

Theories Explaining Racial Differences in the Utilization of Diagnostic and Therapeutic Procedures for Cerebrovascular Disease

RONNIE D. HORNER,
EUGENE Z. ODDONE,
and DAVID B. MATCHAR

*Veterans Affairs Medical Center; Duke University Medical Center,
Durham, North Carolina*

STROKE IS A MAJOR CAUSE OF DISABILITY AND IS THE third leading cause of death in the United States (Centers for Disease Control 1992). Epidemiological studies indicate that ischemic stroke and transient ischemic attack (TIA) account for 67 percent of cerebrovascular disease (Wolf, Cobb, and D'Agostino 1992). Compared with whites, blacks have a higher incidence of ischemic stroke, may experience more severe strokes with greater disability, and may have a higher level of stroke-related mortality (Eckstrom et al. 1969; Heyman et al. 1971; Gross et al. 1984; Horner et al. 1991; Klatsky, Armstrong, and Friedman 1991; Sacco, Hauser, and Mohr 1991; Sacco et al. 1991; Aronow 1992; Centers for Disease Control 1992; Kuhlemeier and Stiens 1994). Current practices for the clinical management of acute stroke are limited in their ability to reduce the associated physical and psychological disability. Thus, practices aimed at preventing stroke constitute the preferred clinical approach to managing cerebrovascular disease.

A number of noninvasive and invasive procedures are used to diagnose and treat cerebrovascular disease. Carotid endarterectomy is effective in preventing ischemic stroke in symptomatic patients with 70 to 99

percent ipsilateral carotid artery stenosis and in asymptomatic patients with at least 60 percent stenosis (European Carotid Surgery Trialists' [ECST] Collaborative Group 1991; Mayberg et al. 1991; North American Symptomatic Carotid Endarterectomy Trial Collaborators 1991; National Institute of Neurologic Disorders and Stroke 1994). Although ineffective for symptomatic patients with low-grade (i.e., less than 30 percent) stenosis, its value for midrange stenosis is under investigation (ECST Collaborative Group 1991; Toole et al. 1992). Despite being at higher risk for ischemic stroke, black patients are substantially less likely than white patients to receive carotid endarterectomy (Maxwell et al. 1989; Gittelsohn, Halpern, and Sanchez 1991; Escarce et al. 1993; Oddone et al. 1993). Explaining this racial variation is essential because carotid endarterectomy is the only surgical procedure proven to prevent stroke. The fundamental concern is that the observed difference reflects racial bias in the use of this effective procedure.

Racial variation is observed for other invasive vascular procedures as well, particularly coronary angiography, coronary artery bypass grafting, and percutaneous transluminal coronary angioplasty (Ford et al. 1989; Weneker and Epstein 1989; Gittelsohn, Halpern, and Sanchez 1991; Goldberg et al. 1992; Ayanian et al. 1993; Escarce et al. 1993; Whittle et al. 1993; Elixhauser, Harris, and Coffey 1994). Although all of these studies document lower utilization of invasive procedures in black relative to white patients, none has been able to determine whether this lower utilization is truly inappropriate; that is, the procedures are clinically indicated but not used.

In this report, we examine the plausible, alternative explanations for the observed racial difference in use of diagnostic and therapeutic procedures in the evaluation and treatment of patients with cerebrovascular disease. The existing evidence is reviewed in terms of its support, or refutation, of these explanations with an emphasis on carotid endarterectomy and angiography. After presenting our conclusions on the current state of understanding about the racial variation in patterns of care for cerebrovascular disease, we delineate directions for future investigations.

Plausible Explanations for the Observed Racial Variation

At least three widely recognized alternative explanations to racial bias should be considered in accounting for the racial variation in the utiliza-

tion of carotid endarterectomy (Williams, Lavizzo-Mourey, and Warren 1994). First, a racial difference in the diagnosis and treatment of cerebrovascular disease may indicate differences in important clinical factors related to the appropriateness of carotid endarterectomy. These factors include the extent and location of carotid artery stenosis, comorbid conditions, and operative risk conditions. The observed racial difference, then, would reflect appropriate care. Second, the ability to pay, regardless of race, may largely explain variations in the use of expensive diagnostic and surgical procedures. That is, variations in utilization of care may be more a function of income or health insurance than race per se. Third, there may be a racial difference in patients' decisions to use invasive diagnostic and therapeutic procedures.

Role of Clinical Differences in Disease

From a clinical perspective, the most important potential explanation of the observed racial difference in utilization of carotid angiography and endarterectomy is a racial difference in the nature of cerebrovascular disease. One requisite clinical indication for carotid endarterectomy is the presence of an atherosclerotic lesion (e.g., 70 percent or greater stenosis) in an operable location within the carotid artery. Other clinical factors include the patient's symptoms and the estimated operative risk, given the number and type of comorbid conditions present. There is theoretical and accumulating empirical evidence that blacks and whites differ in the extent and location of cerebrovascular atherosclerosis. These differences may render black patients potentially less appropriate candidates for carotid endarterectomy.

Pathophysiological Basis for a Racial Difference in Disease. Pathophysiological evidence suggests a significant racial difference in the extent and location of atherosclerotic disease (Heyden, Heyman, and Goree 1970; Heyman, Fields, and Keating 1972; Kuller and Reisler 1971; Gorelick et al. 1984; Gross et al. 1984; Caplan, Gorelick, and Hier 1986; Reed 1990; Gil-Peralta et al. 1990; Aronow and Schoenfeld 1993; Prisant et al. 1993). More than two decades ago, clinical epidemiologists hypothesized that there are at least two types of atherosclerotic disease of the intracranial arteries (Kuller and Reisler 1971). In one type, the proximal intracranial arteries are affected primarily through elevated blood pressure levels and secondarily through high blood lipid and glucose levels. A second type involves the smaller intracerebral arteries that are affected by both blood pressure and serum glucose levels; serum lipid levels are thought to

be a minor factor. The hypothesis specifies that some populations, including blacks, in which hypertension and diabetes are prevalent, will experience more ischemic strokes that involve the smaller cerebral arteries. Recently, empirical evidence from the Honolulu Heart Program, an ongoing prospective study of cardiovascular disease among 8,000 men, showed that the location of extracranial and intracranial atherosclerosis is associated with hypertension, diabetes, and serum lipids as hypothesized (Reed 1990).

Empirical evidence of a racial difference in the extent and location of cerebrovascular atherosclerosis arises from several sources. The weakest source of evidence comes from autopsy series of patients who have died from stroke. The second source consists of case series of symptomatic patients who have received ultrasonography or arteriography of their carotid arteries. The third source of evidence is the set of supplemental studies of patients in randomized controlled trials who have undergone neuroimaging, particularly carotid angiography (table 1).

Autopsy studies and studies of patients receiving angiography indicate that stenosis of the middle cerebral arteries (i.e., intracranial arteries) is more prevalent among black patients, whereas extracranial artery stenosis is less prevalent (Heyden, Heyman, and Goree 1970; Caplan, Gorelick, and Hier 1986; Gorelick et al. 1984). Stenoses of the middle cerebral arteries and other intracranial arteries are inaccessible to the surgeon and, hence, not amendable to surgery. Ultrasonography studies of consecutive patients also indicate a lower prevalence of, and less extensive, extracranial disease among blacks. In a series of patients with stroke or transient ischemic attack who were referred for evaluation of their carotid arteries by duplex Doppler ultrasound, the 61 black patients were approximately half as likely to have high-grade stenosis as the 65 white patients (Gil-Peralta et al. 1990). Only 16 percent of the black patients, but 40 percent of the white patients, had 65 percent or greater stenosis of the carotid arteries, whereas 38 percent of blacks, but only 18 percent of whites, had no disease present ($p < 0.006$).

Further evidence of a racial difference in the presence and location of atherosclerosis comes from supplemental studies of patients screened for randomized clinical trials. In the Joint Study of Extracranial Arterial Occlusion, the presence, extent, and location of lesions in ischemic stroke patients was angiographically determined in 911 black and 5,593 white patients (Heyman, Fields, and Keating 1972). In 20.6 percent of black patients and 12.8 percent of white patients, no "obstructive" lesions of

TABLE 1
Racial Differences in the Presence of Carotid Artery Stenosis

Study	Population	Year	Location	Artery	Degree of stenosis (%)	Black (%)	White (%)
Gorelick et al. (1984)	Stroke registry patients	1979-81	NY	ICA	75+	17	64
Gil-Peralta et al. (1990)	Consecutive patients with stroke or TIA referred for noninvasive evaluation of the carotid arteries	1988-89	PA	Carotid (max.)	0 40-99 100	38 36 8	18 69 4
Heyman et al. (1972)	Patients enrolled in the Joint Study of Extracranial Arterial Occlusion	1961-69	23 centers, nationally	Carotid	0 30+ 100	21 29 3	13 56 <1
Prisant et al. (1993)	Patients screened for inclusion in MIDAS	Late 1980s	Detroit, MI; Atlanta, GA	Carotid	≤45	43 66	61 70

Abbreviations: ICA, internal carotid artery; TIA, transient ischemic attack; carotid, extracranial carotid artery; MCA, middle cerebral artery and major branches; MIDAS, Multicenter Isradipine Diuretic Atherosclerosis Study.

the extracranial or intracranial arteries were found. Extracranial arterial stenosis of 30 percent or greater was observed in 29.4 percent of blacks, but 55.5 percent of whites. In the more recent Multicenter Isradipine Diuretic Atherosclerosis Study (MIDAS), all of the hypertensive patients who were screened for inclusion were evaluated by carotid ultrasound for the presence of low-grade carotid plaques of 1.3 to 3.5 millimeters (i.e., luminal stenosis of 45 percent or less). A greater proportion of white than black patients had low-grade plaques present in their carotid arteries after adjusting for age, sex, level of serum cholesterol, and cigarette smoking (Prisant et al. 1993). Thus, existing studies indicate that blacks are less likely than whites to have high-grade extracranial atherosclerosis that is amendable through carotid endarterectomy.

Race and the Appropriateness of Carotid Endarterectomy. Based on expert ratings (Matchar et al. 1992), carotid endarterectomy is an appropriate procedure when the expected health benefits (e.g., increased life expectancy, pain relief, improved functional capacity) exceed the expected health risks (e.g., procedure-related mortality or morbidity). The appropriateness of carotid endarterectomy is adjudicated from the degree of ipsilateral and contralateral carotid artery stenosis, the constellation of patient symptoms at presentation, and the patient's surgical risk.

There is no indication of a racial difference in the appropriateness of completed carotid endarterectomies. In the only published study, Brook et al. (1990) found that the proportion of appropriate carotid endarterectomies was similar for whites and nonwhites in a sample of Medicare patients who received the procedure in the mid-1980s (relative risk [RR] = 1.15; 95 percent confidence interval [CI] = 0.75, 1.59). This study, however, was not designed explicitly to ascertain racial differences in the appropriateness of carotid endarterectomy because the number of black patients required to address this issue was insufficient. Moreover, their data revealed nothing about possible racial variation in the proportion of patients who did not receive the surgery among those for whom it may be clinically indicated. Even if carotid endarterectomy is appropriate for fewer blacks, it remains to be determined whether a similar proportion of white and black patients receive the procedure when it is clinically indicated. No published studies address this important issue.

Role of Economic Factors

Race, Economic Status, and Use of Carotid Endarterectomy. Because race and socioeconomic status are highly associated in U.S. society, it is

possible that the observed patterns of utilization of expensive diagnostic or therapeutic procedures reflect the ability to pay for care. Blacks represent between 2 percent and 4 percent of patients who receive carotid endarterectomy (Maxwell et al. 1989; Brook et al. 1990; Oddone et al. 1993). With and without adjustment for income, the relative odds of whites versus blacks undergoing carotid endarterectomy are approximately three (table 2). Moreover, this degree of variation in the proportion of whites and blacks receiving carotid endarterectomy is found across hospitals with different reimbursement arrangements. It is observed in private sector hospitals, where fee-for-service reimbursement predominates, and in Veterans Health Administration (VHA) hospitals, where hospital budgets are capitated, physicians are salaried and have no financial incentive to perform unnecessary procedures, and patients are not responsible for the costs of their care. Thus, among hospitalized patients, "ability to pay" does not appear to explain a significant amount of the racial variation in the use of carotid endarterectomy.

The available studies, however, report on the experience of hospitalized patients, that is, patients who have gained access to the health care system. Moreover, symptomatic inpatients represent patients at the highest risk for stroke for whom further diagnostic evaluation and treatment are most likely warranted. If racial bias has a significant role in the evaluation and treatment of patients for cerebrovascular disease, it may be a particularly important factor earlier in the process of care when the presenting signs and symptoms are vaguer and, hence, the approach to clinical management is less clear. Consequently, the experience of inpatients may not be generalizable to patients prior to hospitalization and, even excluding bias as an explanation for the symptomatic inpatients, the possibility that bias operates earlier in the clinical evaluation process should not be precluded.

Socioeconomic factors (i.e., ability to pay) may be operative at any point in the sequence of events from onset of symptoms to performance of surgery. Key points would occur when the patient:

1. presents to his or her physician for evaluation of symptoms
2. is referred by the physician and receives outpatient (noninvasive) diagnostic evaluation, such as by carotid ultrasonography, or in the face of abnormal noninvasive test results
3. is referred for more invasive diagnostic evaluation and treatment in the inpatient setting

Evidence is available only for the latter two events in this sequence.

TABLE 2
Utilization of Carotid Endarterectomy among White and Black Patients

Study	Population	Year(s)	Data source	Relative odds (95% CI)
Nonfederal hospitals				
Elixhauser, Harris, and Coffey (1994)	Inpatients, nationally	1980-87	Discharge data, 20% random sample from a national sample of nonfederal, general hospitals	2.50 (NA) ^a
Escatce et al. (1993)	Medicare enrollees, 65 years or older, nationally	1986	Physician claims, 5% national sample	3.01 (2.32, 3.89) ^a
Gittelsohn et al. (1991)	Inpatients, MD	1985-87	Discharge data from all acute care hospitals	3.23 (NA) ^b
Mort, Weissman, and Epstein (1994)	Inpatients, MA	1988	Discharge data from all hospitals, including VA hospitals	2.98 (NA) ^a
Veterans Affairs hospitals				
Oddone et al. (1993)	Inpatients, 45 years and older, admitted for stroke or transient ischemic attack, nationally	FY 1989	Discharge data from all VA hospitals, nationally	3.52 (2.60, 4.77) ^c 2.36 (1.53, 3.63) ^d

^a Based on age- and sex-adjusted rates.

^b Adjusted for age, sex and income.

^c Unadjusted.

^d Adjusted for age, reason for admission (transient ischemic attack versus stroke), prior history of stroke or transient ischemic attack, presence of hypertension and comorbidity by the Charlson index (Charlson et al. 1987; Deyo, Cherkin, and Ciol 1993).
Abbreviation: NA, not available.

Race, Economic Status, and Use of Noninvasive and Invasive Diagnostic Evaluation of the Carotid Arteries. Noninvasive and invasive procedures (i.e., carotid ultrasonography and cerebral angiography) are used to determine the existence of high-grade, operable stenosis of the carotid arteries. There are only a few studies of racial differences in the use of noninvasive and invasive diagnostic procedures (Escarce et al. 1993; Oddone et al. 1993; Elixhauser, Harris, and Coffey 1994). Compared with the findings for carotid endarterectomy, relatively modest racial variation is reported in the use of noninvasive tests. For example, Escarce et al. (1993) found, among Medicare Part B beneficiaries, that the relative odds of whites to blacks undergoing noninvasive carotid imaging were 1.26 (95% CI = 1.19, 1.34) and, for other noninvasive cerebrovascular imaging, 1.14 (95% CI = 1.05, 1.23). However, these relative odds were not adjusted for the patient's presenting symptoms.

For invasive diagnostic procedures, a racial difference in utilization is more apparent. Elixhauser, Harris, and Coffey (1994) found, among hospitalized patients, the relative odds of whites versus blacks undergoing cerebral angiography were 1.58, a significantly elevated odds ratio. Oddone et al. (1993), however, found even greater racial differences in use of cerebral angiography within VHA hospitals. The unadjusted relative odds for receiving carotid angiography were 2.19 (95% CI = 1.95, 2.45) and, after adjusting for various clinical and sociodemographic characteristics, the relative odds were 1.90 (95% CI = 1.60, 2.26).

Procedural costs and risks may account for part of the racial variation in use of these noninvasive and invasive diagnostic tests. Ultrasonography of the carotid arteries can be performed in an outpatient setting, making it less expensive than more invasive diagnostic approaches. Ultrasonography also has fewer risks for the patient than angiography. Thus, it is possible that carotid ultrasonography is being substituted for angiography among black patients. It may also be that the noninvasive test results indicate that further testing by invasive procedures is not warranted. However, no published studies address either hypothesis.

Role of Patient Decision Making

A third potential explanation for the observed racial variation in the use of carotid endarterectomy is a racial difference in patients' decisions regarding their care. There are no published data indicating the importance of patient preferences as an explanation for racial variation in the

use of carotid endarterectomy or other invasive procedures. Nor is there evidence of a racial difference in persons seeking care for neurologic symptoms, although there are a limited number of studies on the role of patient decisions to seek and accept care for cardiovascular disease. These latter studies suggest patient decisions may explain some of the difference in the diagnostic and treatment patterns for this disease (Cooper et al. 1986; Maynard et al. 1986; Bailey 1987; Folsom et al. 1988; Strogatz 1990; Lewis et al. 1991; Ghali et al. 1993; Johnson et al. 1993). To the extent that the situation for cardiovascular disease is representative of that for cerebrovascular disease, insights can be gained into the importance of patient decisions as an explanation of racial variation in the use of diagnostic and therapeutic procedures for cerebrovascular disease. Because the general clinical approach to diagnosing and treating cardiovascular disease is similar to that for cerebrovascular disease, the literature relating to race and patient decision making for cardiovascular disease may provide insight into this aspect of care for cerebrovascular disease.

Racial Differences in Seeking Care. Racial differences in care-seeking patterns and in acting upon physician recommendations are documented. Several studies indicate that blacks delay seeking care for possible myocardial infarction (Cooper et al. 1986; Bailey 1987; Lewis et al. 1991; Ghali et al. 1993). In a Chicago study, black patients with chest pain had a mean delay before presenting to the emergency room that was approximately twice that of other patients (Cooper et al. 1986). Longer delay was associated with a higher death rate among these black patients. This racial pattern of delay in presenting at an emergency room with chest pain is a widely reported phenomenon. For example, at Massachusetts and Ohio hospitals, 61 percent of the 1,345 black patients versus 50 percent of 1,623 white patients ($p < 0.001$) presented more than six hours after onset of their chest pain; the delay among blacks was independent of age, sex, and clinical factors, including severity of symptoms or history of heart disease (Johnson et al. 1993).

The likelihood of accepting a physician's recommendation for surgery also varies by the patient's race. Maynard et al. (1986), using data from the Coronary Artery Surgery Study, found that 80.5 percent of black patients, but 90.4 percent of white patients, for whom surgery was recommended agreed to the surgery ($p = 0.002$). The authors of the study offered no explanation for this higher rate of refusal of surgery among the black patients. However, they also found that surgery was recom-

mended less often to blacks than to whites, despite similar clinical and angiographic characteristics.

These findings of Maynard et al. (1986) suggest that decisions by physicians and patients explain, in part, the racial variation in the use of surgery and other invasive procedures. Although the relative importance of physician vis-à-vis patient decisions has only begun to be studied, the results from the one available study appear to indicate that patient decisions play a greater role in determining patterns of care than was heretofore thought. Mort, Weissman, and Epstein (1994) found varying white:black ratios for undergoing procedures that were adjudicated by an expert panel to involve a similar level of physician discretion for selection. For example, among low discretionary procedures, the white:black ratio of utilization rates ranged from 1.14 for appendectomy to 3.5 for abdominal aortic aneurysm repair. For moderately discretionary procedures, the white:black ratios ranged from 0.93 for prostatectomy to 2.98 for carotid endarterectomy. And for highly discretionary procedures, the ratio of white to black utilization rates ranged from 0.79 for hysterectomy to 1.41 for tonsillectomy.

A Rationale for Racial Differences in Health Care Decision Making. The "health belief model" provides a framework for understanding these observed racial differences in decisions to delay or refuse recommended care and for guiding further investigation of these patterns. Under the "health belief model," a patient's decision to act upon medical advice is postulated to be a function of several psychosocial factors: belief in one's personal susceptibility to the disease; perceived seriousness of the disease; belief in the efficacy of the recommended care; and motivation to regain health as balanced against perceived barriers to care, such as lack of satisfaction with the physician and previous care provided and concern about the cost of the care (Kirscht 1974; Maiman and Becker 1974; Maiman et al. 1977; Berkanovic, Telesky, and Reeder 1981). Evidence on the existence of racial differences in these psychosocial factors, primarily for cardiovascular disease, is presented below.

Race and Beliefs in Disease Susceptibility and Treatment Efficacy. A racial difference in cultural beliefs regarding illness and treatment has been suggested (Bailey 1987). The conclusion of at least one study is that blacks and whites have significantly different beliefs about the causes and prevention of cardiovascular disease (Folsom et al. 1988). For example, when asked about the symptoms and causes of cardiac disease, sig-

nificantly fewer blacks than whites cited any of the classic symptoms of myocardial infarction (e.g., 72 percent of blacks versus 85 percent of whites cited chest pain) or identified at least one of the three major risk factors (65 percent of blacks versus 76 percent of whites). Adjustment for years of education did not eliminate the racial difference.

Differences in black and white patients' beliefs in the efficacy of accepted medical therapy are also noted. For example, the lower rate of compliance with pharmacological therapy among black hypertensive patients (see National Heart, Lung, and Blood Institute 1984) is linked in at least one study to the patients' beliefs about the causes of hypertension and, hence, in their perception of the necessity of medications to control their blood pressure (Heurtin-Roberts and Reisin 1992).

Self-Perceived Barriers to Care. One proposed explanation of the racial difference in patient decisions regarding medical care is previous negative experiences with the health care system. It is postulated that previous encounters with physicians have led black patients to believe that the evaluation of their symptoms, for example, is less thorough than for white patients. There are no published reports on the role of dissatisfaction with previously received care as an explanation for the racial differences in use of health care for the prevention or treatment of stroke or other chronic diseases.

Another postulated patient-perceived barrier to care is fear of the financial implications, particularly the inability to pay for the care. Again, there is no direct evidence of a racial difference in the prevalence of such fears, although there may be indirect indication of its existence. For example, the work by Ghali et al. (1993) suggests that patients of lower socioeconomic status, regardless of race, delay seeking medical care for potentially fatal conditions. In a study of 74 white and black inner-city patients who presented to the emergency room with chest pain or myocardial infarction, the investigators found a mean delay of 11.3 hours for patients with myocardial infarction and 20.5 hours for patients without myocardial infarction. Unfortunately, the clear absence of a racial difference in delay cannot be concluded because race-specific data were not presented.

Socioeconomic status encompasses both income and education or, more precisely, knowledge regarding when to seek care. Folsom et al. (1988) demonstrated a residual racial difference in knowledge of risk factors for disease after adjustment for years of education. Raczynski et al. (1993) reported a racial difference in seeking care for coronary heart dis-

ease after adjustment for education and health insurance. And Strogatz (1990) reported that, among North Carolinians with chest pain, significantly fewer blacks than whites saw a physician about the pain (22 percent versus 49 percent, $p < 0.05$), and that adjustment for income and health insurance as well as gender, age, and health status did not fully account for the racial difference. Additional evidence against an economic explanation—“fear of the inability to pay”—for the racial variation in use of carotid endarterectomy was presented in the earlier section, “Role of Economic Factors.”

Directions for Future Research

Clearly, the current state of knowledge is insufficient to assess fully the alternative explanations of the observed racial variation in the use of diagnostic and therapeutic procedures for cerebrovascular disease. The principal weakness of the literature is that the majority of studies assessing racial variation examine the final stage in the evaluation and treatment of cerebrovascular disease, specifically, the use of carotid endarterectomy. The existence of racial variation in use of this procedure and other diagnostic and therapeutic procedures is well documented (e.g., Elixhauser, Harris, and Coffey 1994), making further studies of such differences unnecessary. Similarly, a substantial number of studies have documented racial differences in the general location of lesions within the cerebral circulation. These studies indicate that fewer black patients have the symptoms of cerebrovascular disease that are associated with high-grade stenosis in an operable location of the carotid arteries.

However, there are several aspects of the evaluation-treatment process for cerebrovascular disease for which there is scant information regarding racial differences. One primary area that has not been given adequate consideration is possible bias in the selection of patients for either noninvasive or invasive diagnostic and therapeutic procedures. The evidence that does exist has focused only on hospitalized patients, and suggests that ability to pay does not account for racial variations in the use of carotid endarterectomy. Further examination is needed of whether ability to pay is associated with the likelihood of an outpatient being referred, either in or out of the hospital, for additional evaluation of symptoms.

A second area requiring inquiry comprises the various clinical factors that may influence either a clinician's suspicion of operable disease or

the choice of care when such disease is discovered. Although a substantial number of studies document a racial difference in the presence of high-grade, operable carotid artery stenosis, this is just one of the several important clinical factors. Others include the patient's symptoms and surgical risk profile; neither of these considerations has been investigated with regard to racial differences. Specifically, there is currently no evidence that either supports or refutes a racial difference in the proportion of patients, for whom it is an appropriate therapy, who actually receive carotid endarterectomy.

A third area ripe for further investigation is the relative importance of the patient and physician decision-making process. Issues here relate to prior knowledge, patient-physician communication about the disease and treatment options, and patient preferences in the face of "complete information." It may be that black patients are not fully informed of the options. It is possible that physicians, unconsciously or otherwise, convey through words, tone, or body language less enthusiasm for surgery when discussing this option with black patients because of a belief in lower efficacy of the surgery for blacks or for other, as yet unclear, reasons. Another possible explanation is that blacks systematically refuse recommended (invasive) diagnostic or surgical procedures despite adequate knowledge of the consequences. If so, the issue can become delicate. If the decision is a reflection of full knowledge, perhaps there should be no cause for concern. If the decision is based on beliefs or attitudes of a social group that are faulty or deleterious (such as fatalism or an unjustified mistrust of physicians), it may be appropriate and feasible to modify these attitudes through culturally sensitive education. Whatever the policy response, it is clearly important to explore fully the decision-making process, including the patient-physician interaction during discussions of treatment options that involve invasive procedures.

If the importance of racial bias is to be adequately assessed, the next generation of research needs to examine more fully the dynamics of care, particularly patient-physician interactions, and to do so at earlier stages in the diagnostic evaluation and treatment process. To be particularly informative, we will need to examine the evaluation and decision-making process from the earliest stages. A theoretically attractive but complex approach would begin with a community-based cohort. The most feasible strategy is to begin with a cohort of patients who have symptoms of carotid artery stenosis (i.e., patients with mild ischemic stroke, transient ischemic attack, or amaurosis fugax), and to track them through as much

of the evaluation–treatment process as possible. A core component of the sort of cohort study we are suggesting is an assessment of the “appropriateness” of further evaluation and treatment and a follow-up of the health outcomes. Appropriateness will need to be assessed in terms of clinical data such as extent and location of carotid artery lesions, comorbidity, and patient characteristics that influence surgical risk status. The study will, ideally, record whether the physician discussed the option with the patient, the content of the discussion, the result of the discussion, and the reasons for the decision. The necessity of assessing short- and longer-term health outcomes is highlighted by studies of cardiac revascularization where, despite the lower utilization of these procedures, the mortality rate experienced by black patients was similar to, or lower than, that of whites (Peterson et al. 1994).

Conclusions

Dramatic racial differences are observed in the use of effective invasive therapies for cerebrovascular disease as well as for cardiovascular disease and other diseases. However, the available evidence is insufficient to exclude racial discrimination as an explanation for the racial differences in utilization of carotid endarterectomy. Future investigations need to clarify the importance of alternative explanations. These alternative explanations include the extent to which the constellation of clinical factors that indicate the appropriateness of carotid endarterectomy accounts for the lower utilization among blacks; the effect of socioeconomic status, particularly the ability to pay, on the diagnostic evaluation and treatment process prior to hospitalization for the disease; and the influence of cultural differences and the dynamics of the patient–physician interaction on treatment decisions among racial groups.

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Address correspondence to: Ronnie D. Horner, PhD, Center for Health Services Research in Primary Care (152), VA Medical Center, 508 Fulton Street, Durham, NC 27705.