cms.hhs.gov/qio/>. Accessed: February 19, 2003.
 - 7 Hebert PL, Geiss LS, Tierney EF, et al. Identifying persons with diabetes using Medicare claims data. *Am J Med Qual* 1999;14:270-7.
 - 8 American Diabetes Association. Tests of glycemia in diabetes. *Diabetes Care* 2002;25 Suppl 1:S97-S99.
 - 9 American Diabetes Association. Management of dyslipidemia in adults with diabetes. *Diabetes Care* 2002;25 Suppl 1:S74-S77.
 - 10 American Diabetes Association. Diabetic retinopathy. *Diabetes Care* 2002;25 Suppl 1:S90-S93.
 - 11 American Diabetes Association. Diabetic nephropathy. *Diabetes Care* 2002;25 Suppl 1:S85-S89.
 - 12 American Diabetes Association. Immunization and the prevention of influenza and pneumococcal disease in people with diabetes. *Diabetes Care* 2002;25 Suppl 1:S117-S119.
 - 13 American Diabetes Association. Clinical practice recommendations 2000. *Diabetes Care* 2000;23 Suppl 1: S1-116.
 - 14 Kell SH, Drass J, Bausell RB, et al. Measures of disease control in Medicare beneficiaries with diabetes mellitus. *J Am Geriatr Soc* 1999; 47:417-22.
 - 15 Cook CB, Penman A, Cobb AB, et al. Outpatient diabetes management of Medicare beneficiaries in four Mississippi fee-for-service primary care clinics. *J Miss State Med Assoc* 1999;40:8-13.
 - 16 Drass J, Kell S, Osborn M, et al. Diabetes care for Medicare beneficiaries: attitudes and behaviors of primary care physicians. *Diabetes Care* 1998;21:1282-7.
 - 17 Mottur-Pilson C, Snow V, Bartlett K. Physician explanations for failing to comply with "best practices." *Eff Clin Pract* 2001;4:207-13.
 - 18 Chin MH, Zhang JX, Merrell K. Diabetes in the African-American Medicare population: Morbidity, quality of care, and resource utilization. *Diabetes Care* 1998;21:1090-5.
 - 19 Gornick ME, Eggers PW, Reilly TW, et al. Effects of race and income on mortality and use of services among Medicare beneficiaries. *N Engl J Med* 1996;335:791-9.
 - 20 Howard G, Evans GW, Pearce K, et al. Is the stroke belt disappearing? an analysis of racial, temporal, and age effects. *Stroke* 1995;26:1153-8.
-