

Carotid Endarterectomy in Older Women and Men in the United States: Trends in Ethnic Disparities

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Trends in utilization of carotid endarterectomy (CEA) among elderly ethnic minorities have received little attention. Data from the U.S. Centers for Medicare and Medicaid Services were examined for the years 1990 through 2000. In women and men, the rate of CEA per 100,000 non-HMO beneficiaries aged ≥ 65 years increased in African Americans and in European Americans between 1990 and 1995, with only small changes thereafter. Between 1990 and 2000, the ratio of rates in European Americans to those in African Americans have decreased slightly, i.e., in women from 2.63 in 1990 to 2.24 (15%) in 2000 and in men from 3.94 to 3.39 (14%). Large ethnic differences in utilization of CEA persist in the elderly requiring further evaluation.

Key words: carotid endarterectomy ■ blacks ■ Hispanics ■ stroke

Carotid endarterectomy (CEA) is an ancillary tool for stroke prevention in the United States.¹⁻⁶ Several studies have reported U.S. rates of CEA that were grossly lower in African Americans than European Americans, similar to the disparate rates seen in cardiovascular surgery and diagnostic procedures.⁷⁻¹² However, changes in the relative utilization of these procedures may have occurred over time. To test the hypothesis that utilization rates of elderly African Americans became more similar to those of European Americans between 1990 and 2000, data from Medicare beneficiaries were examined to describe trends in relative utilization of CEA by ethnicity in U.S. Medicare enrollees. Given the lack of published data for Hispanics, preliminary data for rates and trends in elderly Hispanic Americans for 1995–2000 are also described. This is the first report of trends in ethnic disparities over the last decade of the 20th century.

METHODS

Study Patients

Data were obtained from the Centers for Medicare and Medicaid Services (CMS), formerly the Health Care Financing Administration, on all short-stay hospital discharges for all non-HMO Medicare enrollees aged ≥ 65 years in the United States in the years 1990 through 2000.¹³⁻²² Records for 1999 were maintained on more than 39 million enrollees. Over one billion claims were processed in fiscal year 1999. Data from the Medicare files provide information about enrollee use of benefits for a point in time or over an extended period. Diagnostic and procedure codes are not available from CMS for HMO enrollees, who comprised about 10% of Medicare enrollees in the study years. Patients were identified who had complete data on ethnicity (African Americans versus European Americans) and were discharged from the hospital with ICD-9CM code 38.12, CEA, in 1990–2000.¹⁵ Data on Hispanic-American ethnicity were also considered.

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Computations

The annual procedure rates were computed as number of persons discharged from a U.S. hospital with CEA listed as a procedure in a given year divided by the number of non-HMO enrollees, expressed here as discharges per 100,000 persons per year. In the data presented here, only one CEA procedure per patient per year is counted. Confounding of trends by age, gender and ethnicity was controlled by stratification on age, gender and ethnicity (African Americans, European Americans, Hispanic Americans). Since no sampling was done and both numerators and denominators of rates were large, estimates of variance of rates were obtained assuming Poisson distribution.¹⁶ Rates in European Americans were divided by rates in African Americans or Hispanic Americans of the same age group and gender to produce ratios. Linear trend lines were fit to the ratios for women and men and confidence intervals for ratios computed using standard methods.¹⁶

RESULTS

Women

Among Medicare beneficiaries aged ≥65 years of

all ethnicities, the number of persons of both sexes discharged from short-stay hospitals with CEA increased steadily from 42,001 in 1990 to 92,046 in 1995 then declined to 80,441 in 1997. Figure 1 shows the rate per 100,000 of non-HMO Medicare enrollees with CEA procedures by ethnicity for African Americans and European Americans for women in 1990–2000 (data table available from author). In women aged ≥65, the rate of operations increased in African Americans by 123% and in European Americans by 116% between 1990 and 1995 (not shown). There was a slight decrease in the ratio of rates in European Americans to rates in African Americans (e.g., for 65+ years: 2.63 in 1990, 2.55 in 1995 and 2.24 in 2000; and for 65–74 years: 2.50 in 1990, 2.35 in 1995 and 2.25 in 2000). However, the absolute differences in rates between European Americans and African Americans increased over the period (not shown). Between 1995 and 2000, preliminary rates in Hispanic-American women were slightly higher than those in African-American women and about half those in European Americans.

Table 1 shows rates of CEA by age group and year for European-American and African-American women. Confidence intervals (CI) of the rates for 65+

Table 1. Short-Stay Hospital Discharges with Carotid Endarterectomy Procedures in Medicare Enrollees by Sex, Age, and Ethnic Group—United States, 1990–2000

Year	AA Rate+			EA Rate+			EA/AA Rate Ratio		
	65–74	75–84	85+	65–74	75–84	85+	65–74	75–84	85+
<i>Women</i>									
1990	50	44	16	125	132	38	2.50	3.00	2.38
1991	60	59	14	151	165	49	2.52	2.80	3.50
1992	67	72	23	166	188	55	2.48	2.61	2.39
1993	68	67	20	165	186	59	2.43	2.78	2.95
1994	81	79	26	184	215	69	2.27	2.72	2.65
1995	110	104	40	258	302	95	2.35	2.90	2.38
1996	117	117	37	260	309	101	2.22	2.64	2.73
1997	113	138	34	242	322	135	2.14	2.33	3.97
1998	120	122	55	241	322	133	2.01	2.64	2.42
1999	121	132	58	229	317	145	1.89	2.40	2.50
2000	97	134	50	218	304	146	2.25	2.27	2.92
<i>Men</i>									
1990	57	68	31	225	269	98	3.95	3.96	3.16
1991	64	80	29	263	340	119	4.11	4.25	4.10
1992	73	98	42	292	381	155	4.00	3.89	3.69
1993	77	100	33	288	377	147	3.74	3.77	4.45
1994	78	103	41	321	433	177	4.12	4.20	4.32
1995	110	155	72	439	595	251	3.99	3.84	3.49
1996	124	153	53	435	594	277	3.51	3.88	5.23
1997	115	176	102	406	638	343	3.53	3.63	3.36
1998	116	174	95	408	635	367	3.52	3.65	3.86
1999	128	166	86	384	617	375	3.00	3.72	4.36
2000	111	178	91	353	594	368	3.18	3.34	4.04

AA: African-American; EA: European-American; * Includes those aged ≥85; + Rate per 100,000 non-HMO enrollees (not shown for blacks aged ≥85 due to small numbers of procedures)

in 1990 and 2000 reveal that these differences remained highly significant throughout the period, 1990: African Americans, 44 (95% CI 40–48) and European Americans, 116 (114–118); 2000: African Americans, 102 (97–107) and European Americans, 229 (227–231). Rates were higher in European-American women throughout the period at each age, with an increase in rates with age up to age 84. On average, during the period, the ratio of rates in European Americans to rates in African Americans was greater at ages 75–84 years (2.64) than at 65–74 years (2.28). This ratio declined slightly over the period for age 75–84 years and for age 65–74 years. For ages 65+, linear regression analysis showed that the ratio declined linearly with a fitted trendline $y = -0.05x + 2.72$, $R^2 = 0.87$ and was significantly lower in 2000 (2.25, 95% CI 2.12–2.37) than in 1990 (2.63, 95% CI 2.41–2.86).

Men

Figure 2 shows the rate per 100,000 male non-HMO Medicare enrollees with CEA procedures by ethnicity in 1990–2000. In men aged ≥ 65 , the rate of operation increased in African Americans by 134% and in European Americans by 106% between 1990 and 1999, then decreased slightly in 2000 for African Americans and European Americans. There was a slight decrease in the ratio of rates in European Americans to rates in African Americans (e.g., 3.94 in 1990 and 3.39 in 2000 at age 65+ and 3.94 and 3.18, respectively, at age 65–74). However, the absolute differences in rates between European Americans and African Americans increased (not shown). Preliminary rates in Hispanic-American men were substan-

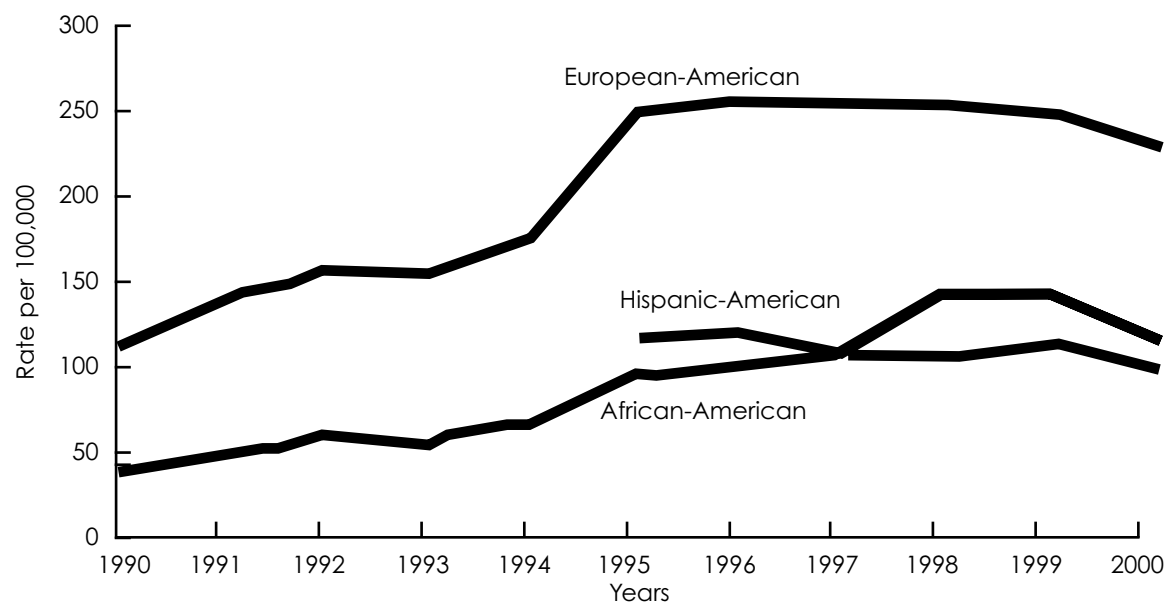
tially higher than those in African Americans but much lower than in European Americans.

Rates in men were higher in European Americans throughout the period at each age (Table 1). Confidence intervals of the rates for 65+ in 1990 and 2000 reveal that these differences remained highly significant throughout the period: 1990: African Americans, 58 (53–63) and European Americans, 229 (226–232); 2000: African Americans, 129 (121–137) and European Americans, 437 (433–441). In 2000, the ratio of rates in European Americans to rates in African Americans was 3.18 at age 65–74, 3.34 at 75–84 and 4.04 at 85+, reflecting an increase in rates with age up to age 84 in European Americans but a lesser increase to age 84 in African Americans (not shown). This ratio on average was lower at ages 75–84 years (2.27) and 65–74 years (2.25) than at age 85+ (2.92). This ratio declined for age groups 65–74 and 75–84 over the period. For ages 65+, linear regression analysis showed that the ratio declined linearly with a fitted trend line $y = -0.07x + 4.24$, $R^2 = 0.71$ but was not significantly lower in 2000 (3.39, 95% CI 3.18–3.60) than in 1990 (3.95, 95% CI 3.59–4.31).

DISCUSSION

Data from CMS are consistent with a slightly more rapid increase in rates of CEA in African Americans compared to European Americans in the 1990s, resulting in a slight decrease (15% in women and 14% in men) in the ratio of rates of inpatient utilization in European Americans to rates in African Americans. However, rates for CEA remained much higher in European Americans than in African Americans

Figure 1. Rate of carotid endarterectomy by ethnicity in female Medicare beneficiaries aged ≥ 65 years—United States, 1990–2000.



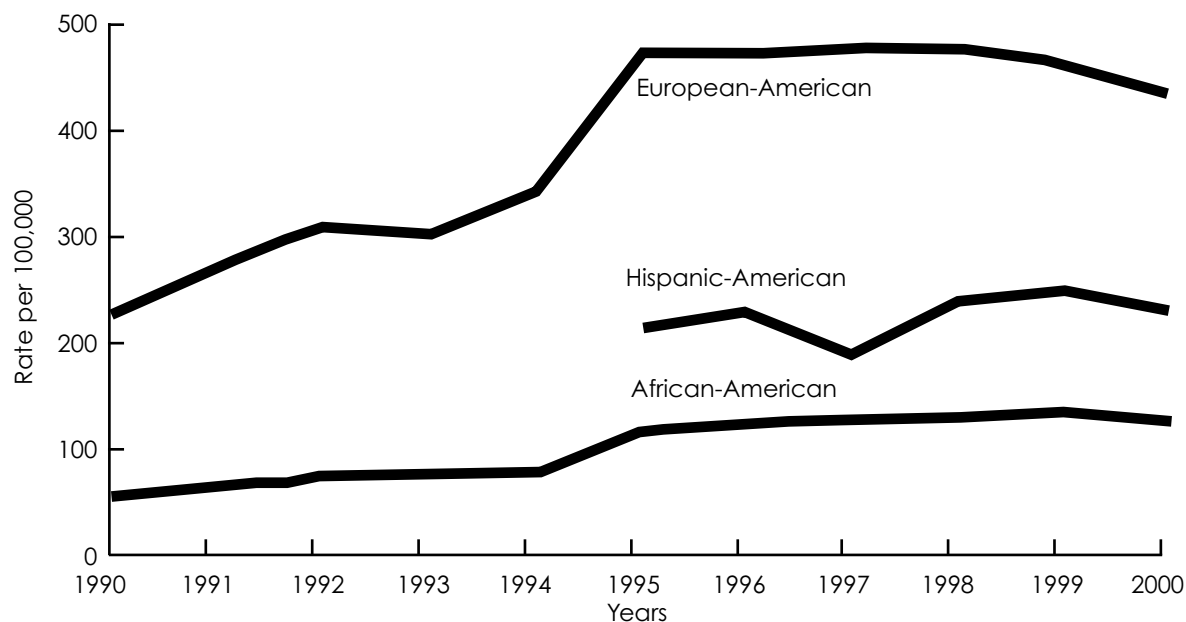
throughout the period, 2.2 times higher in 2000. The small magnitude of the changes in this ratio between 1990 and 2000 is confirmed by the fact that the absolute differences in rates between European Americans and African Americans actually increased. For example, for women, the difference between European-American and African-American CEA rates increased from 72 to 127 per 100,000 among Medicare beneficiaries ≥ 65 years; for men, the difference between European-American and African-American rates increased from 171 to 308 per 100,000 among Medicare beneficiaries ≥ 65 years. Meaningful progress towards equalization of rates of appropriate utilization would be expected to result in decreases of both relative and absolute differences.

Following a large number of journal reports, professional education efforts, publications, symposia and continuing medical education programs, as well as news media reports and patient education efforts, a decrease in the ratios of rates of coronary artery bypass grafting and percutaneous transluminal coronary angioplasty in European Americans to those in African Americans was seen in persons ≥ 65 years during the 1990s.²² However, whether these trends were causally related cannot be determined. The lack of a similar decrease in ratios of rates in European Americans to rates in African Americans for CEA may well be due to any of the following: 1) the lack of definitive reports addressing the ongoing debate over the relative roles of biological factors,

access to care, 2) comorbidities, 3) referral patterns for neurological consultation and carotid imaging, 4) frequency of transient ischemic attacks, 5) socioeconomic and cultural factors and/or provider bias. Hence, educational programs must be limited to increasing awareness of carotid stenosis and atherothrombosis as a major problem among African Americans and of the ethnic disparities in treatment of carotid artery disease.³⁻¹² More sophisticated clinical and epidemiological studies similar in design to those being done for coronary artery bypass grafting and percutaneous coronary revascularization are needed to address these lingering questions and to determine the medically appropriate rate of CEA in African Americans in relative and absolute terms.¹⁷⁻³⁰

Several reports suggest higher mortality in African Americans than in European Americans after CEA, the excess mortality in African Americans estimated to be 40% in one meta-analysis.^{25,26} Higher rates of in-hospital stroke, higher hospital charges and longer stays in African Americans have also been reported.²⁷ However, other reports failed to find ethnic differences in outcome.²⁸ Publication of results of clinical trials showing reduced rates of death or acute cerebral infarction in CEA compared to medical management in selected patients generally lacked statistical power to convincingly show a benefit in African Americans.^{31,32} This might have led to reluctance by some physicians to recommend CEA in African Americans. Recommendations for

Figure 2. Rate of carotid endarterectomy by ethnicity in male Medicare beneficiaries aged ≥ 65 years—United States, 1990–2000.



revascularization evolved over the study period.^{32,33} Unknown is whether such changes would have been applied differentially by ethnicity or gender. Clearly, further studies are needed to monitor CEA trends and test these and other hypotheses.

Several reasons for the repeatedly observed lower rates of CEA in African Americans than European Americans have been advanced.^{4-10,16-30} A possible lower prevalence of high-grade extracranial carotid obstructive disease in African Americans than in European Americans has been postulated to explain the difference. Although African Americans have a higher prevalence of intracranial obstructions than European Americans, they also have a high prevalence of coexisting extracranial disease leading to similar or even higher overall prevalence of extracranial disease as European Americans.²⁸⁻³¹ African Americans may have lower rates of referral to neurologists or neurosurgeons by primary care physicians compared to European Americans. If referred, they may be less likely to receive carotid angiography. Physicians may make different recommendations for CEA in African Americans than European Americans with carotid stenosis, as was found in one study for cardiac catheterization or revascularization for African Americans compared to European Americans with similar histories and coronary anatomy in similar clinical settings. This could be due to their perception of higher procedure risk in African Americans, or to ethnic bias, conscious or unconscious.^{23,25-29} African Americans may have a greater preference for nonsurgical care.⁸ African Americans have lesser ability to pay for care than others.^{18,19} Clearly more study is needed in this area.

A few studies in which access to care was equalized and financial barriers were removed have found a smaller ethnic difference in utilization of CEA compared to CMS or National Hospital Discharge Survey data.^{8,28} This suggests that insurance, institutional policies and patient education can eliminate utilization differences.^{3,22}

Limitations of this analysis of CMS data for the study of patterns and trends in cardiovascular procedures have been discussed elsewhere and include well-recognized limitations of administrative data, such as lack of data on prevalence of transient ischemic attack symptoms, carotid stenosis >50%, or contraindications to surgery among those with or without CEA.^{4-14,22-30} However, only such data can yield nationwide statistics. Possible effects of shifts of Medicare enrollees to HMOs in the 1990s, or differential enrollment by ethnicity, could introduce some bias. Studies of patient cohorts are needed to establish first versus recurrent CEA rates by ethnicity and monitor long-term survivorship. Unfortunately, adjustment for clinically relevant characteristics of patients, physicians and hospitals was not possible

using the data obtained from CMS. Hence, the mediators of ethnic differences could not be explored. For example, overutilization by European Americans as well as underutilization by African Americans are possibilities that cannot be distinguished with such data. Trends in crude rates and ratios should be interpreted together with age-specific data.

Accurate numbers of Hispanics cannot be obtained from CMS data.¹⁴ A recent report documents the ethnic misclassification of Hispanics as European Americans or "other" among discharged patients and enrollees as described elsewhere.¹⁴ However, given the lack of data for Hispanics, these investigators concluded that CMS data may provide useful preliminary estimates of discharge and procedure rates for Hispanics. Preliminary data for Hispanics were available for only 1995–2000 and must be interpreted with caution and confirmed by other studies. In both women and men aged ≥ 65 , the rate of operation per 100,000 showed no consistent trend between 1995 and 2000. The CEA rates in European Americans were about double those in Hispanic Americans, while rates of discharge with a principal diagnosis of stroke were nearly the same. To our knowledge, these are the only national data published to date for Hispanics and suggest that the apparent disparity between utilization of CEA in Hispanics and European Americans warrants further study. A study of a California administrative data base found European Americans 32% (95% CI -8%–89%) more likely to undergo CEA than Hispanics after adjustment for multiple variables in 1989–1990.⁹

Of some concern was the large one-year increase in number of procedures from 1994 to 1995. However, comparison with data from the National Hospital Discharge Survey for ages ≥ 65 years showed somewhat similar pattern of changes. Estimated numbers of discharges tended to be higher in that survey than in CMS for all the years, at least in part due to exclusion of HMO enrollees in CMS data and the lack of Medicare enrollment among a small percentage of persons aged ≥ 65 years. No data were available on non-Medicare insurance.

CONCLUSIONS

Large ethnic disparities in utilization of CEA persist and require further evaluation. Ethnic variation in postoperative complication rates requires further study and possible intervention. Data are needed for each of the major groups of Hispanic Americans. Continued monitoring of trends in CEA and associated procedures and diagnoses in CMS data will be useful in assessment of the impact of technologic innovation, clinical trials and of studies of appropriateness of technology utilization in each ethnic group.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance of

Dr. P.W. Eggers of the National Institutes of Health and
J.F. Gonzales of the National Center for Health Statistics.

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C A R E E R O P P O R T U N I T Y

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