

## BLACK-WHITE DIFFERENCES IN BLOOD PRESSURE: THE ROLE OF SOCIAL FACTORS

DAVID R. WILLIAMS, PhD, MPH

This review summarizes current knowledge about the social sources of differences in blood pressure between blacks and whites in the United States. Genetic variables may play some role in explaining black-white differences in blood pressure, but social factors are more important than genetic ones. I review evidence linking stress, social integration, coping styles, and health behavior (including obesity) to high blood pressure, emphasizing that the distribution of these risk factors is shaped by larger social structures and processes. Effective efforts to reduce stress and improve health practices must not focus only on the individual but must seek to alter the social, economic, and political structures and arrangements that produce disease. (*Ethnicity Dis.* 1992;2:126-141)

KEY WORDS Blacks, Blood Pressure, Obesity, Racial Differences, Risk Factors, Stress

Hypertension and high blood pressure are interchangeable terms used to describe the sustained elevation of blood pressure above the normal range. Over 90% of persons with high blood pressure have "essential" hypertension; that is, there is no known medical cause for the disease.<sup>1</sup> The remainder have secondary hypertension, in which blood pressure elevation is related to an organic problem, such as kidney disease. Blacks have rates of high blood pressure that are twice those of whites, and the excess level of high blood pressure in the black population is entirely due to essential hypertension.<sup>1</sup> Several decades of research indicate that a broad range of social and psychological factors are associated with high blood pressure.<sup>2,3</sup> This paper reviews the evidence linking these factors to hypertension and suggests that they may play a major role

in accounting for racial differences in high blood pressure.

In most prior research, the psychological and behavioral risk factors for hypertension have been viewed as if they were autonomous individual characteristics, unrelated to working and living conditions, and independent of the broader social and political order. In contrast, this paper emphasizes that the determinants of blood pressure levels are embedded in social structures and arrangements. The primary causes of racial disparities in hypertension are rooted not in individuals but in differences between the races in exposure or vulnerability to pathogenic factors in the physical, social, economic, and cultural environment.

### THE LIMITS OF BIOLOGY

Race is a concept widely used to study variations in the distribution of disease. Many researchers view race as primarily reflecting genetic endowment, despite growing recognition that racial classification schemes are arbitrary and that race is more of a social category than a biological one.<sup>4</sup> There is more genetic variation within races than between them, and given the extent of racial admixture, racial classification schemes tend not to represent biological distinctiveness.<sup>5</sup> Thus, it is likely that racial

---

From the Department of Sociology, Yale University, and the Department of Epidemiology and Public Health, Yale School of Medicine.

Presented at the Second International Conference on Race, Ethnicity, and Health: Challenges in Diabetes and Hypertension, Salvador, Brazil, July 30-31, 1991.

Reprint requests to Department of Sociology, Yale University, PO Box 1965, New Haven, CT 06520 (Dr Williams).

Received September 16, 1991; accepted in revised form February 13, 1992.

differences in the distribution of disease in general, and of high blood pressure in particular, are determined more by social factors than by genetic differences. Genetic differences do exist, but their role in health is frequently overstated. Environmental factors are more important determinants of variations in most diseases than biological ones.<sup>6</sup>

In the case of hypertension, it has been well documented that the physiological profile of high blood pressure in black patients tends to differ from that of white patients. Differences in hemodynamic profile include lower plasma renin, a larger plasma volume, more peripheral and renal vascular resistance, and greater sensitivity to sodium in blacks than in whites.<sup>7,8</sup> However, whether these differences are due to genetic factors or to racial differences in nutrition is not known.<sup>9</sup> Moreover, not all of the observed differences are in the direction of increased risk of hypertension for blacks, and the relationships between all of the observed differences and increases in blood pressure levels have not been firmly established.<sup>1</sup> This is not to imply that these differences are unimportant or should be ignored. In fact, consideration of these differences can facilitate better medical management of hypertension, including more appropriate selection of antihypertensive medications for black patients.<sup>8,10</sup>

Efforts to identify a role for genetic factors in hypertension suggest that they are unlikely to explain race differences in blood pressure. Studies of blood groups, twins, and gene markers indicate that although genetics may play some role, the genetics of hypertension is not clearly understood, and genetic variables alone are unlikely to adequately account for blood pressure differences between blacks and whites.<sup>1,11-13</sup> Moreover, to the extent that genetic differences exist, they are likely to operate by interacting with environmental factors. Skin color has been a primary genetic marker used in studies that have sought to investigate a role for genetic

factors in racial differences in blood pressure. Early evidence suggested a positive association between dark skin color and blood pressure level within the black population. However, later studies revealed that skin color is an indicator of socioeconomic status (SES) as well as of racial admixture.<sup>1</sup> These studies indicated that when adjusted for SES, the relationship between skin color and blood pressure disappeared. However, one recent report documents that there is an interaction between skin color and SES.<sup>14</sup> This study of urban blacks found that at low levels of SES, blood pressure is higher in darker persons; at higher levels of SES, skin color is unrelated to blood pressure level. The researchers concluded that their findings suggest an interaction between a susceptible gene that may be more prevalent among blacks with darker skin color and an environmental factor present in persons of low SES, or that darker skin color is a social characteristic predictive of less access to economic and social resources among lower-SES persons.

Research by Dressler in the United States and Brazil provides support for the latter interpretation.<sup>15</sup> Dressler argues that skin color is an indicator of SES *and* discrimination. Thus, the struggle to obtain and maintain desirable resources in color-conscious societies is more acute for darker-skinned persons, and the associated stress leads to high blood pressure. Further, in a recent report using data from the National Study of Black Americans, Keith and Herring found that skin color is a stronger predictor of the occupational status and income levels of adult blacks than parental SES.<sup>16</sup> This study also documented that darker-skinned blacks in the United States are twice as likely to experience racial discrimination as their lighter-skinned peers.

#### SOCIAL EPIDEMIOLOGY OF BLOOD PRESSURE

The social distribution of high blood pressure also suggests an important role for environmental factors. First, there are cul-

tural variations in the relationship between age and blood pressure. Blood pressure increases with age among both blacks and whites in the United States; the increase is more marked among blacks than among whites.<sup>17</sup> In contrast, there are populations in Africa, Asia, and South America where blood pressure levels remain stable over the life course.<sup>5,18,19</sup> Cross-cultural studies also indicate that blood pressure within large racial groups varies by the particular geographical or social context. For example, blood pressure levels in West Africans are generally lower than those in US and Caribbean blacks.<sup>1,18</sup> Moreover, when black populations in Africa and other traditional populations in Third World countries move from their original communities to large urban centers, their blood pressure levels increase.<sup>19</sup> However, the interaction of historical factors with the current social environment may be complex. In a comprehensive review of cross-cultural studies of blood pressure levels, Waldron et al<sup>20</sup> documented that black descendants of slaves, especially black women, had higher blood pressure levels than blacks who were not descendants of slaves, even when the effects of economic modernization were controlled.

Blood pressure variations within the United States also suggest an important role for environmental factors. Blood pressure levels are inversely related to SES for both blacks and whites.<sup>2</sup> One study of employed women found that SES was a stronger predictor of blood pressure than was race,<sup>21</sup> but studies have more generally found that controlling for SES reduces, but does not eliminate, racial differences in high blood pressure.<sup>2</sup> Place of residence also appears to be a predictor of blood pressure levels. Blacks and whites in urban areas tend to have higher blood pressure levels than their suburban peers,<sup>17,22</sup> but opposite patterns have been found in some studies.<sup>22</sup> Moreover, complex interactions between race and residence are sometimes observed. For exam-

ple, a study of adolescents in the Dayton, Ohio area found that although urban residents of both races had higher blood pressure levels than their suburban counterparts and urban black males had higher blood pressure levels than urban white males, suburban white males had higher mean blood pressures than suburban black males.<sup>22</sup>

Studies of blood pressure in children also suggest an important role for the social environment. Akinkugbe et al compared the blood pressures of black and white American children with those of Nigerian children.<sup>23</sup> They found that blood pressures were marginally but consistently higher in black than in white US children. Surprisingly, there were large differences in blood pressure between the African and the American children; African children had blood pressure levels that were significantly higher than levels among both black and white American children. Studies of regional and national populations in the United States have generally found that there are no blood pressure differences between black and white preadolescent children.<sup>17</sup> Thus, race differences in blood pressure tend to be evident only in adulthood. This may indicate a lag in the effect of environmental exposures on the sustained elevation of blood pressure. Alternatively, it may also reflect a rapid increase of hypertension in black young adults as they are forced to confront the reality of restricted socioeconomic opportunities and truncated options.<sup>24</sup>

The consistent pattern of these findings has been challenged by the Bogalusa Heart Study in Louisiana,<sup>25,26</sup> which found that black children aged 5 through 14 years have higher blood pressure levels than do whites, even after controlling for parental education and occupation.<sup>26</sup> However, Bogalusa appears distinctive in several respects, and the results of this study should not be generalized to other populations. First, the mean pressures for children in Bogalusa were lower than those reported in other studies, and a significant racial difference in blood pres-

sure level was evident only at the upper five percentiles of blood pressure.<sup>25</sup> Second, and more important, Bogalusa appears to have a greater concentration of socioeconomically disadvantaged blacks than is typically found in population-based studies. For example, only 9% of the black parents in Bogalusa had more than a high school education, and 82% were employed in blue-collar occupations.<sup>26</sup> The comparable numbers for whites are 28% and 47%, respectively. Thus, the findings from the Bogalusa Heart Study may further illustrate how the distribution of blood pressure in a given study is conditioned by the particular sociocultural environment in which the study occurs.

#### STRESS AND SOCIAL CONDITIONS

As noted earlier, urbanization and industrialization tend to be predictive of increases in blood pressure levels. This suggests that environmental stress may make an important contribution to hypertension. Because of past and present economic exploitation, blacks are likely to experience more stress than whites. If stress is causally linked to hypertension, its role may be crucial in accounting for racial differences in high blood pressure. The available evidence suggests that there are specific characteristics of occupational, family, and residential environments that are associated with higher levels of blood pressure. Stress does not occur by chance, nor is it randomly distributed in the population.<sup>27</sup> To a large degree, stressors are initiated and maintained by the social, political, and economic structures and arrangements that both create the conditions under which people live and work and constrain the response of social groups to these conditions.

Laboratory experiments with animals reveal that stress can cause chronic elevations in blood pressure.<sup>28</sup> This stress-induced hypertension is more likely to occur in animals that have a predisposition to high blood pressure. Case-control studies of humans

indicate that persons with essential hypertension show exaggerated blood pressure responses to a broad range of experimentally induced stressors.<sup>29</sup> Other experimental data indicate that blacks have greater blood pressure elevations than whites in response to stress, and there is some evidence that cardiovascular reactivity to stress is predictive of future hypertension.<sup>30</sup> Studies of human populations outside the laboratory cannot employ the same level of methodological rigor as the experimental studies, but the overall weight of data from these studies strongly suggests that stress may play an important role in the etiology of hypertension.

#### *Occupational stress*

Studies of occupations indicate that both work stress and blood pressure levels vary by occupational group.<sup>31</sup> Persons in occupations with higher stress levels (such as air traffic controllers, soldiers, and urban bus drivers) tend to have higher levels of blood pressure.<sup>28,32</sup> Specific occupational experiences have also been linked to elevated blood pressures. The blood pressures of men in a prospective study of factory workers increased after they lost their jobs,<sup>33</sup> and a cross-sectional study of black males found a positive relationship between job insecurity and blood pressure.<sup>34</sup>

A study of blood pressure in a large probability sample of women from four midwestern corporations illustrates the potential relationship between occupational environment and blood pressure.<sup>21</sup> One of the four companies had a rate of hypertension four times higher than the other three. This large disparity persisted after adjustment for race, age, obesity, parental hypertension, the likelihood of working in isolation, income, the use of oral contraceptives, and general health problems. The researchers noted that the work environment of the company with the high rate of hypertension differed from those of the other three. Workers at this corporation were not unionized and were under greater per-

formance pressures than employees at the other three. Moreover, given this company's strong emphasis on personal appearance and decorum, the work atmosphere was restrained and formal, although efforts were made to appear gracious and relaxed. The researchers suggested that the work environment at this company created an underlying tension, which, combined with the high levels of competition and work pressure, produced a stressful occupational environment that may have led to the unusually high levels of blood pressure.

Attempts have been made to identify the specific features of work environments that are related to an increased risk of hypertension. In a study of male workers in Sweden, for example, Lundberg et al found that both systolic and diastolic blood pressures are elevated during repetitive work on an assembly line.<sup>35</sup> In addition, these researchers reported that blood pressure elevations were lower in workers who reported "a good day." More generally, a review of this literature indicates that the working conditions strongly associated with a high risk of hypertension are high job demands combined with low control.<sup>32</sup> Occupations falling into this category (such as laborers, servers, assembly line workers, textile operators, and clerks) are those in which blacks in particular, and persons from lower socioeconomic groups more generally, are likely to be overrepresented.

It is likely that blacks experience more occupational stress than do whites. Lower-SES blacks are more likely to experience unemployment than their white peers,<sup>6</sup> and employed blacks are more likely than whites to be exposed to occupational hazards and carcinogens even after controlling for job experience and education.<sup>36</sup> The occupational hazards that blacks are more likely to experience include exposure to high temperatures, dusty conditions, noise, and infectious diseases. In addition, for a given level of education, blacks receive less income than whites.<sup>37</sup>

### *Socioecologic stress*

Researchers have also linked stress in residential areas to elevated blood pressure levels. Specific stresses that show a positive association with blood pressure include industrial noise, airport noise, traffic noise, and overcrowding.<sup>32</sup> An ecological study of stress and blood pressure in Detroit provides compelling evidence that stress in the social environment can explain at least part of the racial difference in hypertension.<sup>38</sup> In this study, the researchers characterized census tracts in Detroit as either high or low in stress, using levels of economic deprivation (based on median income and education, and rates of unemployment, home ownership, and employment in professional and managerial jobs), marital instability, and crime as indicators of stress. Factor analysis of these variables yielded an SES factor and a social instability factor (SIS). High-stress areas in Detroit were defined as census tracts high on the SIS and low on the SES factor. Low-stress census tracts had the converse conditions. This study found that persons residing in low-stress areas had lower levels of blood pressure than those in high-stress areas. This association was stronger among blacks than among whites. In addition, the blood pressure levels of black males in low-stress areas did not differ from those of white males in low-stress areas.

Another ecological study, using somewhat similar methods, classified counties in North Carolina as either high or low in stress and assessed the relationship between county of residence and hypertension-related death rates among 45- to 54-year-old black and white males.<sup>39</sup> This study found that hypertension-related death rates were almost twice as high for black men in high-stress counties compared to their peers in low-stress counties. Unlike the Detroit study, this study assessed the separate effects of the SIS and SES components of the stress measure. Both SIS and SES were positively related to death rates for blacks and

whites, but the SIS effect was independent of the SES effect. For blacks, SIS was the stronger predictor of hypertension-related mortality, while for whites, SES was the stronger predictor.

### *Social support*

These SIS effects suggest that the absence of supportive social relationships may also play an important role in racial differences in high blood pressure. This is consistent with the burgeoning literature on social support that indicates that the quantity and quality of social ties are predictive of a broad range of health outcomes.<sup>40</sup> A lack of social relationships, for example, is more strongly linked to all-cause mortality than is cigarette smoking.<sup>41</sup> Similarly, a comprehensive review of studies of high blood pressure conducted in 84 societies concluded that a decline in the prevalence of extended family systems is one of the factors associated with higher blood pressure.<sup>20</sup>

An earlier ecological study of stroke mortality in North Carolina also linked mortality rates to SIS levels in North Carolina counties.<sup>42</sup> The level of SIS, called social disorganization in this study, was measured by rates of single parent households, separation and divorce, illegitimate births, males sentenced to prison workcamps, and children under 18 years not living with both parents. This study found a strong, linear relationship between stroke mortality and SIS rates for blacks but not for whites. The association was strongest for the 25- to 44-year age group. This relationship was also independent of poverty level.

The consistent findings from the ecological studies suggest, but do not provide direct evidence, that impaired social relationships are linked to high blood pressure levels. The limited evidence from epidemiologic studies that have attempted to assess this relationship directly suggests that this is a promising area for future research.<sup>43</sup> Livingston and colleagues recently reported that

church affiliation was inversely related to blood pressure in a large sample of black residents in the state of Maryland.<sup>44</sup> A study of blacks and whites in North Carolina provides direct evidence that social support is related to blood pressure among blacks.<sup>43</sup> Instrumental support was significantly associated with hypertension among low-SES blacks, even after adjustment for other hypertension risk factors. This pattern of results suggests that in the absence of other social and economic resources available to higher-SES persons, informal support provided by the social networks of the black poor is critical to maintaining life in the face of stress and can have health-enhancing effects on blood pressure.

The North Carolina study also indicated that levels of both emotional and instrumental support were higher among blacks than among whites. This is instructive because the literature on social relationships and health has tended to neglect the social determinants of variations in the levels of social ties.<sup>45</sup> Variations in levels of social support and social integration do not merely reflect individual choices and preferences; they are linked to broader societal structures and processes. Marriage, for example, is the cornerstone of most measures of social relationships,<sup>46</sup> but socioeconomic factors affect the likelihood of getting married.<sup>47</sup>

A recent review of the socioeconomic roots of social integration reveals that unemployment, declines in income, and high job turnover are all associated with increased rates of marital dissolution.<sup>6</sup> This review also indicated that rates of female-headed households rise with increases in male unemployment and decline when males' earnings rise. Unemployment is linked to declines in levels of social contact, not only with coworkers, but also with friends, relatives, and community organizations.<sup>6</sup> A review of the health-enhancing effects of social support in occupational contexts provides further evidence of the structural determinants of social support.<sup>48</sup> Char-

acteristics of occupational environments, such as machine-bound jobs or high noise levels, can reduce levels of social contact among coworkers.

#### *Coping patterns*

The Detroit study also examined the relationship between blood pressure levels and the emotional response to being treated unfairly in hypothetical situations.<sup>49</sup> Holding anger in or feeling guilty about displaying anger were both positively related to blood pressure. Suppressed hostility, a combination of keeping anger in and feeling guilty if anger is expressed, was found to be positively related to hypertension for both black and white males. Men in high-stress areas reported more suppressed hostility and greater tendency to keep anger in than did men in low-stress areas. This clearly suggests that exposure to anger-arousing situations is dependent on an individual's particular social environment. Persons who live and work under conditions of acute social and economic deprivation are likely to be exposed to more anger-arousing social situations. Research is needed to delineate the mechanisms by which social structure and processes create anger-arousing and other stressful social situations and constrain responses to them.

Dressler's research on the association between thwarted aspirations and high blood pressure provides a further illustration of how conditions of life linked to the larger social structure can affect levels of hypertension.<sup>50,51</sup> An early study conducted in the eastern Caribbean island of St Lucia noted that modernization in this society, as in many others, creates widespread expectations of upward social mobility and acquisition of consumer goods that cannot be realized within the constraints of the local economy.<sup>50</sup> This study found elevated blood pressure levels among persons who actively pursued material success without the economic resources to obtain it.

Dressler has argued that the social transformation of the black community in the United States in the last half century is similar to that of developing countries.<sup>51</sup> He has replicated his study of St Lucia in a southern black community. In this study, life-style incongruity, the measure of thwarted aspirations, was defined as the discrepancy between one's occupational status and one's desired life-style as defined by ownership of material goods and by behaviors that increase exposure to cultural messages regarding life-style. Dressler found that life-style incongruity was related to higher blood pressure independent of the effects of sex, body mass, darker skin color, and age. The relationship between life-style incongruity and blood pressure was stronger among persons aged 40 years and older, suggesting that the pathogenic effects of thwarted aspirations may be linked to the length of exposure. The relationship between life-style incongruity and blood pressure was independent of a scale of chronic stress that measured ongoing difficulties in the areas of employment, marriage, finances, and racial relations.

Further evidence that thwarted aspirations may play an important role in the excess levels of high blood pressure in the black population come from the classic studies of John Henryism.<sup>52,53</sup> According to a black American folk tale, John Henry was a strong but uneducated steel driver who died of exhaustion right after he successfully conquered a mechanical steel drill. A high score on the John Henryism scale reflects an active orientation to cope with stress. A study of low-income black men in eastern North Carolina found the highest blood pressure levels among men who scored above the sample median on John Henryism but below the median on formal education (11 years of education or less).<sup>52</sup> Conversely, men who scored above the sample median on both formal education and John Henryism had the very lowest mean blood pressure levels. Thus, the active pursuit of ma-

terial success without the requisite social and economic resources to facilitate its accomplishment was associated with higher blood pressure.

Subsequent research in a larger sample found that among blacks who scored high on the John Henryism scale, persons of low SES were three times as likely to be hypertensive as their higher-SES peers.<sup>53</sup> Interestingly, John Henryism was unrelated to blood pressure among whites. Together, the studies of Dressler and of James and colleagues suggest that under certain conditions the encounter between an individual and the socioeconomic system can trigger disease. Efforts to succeed and advance socioeconomically are a risk factor for high blood pressure in individuals or groups that have limited access to economic resources. More rigorous tests of the relationship of these factors to blood pressure levels require longitudinal research.

A recent study of black and white women's responses to gender and racial discrimination further illustrates how the unique social situation of blacks and the experience of blocked opportunity can be linked to high blood pressure.<sup>54</sup> The study found that black women were six times more likely than whites to indicate that they responded to unfair treatment by keeping quiet and accepting it. Black women who displayed this internalized response to unfair treatment were more than four times as likely to report having high blood pressure than were black women who said they talked to others and took action in response to unfair treatment. Interestingly, black women who reported no incident of gender or racial discrimination were two to three times as likely to have high blood pressure as those who reported that they had experienced unfair treatment. Gender discrimination was unrelated to hypertension in whites. This is similar to the results of the John Henryism study<sup>53</sup> and of the studies of socioecological stress in Detroit<sup>38</sup> and North Carolina,<sup>42</sup> where either stress was unrelated to hypertension among

whites or the association was weaker among whites than among blacks.

#### *Stress and blood pressure control*

Stress may play a role not only in initiating higher blood pressure levels but also in sustaining them. Some limited evidence suggests that stress can exacerbate the progression of hypertensive disease and make the medical management of high blood pressure more difficult. In a 6-month follow-up study of 99 hypertensive patients, Brody used a four-item self-report measure of psychological stress.<sup>55</sup> He assessed the relationship between psychological distress and high blood pressure control and found that patients in the highest quartile of psychological stress received more antihypertensive medications but had smaller reductions in blood pressure than those who scored lower on psychological stress.

Similar evidence comes from a 2-year follow-up study of 148 persons with essential hypertension at an outpatient clinic.<sup>56</sup> Forty-one percent were untreated at the start of the study. This study found that an overall measure of stress that included personal problems, worries, life events, conflicts at home, and job loss strongly predicted the initiation of drug treatment over the course of the study. Conflict at home was the single best predictor of the initiation of drug treatment.

Indirect evidence for stress's role in hypertension also comes from the studies that have used relaxation techniques to treat hypertension. Recent reviews of this literature indicate that mild to moderate hypertension can be treated effectively by relaxation therapy.<sup>57,58</sup> These strategies include breathing techniques, deep muscle relaxation, visualization, simple forms of meditation, and biofeedback, as well as stress-reducing behavioral and cognitive strategies. Programs that attempt to combine several strategies are more effective than those that use only one technique.<sup>58</sup>

There is reason to believe that relaxation



training may have only limited effectiveness in reducing high blood pressure levels among blacks. The effectiveness of relaxation therapy depends upon the social circumstances in which the targeted individuals are embedded.<sup>58</sup> Patients need to be highly motivated and to have favorable family and social surroundings for relaxation strategies to work effectively. In addition, the degree of stress in an individual's life influences the effectiveness of stress-reduction strategies. This suggests that approaches to dealing with stress in the black community should attend not only to training the individual to cope with stress, but should also address the underlying causes of stress and attempt to improve social circumstances to remove some of the underlying causes.

A study of hypertensive patients (85% black) in a low-income community powerfully illustrates the extent to which a comprehensive approach to blood pressure management can not only reduce blood pressure, but also improve the effectiveness of antihypertensive therapy itself.<sup>59</sup> In this study, 244 individuals matched on age, race, gender, and blood pressure history were randomly assigned to one of three groups. The first group, the "medical approach" group, received routine hypertensive care from a physician. In the second group, the "group approach" group, patients attended weekly clinic meetings, run by a health educator and a nurse practitioner, for 12 weeks. Emphasis in the group sessions was on providing health education regarding high blood pressure. Patients in the third group, the "outreach approach" group, were visited by community health workers who were recruited from the immediate community and were provided 1 month of training to help them address the diverse social and medical needs of persons with hypertension. The outreach workers discussed family difficulties, financial strain, and employment opportunities, as well as health and illness, and provided support, advice, referral, and direct assistance.

Over the 7-month follow-up period, participants in all groups were seen by clinic medical staff and had their blood pressures checked. At the end of the 7 months, more patients in the "outreach" group had blood pressure controlled than in either of the other two groups. In addition, those in the outreach group knew twice as much about blood pressure and were more compliant with medical regimens than patients in the other groups. Moreover, the study found that good compliers in the outreach group were twice as successful in controlling blood pressure as good compliers in the "group approach" group. Thus, even the effectiveness of pharmacologic treatment was enhanced in the outreach group. This study provides dramatic evidence that reducing stress and helping patients deal with their social needs can be an effective strategy in the comprehensive control of blood pressure.

#### HEALTH BEHAVIOR

Dietary patterns and exercise habits may also be causally related to blood pressure levels.<sup>60</sup> Changes in these health behaviors can reduce elevated blood pressure without antihypertensive medication or can reduce the need for pharmacologic treatment. The racial distribution of these health behaviors suggests that they may account for at least part of the race differences in hypertension. Research on health behaviors tends to focus on the individual factors that give rise to the initiation and maintenance of particular unhealthy practices. However, the available evidence suggests that larger social structures and processes also affect the social distribution of health behaviors.

#### *Sodium, potassium, and calcium*

The average American consumes 10 to 25 times the minimum daily requirement of sodium, and evidence from experimental and epidemiologic studies indicates that there is a strong linear relationship between salt intake and systolic and diastolic pressure.<sup>61</sup> However, the increased intake of so-

dium appears to have an adverse effect on blood pressure only among a sodium-sensitive minority of the population, with higher proportions among blacks and the elderly.<sup>62</sup> Some evidence suggests that there is a sodium threshold below which hypertension is rare in human populations but above which sodium adversely affects susceptible individuals.<sup>61,63</sup> Moderate sodium restriction can reduce blood pressure by 5 to 15 mm Hg in half of all hypertensive patients,<sup>64</sup> and this restriction of sodium alone would reduce blood pressures to normal levels in 30% to 50% of patients with essential hypertension.<sup>57</sup>

Some evidence suggests that a favorable potassium-to-sodium ratio is more strongly linked with hypertension than the absolute amount of sodium.<sup>65</sup> As noted earlier, given the high prevalence of suppressed plasma renin activity characteristic of hypertension in blacks, blacks tend to be more sensitive to sodium. However, the increased dietary consumption of potassium improves plasma renin activity and produces greater reductions in blood pressure among blacks than among whites.<sup>7</sup> The evidence for calcium is not as good as that for potassium, but some data suggest that a reduced dietary calcium intake also plays a role in increasing an individual's risk of developing hypertension and may play a role in accounting for racial differences in blood pressure levels.<sup>66,67</sup> McCarron indicates that there are several societies with high sodium intakes and low levels of hypertension that also have high calcium intakes.<sup>66</sup> He also notes that some dietary sources of calcium, such as dairy products, are also high in potassium, and societies that consume adequate amounts of calcium tend to have adequate amounts of potassium.

Racial differences in sodium intake do not explain black-white differences in hypertension; studies have consistently found that blacks do not consume more sodium than whites.<sup>68,69</sup> In contrast, there are large and consistent differences in the potassium and

calcium intakes of blacks and whites, and these dietary differences, especially in potassium intake, could play a major role in accounting for racial differences in blood pressure. In the Evans County study, for example, dietary intake of potassium among black men was less than half that of white men.<sup>68</sup> Other studies have found that blacks consume less potassium and calcium than whites.<sup>69</sup>

Blacks are more likely than whites to be lactose deficient, and the resultant problems when milk is consumed may account for the lower level of dairy product consumption (a primary dietary source of calcium) among blacks than among whites.<sup>69</sup> Potassium consumption among blacks may be linked to their economic situation. National data reveal that people below the poverty level consume less potassium than their more affluent peers.<sup>69</sup> Fruits and vegetables, premier sources of potassium, are generally very expensive except at harvest times. Langford et al indicate that cultural differences in nutritional patterns may also account for lower potassium consumption among blacks.<sup>69</sup> The traditional southern style of overcooking vegetables tends to reduce the potassium content of foods, and blacks, especially southern blacks, tend to rely on bread rather than potassium-rich potatoes as their major source of starch.

The current pattern of sodium and potassium consumption in the American diet is linked to larger changes in society. The processing and refining of foods by manufacturers more interested in profits than in health has led to increases in sodium consumption, declines in potassium intake, and the creation of a sodium-to-potassium ratio in the American diet that is more favorable to the development of hypertension. Almost two thirds of the average American dietary intake of sodium comes from salt that is added in the processing of foods.<sup>61</sup> In their natural state, most foods, and especially fruits, grains, and vegetables, are high in potassium and low in sodium. Thus,

diets in most nonindustrialized societies are high in potassium and low in salt.<sup>61</sup> However, the processing and refining of foods produce a dramatic reversal of sodium-to-potassium ratios by adding sodium and decreasing the natural potassium content of foods.

There is another way in which salt intake may be linked to the larger social environment. Henry recently proposed that the high sodium consumption in western industrialized societies is an adaptation to the high level of psychosocial stress.<sup>62</sup> His review of anthropologic data as well as findings from laboratory studies of animals indicates that an increased salt intake facilitates adaptation to stressful environments. The desire to use salt and the voluntary consumption of salt increase when an organism is under stress.<sup>62,70</sup> Henry argues that the strong linear relationship between population levels of salt intake and blood pressure has been misinterpreted to suggest that sodium consumption is causally related to blood pressure. Instead, both salt intake and blood pressure may be causally dependent on social stress.

Other experimental evidence indicates that salt intake may interact with stress to produce chronically elevated blood pressures.<sup>70</sup> Dogs, for example, develop hypertension when exposed to experimentally induced stress combined with saline infusion. However, neither the stress alone nor the saline alone leads to increases in blood pressure levels. Consistent with this perspective, Henry indicates that there are populations with moderate to high salt intake but low levels of stress that have no hypertension or no trend for blood pressure to increase with age.<sup>62</sup> Conversely, there are populations with high stress levels but low salt intake where blood pressure increases with age.

### *Alcohol*

Alcohol is another behavioral factor associated with high blood pressure. The precise mechanisms by which alcohol raises

blood pressure are not known, but there is clear evidence of a dose-response relationship between blood pressure levels and the consumption of more than two drinks of alcohol per day.<sup>71</sup> However, the existence of this threshold effect of alcohol on blood pressure is somewhat controversial. Some evidence indicates that there is a progressive rise in blood pressure throughout the entire range of alcohol consumption.<sup>72</sup> Beilin argues that the threshold effect reported in some studies may be spurious due to a combination of errors in reporting alcohol consumption and the failure of some studies to control for other factors, such as cigarette smoking, that are related both to alcohol consumption and to blood pressure level.<sup>72</sup> A recent study of a large black sample in North Carolina found no evidence of a threshold effect but documented a strong positive relationship between moderate alcohol consumption and systolic blood pressure.<sup>73</sup>

Alcohol use is positively associated with SES, but the poor are more likely to be abstainers or heavy drinkers than their more wealthy counterparts. Similarly, blacks are more likely than whites to be abstainers or heavy drinkers, with rates of abstinence being particularly high among black females.<sup>65</sup> Thus, US blacks tend to have high rates of alcohol abuse, to spend more than whites on alcohol, and to consume a disproportionate share of hard liquor.<sup>74</sup>

The social distribution of alcohol problems illustrates how powerful economic and political interests can create, reinforce, and institutionalize health behaviors within particular social groups. Alcoholic beverages are frequently used for emotional self-regulation. The consumption of alcoholic beverages is a socially accepted means to provide relief from stressful conditions of life. Feelings of powerlessness and helplessness are critical determinants of drinking frequency, drinking quantity, and drinking problems.<sup>75</sup> These conditions of social and economic deprivation do not occur by

chance, but are in fact created by larger social processes. The sale of alcoholic beverages increases during economic recessions and periods of increasing unemployment.<sup>76</sup> Alcohol abuse is also positively related to the availability of alcoholic beverages, and the government policies that control the availability of alcoholic beverages in the United States have led to a greater number of retail outlets for the sale of alcoholic beverages in poor and minority communities than in more affluent neighborhoods.<sup>77</sup> In addition, the black community has been a special target for the promotion of alcoholic beverages by the alcohol producers.<sup>78</sup>

### *Obesity*

Obesity is the strongest factor associated with blood pressure. Overweight adults in the United States are three times more likely to have hypertension than nonoverweight persons.<sup>79</sup> Excessive energy intake and inadequate physical activity are important behavioral factors underlying obesity. Physical inactivity is a major contributor to obesity, and increased levels of exercise may be an important prerequisite for long-term weight loss.<sup>80</sup> In addition, exercise of moderate intensity lowers blood pressure independent of weight loss and may delay the onset of hypertension in persons predisposed to the disease.<sup>81</sup>

Black men do not have higher levels of obesity than their white counterparts, but black females are twice as likely to be obese as their white peers, and controls for SES reduce, but do not eliminate, the relationship between race and obesity.<sup>82</sup> It has been noted that the excess obesity in black women mirrors the black female excess in obesity-related illnesses such as hypertension. In the Hypertension Detection and Follow-Up study, adjustment for obesity reduced the size of the black-white differences in hypertension.<sup>83</sup> Recently, analyses of data from the Second Health and Nutrition Examination Survey revealed that controlling for obesity completely eliminates race differ-

ences in mean levels of systolic and diastolic blood pressure among females.<sup>84</sup>

We do not know why black females are twice as likely to be overweight as their white peers, but the available evidence suggests that the high levels of obesity within the black population are also linked to the larger social environment. Kumanyika's comprehensive review of the literature on obesity in black women suggests that the excess levels of overweight are probably not due to anthropometric differences, genetic differences, or differences in caloric intake between black and white females.<sup>82</sup>

Race differences in physical exercise may be an important contributor to the excess levels of overweight in black females. Physical inactivity may be a stronger predictor of obesity than caloric intake.<sup>80</sup> Large epidemiologic surveys have tended not to use good measures of energy expenditure, so we do not have clear evidence of race differences in physical activity.<sup>82</sup> However, given that most exercise by US adults is obtained through leisure-time physical activity, it is likely that black females get less exercise than their white peers. Black women are more likely to be poor, to be single parents, and to reside in poor neighborhoods than their white counterparts. This combination of factors may lead to constraints on time, financial resources, and the availability of facilities and opportunities for obtaining physical exercise.

Socioeconomic factors linked to health knowledge may also contribute to overweight in black females. Overweight black women are as likely as white women to try to lose weight, but they are considerably less likely than white women to correctly identify the two best weight-loss practices.<sup>85</sup> The high levels of obesity in black women may also reflect the influence of psychosocial stress. The consumption of food may be used by black females as a coping strategy to deal with stress. The distribution of overweight and alcohol problems in the black population suggests that black men tend to

respond to stress by consuming alcohol, while black women respond by consuming food.<sup>86</sup> As noted earlier, general population studies indicate that black females do not consume more calories than do white females.<sup>82</sup> However, these assessments of normal eating patterns are unlikely to capture occasional but recurring eating binges that are associated with using food to obtain comfort and relief from stress. Research is needed to identify the extent to which patterns of stress-induced eating exist and the contribution they may make to obesity in black women.

#### CONCLUSION

I have reviewed evidence from a broad range of studies that demonstrate the existence of associations between a variety of environmental factors and blood pressure. The results of any given study are subject to alternative interpretations, but the consistent pattern in this large body of empirical evidence strongly suggests that the causes of essential hypertension lie in the social environment. This review also suggests that essential hypertension is multifactorial in its etiology and that research efforts to identify and understand its determinants must be characterized by an equivalent degree of breadth and complexity.

Prospective studies that focus specifically on race differences in blood pressure are urgently needed. Research efforts must consider, in a more integrated way than has been done previously, how macrosocial structures and processes, socializing mechanisms, and individual constitutional and dispositional factors relate to each other and combine, both additively and interactively, to affect race differences in blood pressure.<sup>6,87</sup> Finally, if larger social processes and institutions are creating pathogenic environments and conditions, then attempts to reduce ill health among disadvantaged populations must extend beyond the curative approaches of clinical medicine and confront the macrosocial factors that affect the

development, course, and the differential distribution of disease.

#### ACKNOWLEDGMENT

This research was supported by Grant AG-07904 from the National Institute on Aging.

#### REFERENCES

1. Gillum RF. Pathophysiology of hypertension in blacks and whites. *Hypertension*. 1979;1:468-475.
2. James SA. Psychosocial and environmental factors in black hypertension. In: Hall W, Saunders E, Shulman N, eds. *Hypertension in Blacks: Epidemiology, Pathophysiology, and Treatment*. Chicago, Ill: Year Book Publishers; 1985:132-143.
3. Anderson BA, Myers HF, Pickering T, Jackson JS. Hypertension in blacks: psychosocial and biological perspectives. *J Hypertension*. 1989;7:161-172.
4. Cooper R, David R. The biological concept of race and its application to public health and epidemiology. *Health Politics, Policy, Law*. 1986;11:97-116.
5. Polednak AP. *Racial and Ethnic Differences in Disease*. New York, NY: Oxford University Press; 1989.
6. Williams DR. Socioeconomic differentials in health: a review and redirection. *Soc Psychol Q*. 1990;53:81-99.
7. Wright J. Profile of systemic hypertension in black patients. *Am J Cardiol*. 1988;61:414-454.
8. Weir MR, Sowers JR. Physiologic and hemodynamic considerations in blood pressure control while maintaining organ perfusion. *Am J Cardiol*. 1988;61:60H-66H.
9. Luft FC, Grim CE, Weinberger MH. Electrolyte and volume homeostasis in blacks. In: Hall W, Saunders E, Shulman N, eds. *Hypertension in Blacks: Epidemiology, Pathophysiology, and Treatment*. Chicago, Ill: Year Book Publishers; 1985:115-131.
10. Materson BJ, Preston RA. Newer principles of patient profiling for antihypertensive therapy. *Circulation*. 1989;80:IV128-IV135.
11. Check WA. Interdisciplinary efforts seek hypertension causes, prevention, therapy in blacks. *JAMA*. 1986;256:11-17.
12. Cooper RS. Hypertension in blacks—a puzzle waiting to be solved. *Ethnicity Dis*. 1991;1:111-122.
13. Hildreth C, Saunders E. Hypertension in blacks: clinical overview. In: Saunders E, ed. *Cardiovascular Diseases in Blacks*. Philadelphia, Pa: F. A. Davis Company; 1991:85-96.
14. Klag MH, Whelton PK, Coresh J, Grim CE, Kuller LH. The association of skin color with blood pres-

- sure in US blacks with low socioeconomic status. *JAMA*. 1991;265:599-602.
15. Dressler WW. Social class, skin color, and arterial blood pressure in two societies. *Ethnicity Dis*. 1991; 1:60-77.
  16. Keith VM, Herring C. Skin tone and stratification in the black community. *Am J Sociol*. 1991;97: 760-778.
  17. Prineas RJ, Gillum R. US epidemiology of hypertension in blacks. In: Hall W, Saunders E, Shulman N, eds. *Hypertension in Blacks: Epidemiology, Pathophysiology, and Treatment*. Chicago, Ill: Year Book Publishers; 1985:17-35.
  18. Akinkugbe OO. World epidemiology of hypertension in blacks. In: Hall W, Saunders E, Shulman N, eds. *Hypertension in Blacks: Epidemiology, Pathophysiology, and Treatment*. Chicago, Ill: Year Book Publishers; 1985:3-15.
  19. James S. Psychosocial precursors of hypertension: a review of epidemiologic evidence. *Circulation*. 1987;76:60-66.
  20. Waldron I, Nowotarski M, Freimer M, Henry JP, Post N, Witten C. Cross-cultural variation in blood pressure: a quantitative analysis of the relationships of blood pressure to cultural characteristics, salt consumption, and body weight. *Soc Sci Med*. 1982;4:419-430.
  21. Zimmerman MK, Hartley WS. High blood pressure among employed women: a multifactor discriminant analysis. *J Health Soc Behav*. 1982;23: 205-220.
  22. Burns MD, Morrison JA, Khoury PB, Glueck CJ. Blood pressure studies in black and white inner-city and suburban adolescents. *Preventive Med*. 1980;9:41-50.
  23. Akinkugbe OO, Akinkugbe FM, Ayeni O, Solomon H, French K, Minear R. Biracial study of arterial pressures in the first and second decades of life. *Br Med J*. 1977;6069:1132-1134.
  24. Schnall PL, Kern R. Hypertension in American society: an introduction to historical materialist epidemiology. In: Conrad P, Kern R, eds. *The Sociology of Health and Illness*. New York, NY: St Martin's Press; 1986:73-89.
  25. Voors AW, Foster TA, Frerichs RR, Webber LS, Berenson GS. Studies of blood pressures in children, ages 5-14 years, in a total biracial community: the Bogalusa Heart Study. *Circulation*. 1976; 54:319-327.
  26. Hunter SM, Frerichs RR, Webber LS, Berenson GS. Social status and cardiovascular disease risk factor variables in children: the Bogalusa Heart Study. *J Chron Dis*. 1979;32:441-449.
  27. Williams DR, House JS. Stress, social support, control, and coping: a social epidemiological view. In: Kickbush I, Badura B, eds. *An Introduction to Health Promotion Research*. Copenhagen, Denmark: World Health Organization; 1992. In press.
  28. Brody M, Natelson B, Anderson E, et al. Task Force 3: behavioral mechanisms in hypertension. *Circulation*. 1987;76:195-1100.
  29. Fredrickson M, Matthews KA. Cardiovascular responses to behavioral stress and hypertension: a metaanalytical review. *Ann Behav Med*. 1990;12: 30-39.
  30. Light K, Obrist P, Andrew S, Jones S, Strogatz D. Effects of race and marginally elevated blood pressure on responses to stress. *Hypertension*. 1987; 10:555-563.
  31. Frommer MS, Edye BV, Mandryk JA, Grammeno GL, Geoffrey B, Ferguson DA. Systolic blood pressure in relation to occupation and perceived work stress. *Scand J Work Environ Health*. 1986;12: 476-485.
  32. Krantz D, DeQuattro V, Blackburn H, et al. Task Force 1: psychosocial factors in hypertension. *Circulation*. 1987;76:184-188.
  33. Kasl S, Cobb S. Blood pressure changes in men undergoing job loss: a preliminary report. *Psychosom Med*. 1970;2:19-38.
  34. James SA, LaCroix AZ, Kleinbaum DG, Strogatz DS. John Henryism and blood pressure differences among black men, II: the role of occupational stressors. *J Behav Med*. 1984;7:259-275.
  35. Lundberg U, Granqvist M, Hansson T, Magnusson M, Wallin L. Psychological and physiological stress responses during repetitive work at an assembly line. *Work Stress*. 1989;3:143-153.
  36. Robinson J. Racial inequality and the probability of occupation-related injury or illness. *Milbank Q*. 1984;62:567-590.
  37. Jaynes GD, Williams R. *A Common Destiny: Blacks and American Society*. Washington, DC: National Academy Press; 1989.
  38. Harburg E, Erfurt J, Chape C, Havenstein L, Scholl W, Schork MA. Socioecological stressor areas and black-white blood pressure: Detroit. *J Chron Dis*. 1973;26:595-611.
  39. James SA, Kleinbaum DG. Socioecologic stress and hypertension-related mortality rates in North Carolina. *Am J Public Health*. 1976;66:354-358.
  40. House JS, Umberson D, Landis K. Structures and processes of social support. *Ann Rev Sociol*. 1988; 14:293-318.
  41. House JS, Landis KR, Umberson D. Social relationships and health. *Science*. 1988;241:540-545.
  42. Nesper WB, Tyroler HA, Cassel JC. Social disorganization and stroke mortality in the black population of North Carolina. *Am J Epidemiol*. 1971; 93:166-175.
  43. Strogatz DS, James SA. Social support and hypertension among blacks and whites in a rural,

- southern community. *Am J Epidemiol.* 1986;124:949-956.
44. Livingston LR, Levine DM, Moore RD. Social integration and black intraracial variation in blood pressure. *Ethnicity Dis.* 1991;1:135-149.
  45. House JS. Social support and social structure. *Sociol Forum.* 1987;2:135-146.
  46. House J, Khan R. Measures and concepts of social support. In: Cohen S, Syme L, eds. *Social Support and Health.* New York, NY: Academic Press; 1985:3-108.
  47. Wilson WJ. *The Truly Disadvantaged.* Chicago, Ill: University of Chicago Press; 1987.
  48. Williams DR, House JS. Social support and stress reduction. In: Cooper CL, Smith M, eds. *Job Stress and Blue Collar Work.* London, England: Wiley; 1985.
  49. Harburg E, Erfurt J, Havenstein L, Chape C, Schull W, Schork MA. Socioecological stress, suppressed hostility, skin color, and black-white male blood pressure: Detroit. *Psychosom Med.* 1973;35:276-296.
  50. Dressler WW. *Hypertension and Culture Change.* South Salem, NY: Redgrave Publishing; 1982.
  51. Dressler WW. Life-style, stress, and blood pressure in a southern black community. *Psychosom Med.* 1990;52:182-198.
  52. James S, Hartnett S, Kalsbeek W. John Henryism and blood pressure differences among black men. *J Behav Med.* 1983;6:259-278.
  53. James S, Strogatz D, Wing S, Ramsey D. Socioeconomic status, John Henryism, and hypertension in blacks and whites. *Am J Epidemiol.* 1987;126:664-673.
  54. Krieger N. Racial and gender discrimination: risk factors for high blood pressure? *Soc Sci Med.* 1990;30:1273-1281.
  55. Brody DS. Psychological distress and hypertension control. *J Human Stress.* 1980;6:2-6.
  56. Aagaard J, Kristensen BO. Social factors and life events as predictors of disease progression in essential hypertension. *Psychiatry Soc Sci.* 1982;2:85-95.
  57. Johnston DW. The behavioral control of high blood pressure. *Current Psychol Res Rev.* 1987;6:99-114.
  58. Patel C, Marmot MG. Efficacy versus effectiveness of relaxation therapy in hypertension. *Stress Med.* 1988;4:283-289.
  59. Syme SL. Drug treatment of mild hypertension: social and psychological considerations. *Ann NY Acad Sci.* 1978;304:99-106.
  60. Stamler J, Rose G, Stamler R, Elliott P, Dyer A, Marmot M. INTERSALT study findings: public health and medical care implications. *Hypertension.* 1989;14:570-577.
  61. Houston MC. Sodium and hypertension. *Arch Intern Med.* 1986;146:179-185.
  62. Henry JP. Stress, salt, and hypertension. *Soc Sci Med.* 1988;26:293-302.
  63. Carvalho JJ, Baruzzi RG, Howard PF, et al. Blood pressure in four remote populations in the INTERSALT study. *Hypertension.* 1989;14:238-246.
  64. Egan B. Nonpharmacological treatment of hypertension. *Pract Cardiol.* 1984;10:50-57.
  65. Department of Health and Human Services. *Report of the Secretary on Black and Minority Health.* Washington, DC: US Department of Health; 1985.
  66. McCarron DA. Calcium and magnesium nutrition in human hypertension. *Ann Intern Med.* 1983;98:800-805.
  67. Freudenheim JL, Russell M, Trevisan M, Doemland M. Calcium intake and blood pressure in blacks and whites. *Ethnicity Dis.* 1991;1:114-122.
  68. Grim CE, Luft FC, Miller JZ, et al. Racial differences in blood pressure in Evans County, Georgia: relationship to sodium and potassium intake and plasma renin activity. *J Chronic Dis.* 1980;33:87-94.
  69. Langford HG, Langford FJP, Tyler M. Dietary profile of sodium, potassium, and calcium in US blacks. In: Hall W, Saunders E, Shulman N, eds. *Hypertension in Blacks: Epidemiology, Pathophysiology, and Treatment.* Chicago, Ill: Year Book Publishers; 1985:49-57.
  70. Denton DA, Coghlan JP, Fei DT, et al. Stress, ACTJ, salt intake, and high blood pressure. *Clin Exper Hypertens.* 1984;6:403-415.
  71. MacMahon SW, Norton RN. Alcohol and hypertension: implications for prevention and treatment. *Ann Intern Med.* 1986;105:124-126.
  72. Beilin LJ. Epidemiology of alcohol and hypertension. *Advances in Alcohol and Substance Abuse.* 1987;6:69-87.
  73. Strogatz DS, James SA, Haines PS, et al. Alcohol consumption and blood pressure in black adults: the Pitt County Study. *Am J Epidemiol.* 1991;133:442-450.
  74. DJATA. The marketing of vices to black consumers. *Business Soc Rev.* 1987;62:47-49.
  75. Seeman M, Seeman A, Budros A. Powerlessness, work, and community: a longitudinal study of alienation and alcohol use. *J Health Soc Behav.* 1988;29:185-198.
  76. Singer M. Toward a political economy of alcoholism. *Soc Sci Med.* 1986;23:113-130.
  77. Rabow J, Watt R. Alcohol availability, alcohol beverage sales, and alcohol-related problems. *J Stud Alcohol.* 1982;43:767-801.
  78. Hacker AG, Collins R, Jacobson M. *Marketing Booze to Blacks.* Washington, DC: Center for Science in the Public Interest; 1987.
  79. Van Itallie T. Health implications of overweight and obesity in the United States. *Ann Intern Med.* 1985;103:983-988.

80. Brownell K, Stunkard A. Physical activity in the development and control of obesity. In: Stunkard A, ed. *Obesity*. Philadelphia, Pa: Saunders; 1980: 300-325.
81. Chesney M, Agras S, Benson H, et al. Task Force 5: nonpharmacologic approaches to the treatment of hypertension. *Circulation*. 1987;76:1104-1108.
82. Kumanyika S. Obesity in black women. *Epidemiol Rev*. 1987;9:31-50.
83. Hypertension Detection and Follow-Up Program Cooperative Group. Race, education, and prevalence of hypertension. *Am J Epidemiol*. 1977;106: 351-361.
84. Williams DR, Bryant S. Race differences in hypertension: identifying the determinants. *Proceedings of the 1989 Public Health Conference on Records and Statistics*. Washington, DC: US Dept of Health and Human Services publication (PHS) 90-1214; 1989.
85. Andersen R, Chen M, Aday LA, Cornelius L. Health status and medical care utilization. *Health Affairs*. 1987;6:136-156.
86. Williams D. Race, social structure, and high blood pressure. In: Davis W, King G. *The Health of Black America: Social Causes and Consequences*. New York, NY: Oxford University Press. In press.
87. Anderson NB, McNeilly M, Myers H. Autonomic reactivity and hypertension in blacks: a review and proposed model. *Ethnicity Dis*. 1991;1:154-170.