RACE AND KIDNEY DISEASE: ROLE OF SOCIAL AND ENVIRONMENTAL FACTORS

Chike M. Nzerue, MD,* FACP, Haliu Demissachew, MD,† and J. Kevin Tucker, MD‡
Rochester, New York, and Birmingham, Alabama

Numerous studies have documented the presence of racial disparities among Americans in health outcomes with respect to cardiovascular disease, infant mortality, cancer, and kidney disease. With regard to kidney diseases, these disparities are more dramatic. African, Hispanic, and Native Americans have the highest risks of end-stage renal disease (ESRD). The incidence of ESRD is four times higher in African Americans than in whites.

Diseases causing chronic kidney failure, such as diabetes mellitus, hypertension, systemic lupus erythematosus, and human immunodeficiency virus-associated nephropathy, are particularly prevalent among African-American patients. In addition to the higher prevalence, the morbidity associated with kidney complications of these diseases appears worse in African-American patients. African Americans also have worse outcomes and a relatively reduced access to kidney transplantation—the best therapy for ESRD. It is highly likely that social and environmental factors play a very significant role in the persistence of these disparities. A detailed understanding of these socioeconomic and environmental factors will be critical in formulating rational public health strategies to redress these disparities. This paper reviews the social, economic and environmental factors that impact on the incidence of ESRD in minority groups.

Key words: end-stage renal disease ♦ kidney disease ♦ minority groups ♦ kidney transplantation ♦ socioeconomic factors

"Put all the miseries that man is subject to together, sickness is more than all...In poverty I lack but other things; in banishment I lack other men; but in sickness I lack myself."

—John Donne, Sermon XX

 From the *†Nephrology Section, Department of Medicine, University of Rochester School of Medicine, Rochester, New York, and the ‡Nephrology Division, University of Alabama School of Medicine, Birmingham, Alabama. Address correspondence to: Chike M. Nzerue, MD, FACP, Associate Professor of Medicine; Director, Nephrology Fellowship Program, Department of Medicine, University of Rochester School of Medicine and Dentistry, 601 Elmwood Ave., Box 675, Rochester, NY 14642; phone (585) 273-4410; fax (585) 461-0662; or direct e-mail to Chike_Nzerue@urmc.Rochester.edu.

"Of all the forms of inequality, injustice in health is the most shocking and the most inhumane."

—Dr. Martin Luther King

More than three decades after the end of enforced segregation that limited opportunities for minorities in the US, racial disparities have persisted in all areas of American society.[1] African Americans have an average life expectancy that is 6 years shorter than that of white Americans—a disparity that has remained unchanged in the past 30 years.[2] Multiple studies have shown that African Americans are less likely than whites to receive potentially life-saving medical and surgical procedures.[3,4] Consequently, in 1998, President Clinton enacted the 'Racial and Ethnic Health Disparities Initiative,' which declared these disparities to be unacceptable in a country that values equality and equal opportunity.[5]

In the area of kidney disease, these disparities are even more dramatic, with studies showing that the risk of end-stage renal disease (ESRD) in African Americans is several-fold higher than in whites.[6,7] Whether race itself, or some as-yet-to-be identified genetic factors or even socioeconomic factors determine these disparities has been hotly debated. Furthermore, some have questioned the validity of the concept of race itself and its significance in health outcomes research,[8,9] suggesting instead that socioeconomic and environmental factors may underlie observed differences. For example, data from the 2000 US Census show that 7 million people identified themselves as belonging to more than one race, and close to 800,000 people said they were both white and black.[10]

In this review, we discuss the impact of social and environmental factors on racial disparities in kidney disease and the possible implications for society, and suggest possible ways to correct these disparities.

RACE AND KIDNEY DISEASE

Racial Disparities in the Incidence of Chronic Kidney Disease

Chronic kidney disease is highly prevalent among the African-American population. Data from the US Renal Data System show that the incidence of diabetic nephropathy, the most common cause of ESRD in the US, is increasing, particularly among African Americans and older Americans (Fig. 1).[11] While several studies have confirmed a two- to three-fold higher risk for the development of ESRD in African Americans compared with whites,[12–14] the reasons for this disparity are uncertain. A recent prospective, community-based, cohort study found that early kidney functional decline was three times more likely to develop in blacks than in whites.[15] The authors further suggest that potentially modifiable factors, such as lower socioeconomic status, suboptimal health behaviors, and poor glycemic and blood pressure control, account for more than 80% of these disparities. In the Multiple Risk Factor Intervention Trial (MRFIT), kidney functional decline was noted to be about five times faster in hypertensive African Americans compared with whites, in spite of comparable blood pressure control.[16] Furthermore, microalbuminuria, a harbinger of chronic kidney and cardiovascular morbidity, has also been shown to be much more prevalent among African-American patients.[17]

The risk of hypertension and its attendant target organ damage is much greater in African Americans

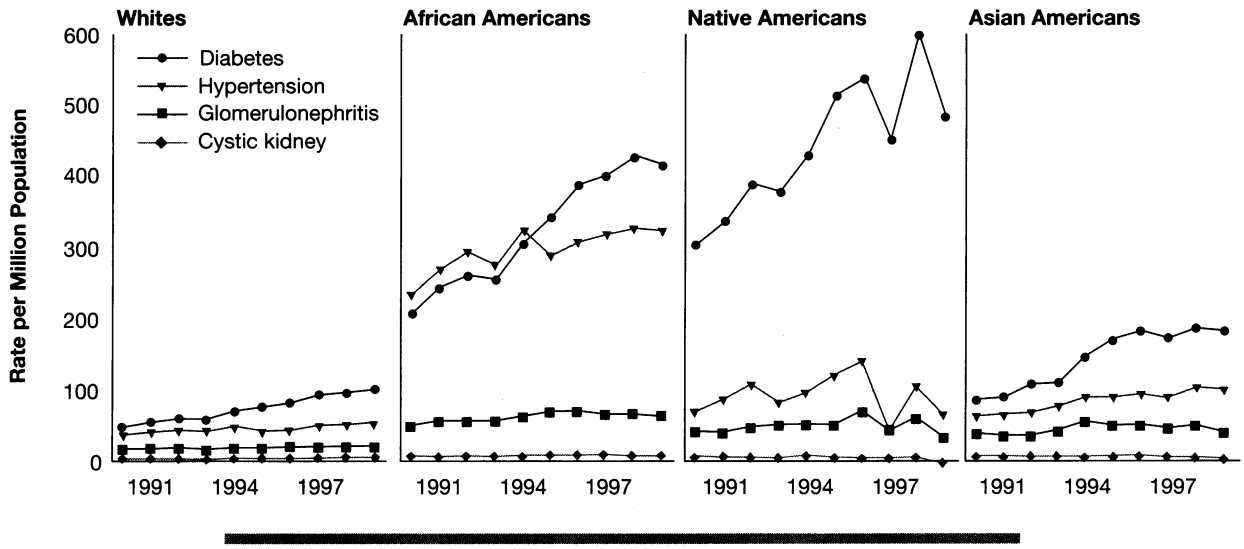

Figure 1. Incidence of ESRD by Primary Diagnosis and Race.[11] *Adapted from US Renal Data System 2001.*

than in whites. While some data suggest an overall over-diagnosis of hypertensive ESRD in blacks,[18] the African-American Study of Kidney Disease and Hypertension (AASK) trial has confirmed the histopathologic association between hypertension and chronic kidney disease.[19] Whether hypertension is a primary cause of ESRD or a secondary manifestation of obscure primary kidney disease remains a subject of intense debate. Currently, hypertension accounts for 33.4% of new cases of ESRD among African Americans, 24% among white Americans, 23% among Asian Americans and 12% among Native Americans.[11]

Human immunodeficiency virus-associated nephropathy (HIVAN) has become the third leading cause of ESRD among African Americans aged 24 to 60 years.[20–22] The reason for the raging epidemic of HIVAN in the African-American population is unclear. Some investigators have observed familial clustering of ESRD in family members of patients with HIVAN, unlike the families of patients without HIVAN, suggesting an independent, and possibly genetic, predisposition to nephropathy in patients with HIVAN.[23] Focal glomerulosclerosis is the commonest cause of nephrotic syndrome in African Americans, and its incidence in the general population has also been rising. This disease is largely resistant to therapy and may recur after kidney transplantation. Finally, some studies have shown a significant relationship between low birth weight and ESRD in both whites and African Americans.[24] Given the higher rates of low birth weight among African Americans, it is possible that social and environmental factors may affect fetal development and contribute to the observed racial disparities in the incidence of primary kidney diseases.

Racial Disparities in the Management of ESRD

Several studies have shown substantial racial differences in the management of ESRD with dialysis and transplantation.[25–30] Compared with whites, African-American patients have poorer outcomes in five clinical parameters (anemia, hypertension, vascular access, adequacy of dialysis, and compliance) as well as poorer employment outcomes and access to transplantation. In spite of these facts, African Americans have a paradoxically higher survival rate

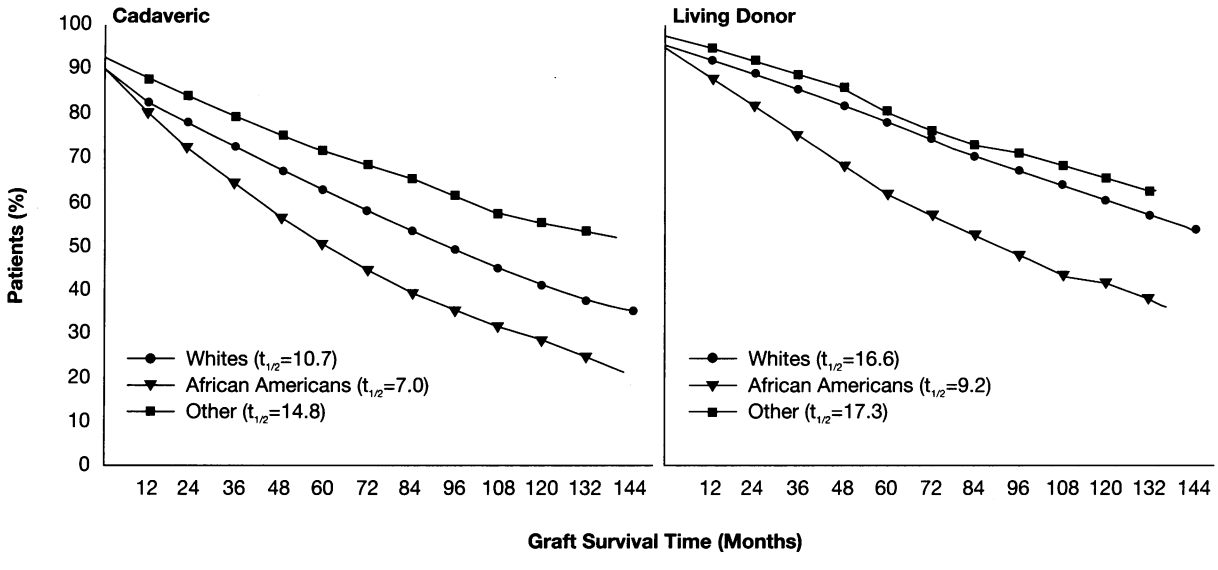

Figure 2. Kaplan–Meier Curves of Graft Survival Rates in Black and White ESRD Patient Populations.[11]
Adapted from US Renal Data System 2001.

on dialysis compared with white patients.[31] However, kidney allograft survival is poorest among African-American patients (Fig. 2).[11]

ROLE OF SOCIOECONOMIC AND ENVIRONMENTAL FACTORS

The social and environmental factors that contribute to the racial disparities seen in kidney disease include: (1) poverty and low household income; (2) lack of health insurance; (3) educational attainment; (4) residence in the inner city or 'urban' location; (5) substance abuse; (6) diet; (7) obesity; (8) stress; and (9) cultural and behavioral factors. These factors are summarized in Table 1, and discussed in detail below.

Role of Poverty or Low Socioeconomic Class

Several studies have addressed the role that socioeconomic status and limited access to healthcare play with regard to the racial inequities in the incidence of kidney disease.[32–34] In one study, Perneger et al. compared 716 patients with ESRD to 361 population controls aged 20 to 64 years from Maryland, Virginia, and Washington DC.[33] Race and indicators of socioeconomic status (income, years of education, and health insurance) were assessed via a telephone interview. The researchers found that the odds ratio for the occurrence of ESRD in blacks was 5.5 at the 95% confidence interval. Adjustment for socioeconomic

Table 1. Social and Environmental Factors that Impact on Kidney Disease

Factor	Evidence
Poverty and low household income	• Minority race, low income, and poor access to healthcare.[33] • Low socioeconomic status.[33–55]
Health insurance	• Lack of health insurance.[42] • Medicare withdrawal of funding for immunosuppressives. • Patients inability to pay for maintaining immunosuppression.
Educational attainment	• Less time spent in education impacts on time spent on transplant waiting list.
Inner city residence	• Living in inner city or urban locations.
Substance abuse	• Cocaine and other drugs of abuse are linked to accelerated hypertension and acute/chronic kidney disease.[57–60]
Cultural and behavioral factors	• Blacks are less likely than whites to want a kidney transplant, complete pre-transplant work-up, and move up the transplant list.[43]
Other factors	• Diet, obesity, and stress.

factors reduced the odds ratio for blacks only partially. The proportion of ESRD incidence that could be attributed to minority race was 46%, while 53% and 33% could be attributed to income categories and poor access to care, respectively. Moreover, the observed poor access to life-saving cardiovascular and other medical procedures in the general population of black patients has also been documented in black patients with kidney disease.[34] Poor access to healthcare has been shown to contribute to the late initiation of dialysis among women and ethnic minorities in the US.[35] Other studies have shown that low-income patients with ESRD experience multiple barriers to kidney transplantation—the best accepted therapy for this disease.[36–41]

In a prospective cohort study of 3165 patients who developed ESRD in the early 1990s, Garg et al. showed that increasing neighborhood income was associated with decreasing mortality and an increased likelihood of placement on the kidney transplant waiting list.[42] These investigators demonstrated that the presence of private insurance coverage in addition to Medicare improved rates of listing for transplantation in a graded manner, with the greatest effect being in those patients living in neighborhoods below the 10th percentile of income.

In general, there are four critical hurdles that a patient must overcome to receive a kidney transplant: Step A: being medically suitable and possibly interested in a transplant; Step B: being definitely interested and motivated to get a kidney transplant; Step C: completing the pre-transplant work-up; and Step D: moving up the transplant list and receiving a transplant.[43] In one study, blacks were 32%, 44%, and 50% less likely than whites to complete steps B, C, and D, respectively.[43] Poverty and lack of health insurance clearly contribute to some of these differences. Furthermore, although Ayanian et al. have demonstrated that black patients may express less preference for kidney transplantation than white patients, the differences in patients' preferences could not explain the much larger differences in actual referrals for transplant evaluation.[44] Even after adjusting for socioeconomic factors, these differences persisted. Sadly, but not entirely unexpectedly, those patients with higher education and private health insurance were more likely to be promptly placed on the transplant waiting list.

If black patients overcome these hurdles and receive a kidney transplant, their graft survival has been shown to be poor compared with white patients, even though their overall survival is improved compared with staying on chronic dialysis. The basis for the relatively poor graft survival in African-American patients is unclear, though multiple factors are likely to be involved. Black patients spend more time on dialysis prior to transplantation. Longer waiting time on dialysis has been shown to negatively impact on post-transplant graft and patient survival.[45–48] Maintenance dialysis for up to 6 months before cadaveric kidney transplantation has been associated with a 17% higher risk of graft loss.[45] Similarly, dialysis duration greater than six months has been associated with a significant and progressive increase in the relative risk of graft loss and patient death. These findings have also been confirmed among living donor transplant recipients.[48] Poverty and lack of health insurance may affect the ability of the patient to pay for drugs used for maintenance immunosuppression after Medicare withdraws coverage for these drugs about three years after kidney transplantation.

Transportation to and from dialysis units may also be affected by poverty, thereby potentially reducing compliance, unless the patient has Medicaid coverage to pay for this. In general, there is ample evidence to suggest that low socioeconomic status is an independent risk factor for ESRD.[33]

Role of Inner City Residence: 'Urban Health and Urban Health Penalty'

One of the major demographic shifts in the US during the 20th century was the migration of the population from rural areas to the urban enclaves. As a result, more than one in five people in the

US now live in the nation's 100 largest cities. The health of the residents of the inner city is thus inextricably linked to the health of the entire nation. African Americans have been major participants in the migration to urban areas, and today have a disproportionate presence in the impoverished urban areas of the nation. It has been documented that, of those people living in urban poverty zones, 67% are African Americans, 20% are Hispanics, and 12% are whites.[49]

The term 'urban health penalty' has been used to describe the conditions that occur when healthier, more affluent persons leave the city, and the remaining individuals experience health problems that interact with the city's physical and economic deterioration.[50,51] The poverty zones created by this deterioration, which include proportionately higher numbers of persons belonging to minority groups, become epicenters of economic decline, job loss, and major health problems. The health problems associated with inner cities include a high prevalence of violence, teenage pregnancy, drug abuse, and HIV infection, as well as poor outcomes in chronic diseases like asthma, diabetes mellitus, hypertension, tuberculosis, and chronic kidney disease.[52–55]

Caring for the urban kidney patient can be a challenge for several reasons.[56] These patients have to grapple with the same issues of poverty, transportation difficulties, poor compliance, and substance abuse that are pervasive in the inner cities. The urban ecology and socioeconomic factors are likely to have critical influences on an individual's risk for kidney disease. For example, Young et al. demonstrated a strong relationship between socioeconomic status and ESRD, independent of race.[55] Using data from the US Renal Data System, these investigators showed that there was an increased incidence of ESRD in US counties with lower median incomes.

Cocaine, the use of which has assumed epidemic proportions, may cause accelerated hypertension, acute and chronic kidney failure, and it can hasten the progression of chronic kidney disease.[57–59] Other drugs of abuse may also be risk factors for ESRD.[60] It should be appreciated that residence in the urban environment may also be associated with high levels of perceived stress, related to high rates of incarceration, violence, substance abuse, unemployment/economic deprivation, and/or racism. The contribution of these elements of stress to kidney disease has not been studied in a systematic fashion.

SOCIETAL IMPLICATIONS OF RACIAL DISPARITIES IN KIDNEY DISEASE

Racial disparities in kidney disease have grave societal implications for at least three reasons: (1) the probability that these disparities lead to an increase in healthcare costs; (2) the likelihood that they may reflect discrimination/racial insensitivity on the part of physicians; and (3) the overall adverse effects of these disparities on quality of care.

Cost Implications

Racial disparities in kidney disease, besides being a loss of opportunity for the patient, may ultimately increase the cost to society. For example, late referral of black and/or poor patients with kidney disease for care by a nephrologist prevents these patients from receiving optimal care.[61–64] Ideal management of chronic kidney disease involves adequate use of drugs to slow the progression of the disease, tight control of both blood pressure and also glycemia, aggressive treatment of anemia, timely preparation for dialysis (including psychological preparation), informed choice of the most appropriate dialysis method, and creation of the optimal dialysis access (an arteriovenous fistula).

Late referral is the cause of severe emotional distress for the patient because of the sudden discovery of irreversible loss of kidney function, the need for dialysis, decreased income, and impending unemployment due to frequent and prolonged hospitalizations.[62,63] Also, late referral often leads to the use of arteriovenous grafts for access, with attendant problems of frequent access thrombosis.

In Europe and Scandinavia, it has been shown that patients with ESRD who were referred late suffered higher rates of prolonged hospitalizations at the initiation of dialysis (approximately 30 days versus eight days), compared with patients who were referred earlier to the nephrologist.[62,63]

In the US, the cost of excess hospitalization is likely to be related to vascular access problems, with estimates suggesting that as much as one-quarter of the total cost of the Medicare ESRD program is spent on the maintenance of vascular access in patients undergoing hemodialysis. Additional indirect costs of late referrals and other disparities include higher costs of treating complications of suboptimal anemia management (such as congestive heart failure), acceleration of atherogenesis, poor rehabilitation with reduced employment, and poor management of renal bone disease. The total cost of extra expenditure related to late referral in the US has been estimated to be greater than $1 billion per year.[61]

Impact of Racial Disparities on Quality of Care

Attempts to improve the quality of healthcare have been integrated recently with efforts geared towards the elimination of racial and ethnic disparities in health.[65,66] The existence of racial/ethnic disparities constitutes a fundamental threat to quality.[66] Mortality rates in patients with ESRD on hemodialysis in the US remain high in spite of the skyrocketing cost of the Medicare ESRD program. It is highly likely that elimination of these racial disparities would improve outcomes in these patients.

Do Racial Disparities Imply Overt Racism?

Racial bias is difficult to document in surveys of physician behavior or medical records. Chen et al. suggested recently that differences between whites and blacks in rates of cardiac catheterization after acute myocardial infarction were more likely to be owing to other subtle biases that may influence physicians' therapeutic decisions than overt racial prejudice.[67] However, previous research in the general population has documented difficulties in communication between physicians and patients of lower socioeconomic status.[68] For example, a sizeable proportion of these physicians reported more negative personal perceptions of less affluent/less well-educated patients, compared with their perceptions of other patients.

AGENDA TO ADDRESS SOCIO-ECONOMIC FACTORS AFFECTING RACIAL DISPARITIES IN KIDNEY DISEASE

Data Collection, Analysis, and Quality Improvement

Racial disparities in kidney disease, as with other racial disparities, must be recognized as an affront to true quality, which also raises the question of distributive justice.[69] Toward this end, we must continue to collect and analyze data to assess these disparities and progress towards eliminating them. Currently, the US Renal Data System collects and analyzes these data on an annual basis.

Improved Access to Care

The Institute of Medicine defines access to healthcare as "...the timely use of personal health services to achieve the best possible outcomes".[70] Several studies have shown the association between health outcomes and access to healthcare. Shea et al. have demonstrated that, among hypertensive minority patients in New York city, a greater severity of blood pressure elevation was significantly related to the patient not having a primary healthcare provider.[71] Furthermore, those patients without health insurance had a greater propensity to use emergency departments for the care of hypertension. Conversely, a recent New Jersey study of Medicaid recipients showed that improved access to care was helpful in improving birth weights of children born to ethnic minority women.[72]

Obviously, improved birth weight through improved access to care leads to better outcomes for the whole population, including better outcomes with respect to kidney disease. In the area of kidney disease, Woodward et al. have shown that extension of coverage for immunosuppressive medication from one to three years post-transplantation reduced the risk of graft loss in patients with low income.[73] However, improved access to healthcare alone will not be sufficient to eliminate racial and socioeconomic disparities. For example, disparities in health across socioeconomic groups widened in the United Kingdom in spite of universal access.[74] In the US as well, the acquisition of Medicare insurance has not abolished these disparities.[75]

Community Mobilization

It may be necessary to involve community groups, such as clergy, barbers, and hair dressers, in campaigns to improve awareness of kidney disease in ethnic minority communities. It may even be helpful to draw on the principles of social marketing and establish campaigns with charismatic public figures to encourage underserved patients to be more assertive in seeking healthcare, as well as to encourage physicians to be more responsive.

The National Kidney Foundation recently collaborated with the National Association for the Advancement of Colored Peoples (NAACP) on an initiative to improve awareness of kidney disease in minority populations. To reduce the impact of socioeconomic factors on race disparities in kidney disease, there needs to be a greater appreciation of the link between these factors and health outcomes. To overhaul healthcare in the urban environment, a comprehensive private–urban health initiative would be beneficial to address the perennial problems of poor housing, unemployment, violence, environmental pollution, and the lack of child care that impact on the health of the residents of these distressed areas.[49] Until socioeconomic factors that may contribute to racial disparities in kidney disease have been addressed, we must be skeptical of attempts to explain these disparities on a genetic basis,[76] with its implication of inevitability.[77]

A preliminary study has shown that outcomes of kidney transplantation can be good even in a population at high risk for kidney disease, such as Native Americans.[78,79] Because these health disparities result from a complex interaction of socioeconomic factors, behavior, environment, and disease that are related to race and ethnicity, multifaceted approaches extending beyond the traditional top-down medical model are needed to improve heath outcomes. These innovative strategies must be tailored to specific locations and clinical situations.

Physician Advocacy and Social Engineering

Medicine and health exist in a social context. Several lines of evidence suggest that social issues influence health to as great an extent as medical issues.[75] Rudolf Virchow stated more than 154 years ago that "medicine is a social science and that physicians are the natural attorneys for the poor".[80] Physicians must, therefore, serve as advocates for poor and underserved patient populations to help reduce health disparities. They must also spearhead one-on-one counseling for patients on issues of nutrition, obesity prevention, exercise, substance abuse prevention, and medical treatment. Physicians treating hypertensive patients must also be alert to the fact that multiple medications will often be necessary and that responses to these medicines may be reduced in racial minorities, as well as in some geographic locations such as the 12 states in the southeastern US that have a high incidence of stroke, known as the 'stroke belt'.[81] Unfortunately, under the aegis of managed care, both qualitative and quantitative aspects of the physician–patient interaction are under stress. Increased investment in

education would be likely to improve income in the general population, including ethnic minorities. In the long term, this would help reduce racial disparities in health outcomes. Indeed, some have argued that investment in education may improve health in the population more effectively than increased investment in health services.[82]

At the same time, efforts must be maintained to address cultural and historical factors that reduce the participation of minority patients in studies aimed at protecting the kidneys from the ravages of hypertension and diabetes. In this regard, it is disheartening to note that African-American patients were not adequately represented in recent studies documenting the efficacy of angiotensin II receptor blockers in patients with type 2 diabetes mellitus.[83,84] It is necessary to build and sustain a capacity for research in minority health populations to address these health disparities.[85] This requires a research infrastructure, plus the will of the professional and lay communities to activate and support such research to study racial disparities in kidney disease. Efforts must also be maintained to build trust and confidence between minorities and the overall research establishment in light of previous errors, such as the Tuskegee syphilis studies.[86] Sadly, some studies show that black patients lack access to research and clinical trials of drug therapies, even for a disease that disproportionately affects black patients, such as HIV infection.[87]

CONCLUSIONS

In conclusion, socioeconomic factors play a major role in the observed racial disparities in kidney disease. To correct racial disparities in kidney and other diseases in the US, these socioeconomic factors need to be addressed. The US government's initiative to eliminate these disparities by the year 2010 is a step in the right direction. A great nation like the US owes its people no less.

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