RACE, SOCIOECONOMIC STATUS, AND HEALTH IN LATE LIFE

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INTRODUCTION

For over a hundred years, medical and social scientists have studied differences in health status among racial groups in the United States. The resulting literature has focused on comparisons between the health of white Americans and that of African Americans, a reflection of the historical and continued prominence of the debates over the status of African Americans in this society. In response to the growth of other racial and ethnic groups, comparisons have been broadened in recent years to include a growing literature addressing the relative health status of Hispanic, Asian, and Native American populations, but the literature remains dominated by black-white comparisons.

In the last 20 years, scientific inquiry has shifted from describing gross health disparities between the races to explaining the underlying factors that account for these differences. Understanding these underlying causes requires disentangling the complex web of factors connecting the nexus between race, socioeconomic status, and health. The more recent literature that has described this nexus has typically posed the research question as, "How much of the racial difference in health is directly accounted for by differences in socioeconomic

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status between populations?"

This paper has two interrelated goals. First, it examines racial and ethnic disparities in health outcomes among older Americans using two important new data sets: the Health and Retirement Survey (HRS) and the Asset and Health Dynamics among the Oldest Old (AHEAD). Second, our research attempts to shed light on the central issue of the underlying causes of the strong relationship between socioeconomic status and health outcomes. The rest of this paper is divided into seven main sections. The first sketches the implications of the principal economic model that has been used to analyze health outcomes. The second section presents a brief review of the existing empirical literature on the relation of racial health disparities to socioeconomic status. Using HRS and AHEAD, the third section describes racial differences in a variety of health outcomes. A brief summary of the income and wealth/health gradients obtained from these data is provided in the fourth section. Using this same data, the fifth section highlights both racial and ethnic differences in health risks. The sixth and major section of the paper summarizes a series of empirical models of self-assessed health status. In particular, these models focus on understanding the reasons underlying the strong correlation between income and health and on the implications of that correlation for racial and ethnic health disparities. The final section presents conclusions.

THE THEORY OF HEALTH PRODUCTION AND ITS RELEVANCE TO SOCIOECONOMIC STATUS-RACE-HEALTH RESEARCH

Most of the research addressing the relationship between socioeconomic status, race, and health has been grounded in a theoretical framework based in sociology. In this framework, social class or socioeconomic status is a way of ranking relative position in a society based on class, status, and power (Liberatos et al., 1988). Only relatively recently have there been significant efforts to explain the well-known differences in health across socioeconomic groups explicitly based on the economic model of health, especially to non-economists (Selden, 1993; DaVanzo and Gertler, 1990; Dardanoni and Wagstaff, 1987; Wagstaff, 1986; Muurinen and Le Grand, 1985). Rarely have these analyses been extended to address the relationships between socioeconomic status, health, and race.

The standard economic model of health is based on a few key principles, largely developed by Grossman (1972). In the economic model, health is considered to be a commodity or "good" that can be viewed as a durable capital stock that produces a flow of services over time, depreciates, and can be increased with investment. Each individual begins life with a genetic health endowment. Choices made over the lifetime, such as the use of preventive medical services or smoking, can decrease or increase the health capital stock, but there are diminishing

returns to investment in health. This capital can also be affected by random events that are not under the control of individuals.

There are a few important and distinct relationships that form the core of this model. First, there is the relationship between various inputs and the stock or commodity "health" (H_t). The inputs might include one's genetic or background endowment (G_o), health promoting activities and other behaviors such as smoking (B_t), use of medical care (MC_t), a vector of family education levels (ED), and environmental factors (E_t) such as the air pollution level. This relationship is described as the health production function:

$$H_t = f(H_{t-1}, G_o, B_t, MC_t, ED, E_t) \quad (1)$$

Health changes over the life course, and the trajectory of these changes are the result of a number of factors. In its most simple form, health in time period t, H_t, is the result of the stock of health in the period time period t-1, H_{t-1}, depreciation over the previous time period, and investments to improve health in the previous time period. This production function, which summarizes the transformation of these inputs into health outputs, is typically governed by biological considerations. Health is produced by a number of different inputs, including a wide variety of purchased medical inputs, the adoption of good

personal health behaviors (exercise), and the avoidance of bad ones (smoking, excessive drinking).

These inputs, such as the demand for medical care, are "derived" demands: not directly valued but valued only because of their impact on health. Because the purchase of these inputs or the adoption of these health-related behaviors are choices individuals or families can make, they are, in the parlance of economics, "endogenous" variables. In addition to purchased inputs and health behaviors, the stock of health may enter into the health production function. To put it simply, individuals in better health may be more able to translate other inputs into more productive health investments. Therefore, today's investments are influenced by today's health status and produce tomorrow's health status.

Education may enter this production function because it may affect the way individuals can transform inputs into good health. For example, more educated households may choose more qualified doctors, be more aware of the harmful health effects of behaviors such as smoking or environmental risks, or be better able to provide self-care to prevent illness or to mitigate its more harmful effects. Since some family members may be more adept at performing these functions than others, a vector of education levels of all family members is included in the production function.

Family background or genetic endowments (G_o), which are

typically unobserved by the researcher, have played an important role in contemporary research on this topic. Rosenzweig and Schultz (1983) have argued that the existence of these unobserved background factors, which can often be traced to early childhood, may seriously bias estimates of this production function. For example, a person who has been generally sickly throughout life may require more medical care. If we do not control for this persistent unhealthiness, a regression of current health on medical services will understate the efficacy of medical care.[1]

Another fundamental insight of the household production approach is that health is a stock. The current inputs and behaviors chosen are investments that produce increments to the stock of health. If these increments are affected by current inputs and current behaviors, today's stock of health is determined by the entire history of current and past inputs and behaviors. A corollary implication is that additional current economic resources are unlikely to have a quantitatively large impact on the current stock of health, especially in the age groups that are the focus of this research. Additional economic resources may increase health care utilization or induce good health behaviors, but these sorts of behavioral changes may be slow to be adopted. Even if these behaviors were altered instantaneously, they can have a direct impact only on health

[1]We do not deal with the important issue of family background effects in this paper. For an recent evaluation of the importance of family background on latter life health outcomes, see Smith and Kington (1996).

investments and not on health capital.

A second relationship describes the process underlying the behavioral choices that affect health. These choices are guided by a utility function (U) measured at the individual or household level. Health (H_t) is one commodity in the function, and X_t represents all other commodities that go into this utility function, U:

$$U = \int_0^T U_t e^{-rt} \quad \text{where} \quad U_t = f(H_t, X_t) \qquad (2)$$

Individuals or households maximize lifetime utility subject to a lifetime budget constraint. Thus, total expenditures across all periods on health- and non-health-related activities must not exceed total lifetime financial resources, Y, where P is a vector of prices for non-health-related activities, P_H is a vector of health-related prices, and H_X is a vector of health-related activities:

$$Y = \int_0^T (W_t + R_t + T_t)e^{-rt} + A_o = \int_0^T (P * X_t + P_{Ht} * H_{Xt})e^{-rt} \qquad (3)$$

Health is desired for two different but related purposes. Health has both consumption benefits (i.e., the benefit of feeling good) and production benefits (i.e., allowing one to engage in activities that produce income). Under utility maximization, individuals will invest in health until the gain in benefits from

more health equals associated costs in terms of time or money.

Equation 3 highlights another central insight of this model. The budget constraint that limits household choices is a lifetime budget summarizing the discounted sum of lifetime income and current asset income. In general, households are not limited solely by their current period resources. Financial resources in any period consist of the earnings W_t of all household members, retirement-related income R_t, government transfers T_t, and asset income A_t. Over the lifetime, these resources are spent on medical services and other desired commodities.[2]

An important consideration is that to different degrees and in different ways, each of these income sources may be affected by the stock of health. For example, earnings (W_t) in each period are a function of an individual's human capital and a set of local labor market demand and supply conditions (d_t). In this formulation, human capital is broadly defined to include health (H_t) and other forms of skill (K_t) including those formed in school and acquired during on-the-job training. Most directly, healthier people can work longer hours in any given week and more weeks during a year, which leads to higher earnings. Similarly, poor health may trigger the receipt of means-tested government transfer income, inducing a causation from health to income.

[2]There is a similar constraint in time devoted to various activities. In order to maintain focus on the essential points, this equation is not discussed in the text.

$$W_t = w(H_t, K_t, d_t) \quad (4)$$

Equations 3 and 4 illustrate our central point that health enters into the model in two ways, producing a two-way causation between health and income. We have already seen that people desire good health as an outcome and that higher income enables them to purchase more of it. Current health also affects a person's ability to earn in some quite fundamental ways. As we have stated, healthier people can work longer hours in any given week and more weeks during a year. This "labor supply" effect leads to higher earnings. Similarly, healthier people may have more incentive to invest in other forms of human capital and therefore command higher wages in the labor market. While good health may facilitate the receipt of some income sources (earnings), it may discourage the receipt of others (transfers). Most of the applied health literature has emphasized the first pathway from income to health, but we will present evidence in this paper that the reverse pathway form health to income cannot be ignored.

Another relationship that flows from this approach is a series of derived demand functions for each input into the health-production function. These input demand functions have as arguments all the input prices and the underlying determinants of the level of health demand, including household income and tastes. For example, the demand for medical care is a function

of its own price (P_{mc}), the price of other inputs (P_o), education of each family member (ED), household resources (Y) and tastes (T).

$$Mc = M(P_{mc}, P_o, ED, Y, T) \quad (5)$$

As with all goods, an increase in the price of medical care will reduce the demand for it; however, as the price of other inputs change, the demand for medical care will increase or decline depending on whether these other goods are substitutes for medical care or complements to it. Education enters into these demand functions in part because it may affect the efficiency with which households can transform inputs into good health. Finally, household income acts as a scaler expanding the demand for health and thereby increasing the demand for the inputs used to produce good health. Whereas in most applications, the arguments in these input demand functions are taken to be exogenous, an important exception in our case is household income, which we have already argued has an important feedback relation from health to income.

The final equation in this system is the reduced-form demand function for health. The purpose of the reduced form is to solve out for the endogenous variables in the system by expressing health as a function of all the exogenous variables.

$$H_t = H^*(H_{t-1}, P_{mc}, P_o, ED, E_t, R_t, T_t, A_t, G_o) \quad (6)$$

Equation 6 expresses current health as a function of all input prices and total household income. While this is a frequent expression of a reduced form, there are two issues with equation 6 that raise a concern. The first issue results from the inclusion of lagged health in the function. Last period's health is determined by last period's set of prices, so that current health is more correctly a function of all past prices. Secondly, there may exist important feedback relations from health to income. It is this second possibility that will be the central focus of this paper.

A reformulation of equation 6 highlights the empirical difficulties in uncovering the relation between socioeconomic status and health. Sequentially solving current health can be expressed as a function of all past prices and past incomes. This argument implies that equation 6 can be solved sequentially as

$$H_t = H^*(\tilde{P}_{mc}, \tilde{P}_o, ED, \tilde{E}_t, \tilde{R}_t, \tilde{T}_t, \tilde{A}_t, G_o) \quad (7)$$

where the ~ indicates a time series vector of values.

Even this simple formulation highlights the extreme demands placed on data, especially cross-sectional surveys. To monitor the evolution of health outcomes over the life cycle, we would

ideally like to know the entire lifetime sequence of health stocks, health behaviors, prices, and components of incomes and wealth. Although eventually the longitudinal nature of HRS and AHEAD will be an important step in that direction for an older population, such data do not currently exist. Consistent with the limitations imposed by current data, our aim here is a more modest but important step in the direction of understanding the reasons for the demographic and economic correlates of health outcomes at older ages. This step rests on the distinction between contemporaneous (current period) feedbacks from health to economic status and health behaviors and the full lifetime sequence of such feedback relationships. The full lifetime sequence of interactions between health and socioeconomic status is beyond the scope of our inquiry in this paper, and we will concentrate instead on informing the nature of the possible contemporaneous feedbacks.

The Socioeconomic Status-Health Gradient

In the theoretical framework outlined above, socioeconomic status may affect health and health-related behaviors in many ways. At the most basic level, income and wealth determine the budget constraint: those who are poor have fewer resources to devote to health. As a result, they may purchase fewer medical services or be less able to afford medical insurance. From this view, health is no different than any other commodity such as

housing, food, or entertainment-the more well-to-do consume more. If this were all there is, knowing the socioeconomic status-health gradient would require only the estimation of the wealth elasticity of health. In the computation of that elasticity, economic status should be defined as broadly as possible to include all income sources of all household members and wealth.

That is not all there is, largely owing to the real possibility of reverse causality or simultaneity bias. A large amount of the literature that has addressed the relationship between health and socioeconomic status has been based on cross-sectional data. Thus, these data have not allowed a simple but important question to be addressed: To what extent does low socioeconomic status lead to poor health rather than poor health's leading to low socioeconomic status? The ambiguity of the association between contemporaneous health and socioeconomic status is most obvious when income is the measure of socioeconomic status, and a classic example of the analytic issue illustrates the problem. There are two plausible explanations for the relationship between contemporaneously measured low income and poor health. First, low income may lead to poor health by, for example, limiting the use of preventive health care services as predicted in the economic model of health production. An alternate plausible explanation, however, is that poor health may lead to lower socioeconomic status by, for example, limiting an individual's ability to work or the wage he

or she can earn.[3]

The statistical conditions for identification of the causal pathways are relatively easy to state and quite difficult to implement. For example, to statistically identify the pathway from health to income requires having exogenous variables that affect income only through their effect on health (that is, these variables have no direct effect on income). In this case, the health-income correlation induced by this variable only reflects a casual pathway from health to income. To use one illustration, a lower price of health care can directly affect health status through increased utilization of health care. Because health status is altered, there may also be subsequent alterations in household income. However, this lower price of health care should not have any direct impact on household income (outside of its influence on health care). In this case, variation in the price of health care can be use to identify the causal pathway from health to income.[4]

Unfortunately, our current data sources do not contain the type of statistical variation that would allow us to formally identify the causal pathways. Consistent with the limitations imposed by current data, our aim here involves a more modest but

[3]The analogous statistical conceptualization of this problem is called simultaneity bias. Namely, estimation of relationships using standard statistical techniques may be biased if explanatory variables can be a consequence as well as a cause of the dependent variable such as health (Garber, 1989).

[4]A completely symmetrical argument exists for the identification of the pathway from income to health.

important step toward understanding the health-socioeconomic status nexus. This step rests first on a distinction between contemporaneous (current period) feedbacks from health to economic status and health behaviors and the full lifetime sequence of such feedback relationships. While our cross-sectional data imply that unraveling the full lifetime interrelated sequences is beyond our scope, our rich array of economic, demographic, health behavior and outcome data allows us to make progress on the contemporaneous relationships.

Our research strategy begins with a separation of household income into its important components. We will a priori argue that some of these income components largely reflect causation from health to income. After these contaminated components are separated out, it is more likely that the other income components will reflect a pathway from income to health. At a minimum, this empirical strategy can serve as an important diagnostic device about the relative importance of the two pathways that connect income and health. For example, both HRS and AHEAD allow us to separate income into its distinct components. Some of these income components are strongly affected by contemporaneous feedbacks from health to economic status. Past the retirement age, other income components are largely free of these feedbacks so that, at a minimum, we will be able to mitigate the contemporaneous feedbacks from health to income.

There are a number of other possible sources of bias that

complicate the estimation of the effect of socioeconomic status on health. For example, financial status may also determine where one lives, which may be related to a range of exogenous factors from the quality of health providers to exposure to air pollution and toxic waste to public expenditures on prevention of communicable diseases. Although environmental factors are often considered to be exogenous, in fact residence may also be a choice partly determined by such factors as regional health risks (Preston and Taubman, 1994).

Financial status may also affect one's choices for such activities as smoking or exercise by determining opportunity sets for the trade-offs between alternative utility-increasing or utility-decreasing activities and the associated increases or decreases in health risk (Muurinen and Le Grand, 1985). For example, individuals clearly derive some benefit from smoking. A person with limited alternative resources to satisfy such needs may be more willing to accept the health risks associated with smoking. Uncertainty may also play a role in explaining differences in investments in health across socioeconomic groups. Early models of investment suggested that the poor may invest less in prevention, because greater risk aversion among the poor may push them away from relatively riskier investments in health capital (Dardanoni and Wagstaff, 1987). However, more recent extensions of the models suggest that there may be a countervailing incentive for poor to invest in health because

they are less able to afford losses in income because of ill health (Selden, 1993).

Measurement of Socioeconomic Status

In studies of the impact of socioeconomic status on health, education, occupation, and financial resources have typically been used as proxies. How each is defined may affect analyses of the race-socioeconomic status-health nexus in late life. If these variables are imprecisely measured, incorrect conclusions may be drawn about the relationships among the variables (Garber, 1989). In this section, we briefly discuss some of the major issues that arise with each proxy.

Education

Education is an important explanatory variable in both economic and sociological-based empirical models of the socioeconomic status-health relationship. As is demonstrated in the theoretical model outlined above, education may affect health status through a number of channels. First, schooling is an important determinant of economic status. Individuals with more schooling in general have significantly higher lifetime wealth than those with less schooling. In addition, schooling may alter the efficiency of health production--that is, the efficiency of the process by which the various inputs are transformed into health. For example, better educated individuals may have more

information at their disposal about the effect of nutrition on health and may thus make healthier choices in eating habits.

An often-cited advantage of education as a proxy for socioeconomic status is that decisions about education are usually completed by early adulthood. This temporal ordering is taken to imply that schooling is free of reverse causality (i.e., not a result of poor health). While there is some truth to this argument, it applies only for health conditions that are unanticipated at the time schooling decisions are made. If poor health conditions are known, they will generally influence investments in schooling since future work effort will be lower owing to poor health. Socioeconomic status may also be related to so-called third factors affecting health investments (e.g., preventive activities). For example, education may be related to one's willingness to invest in health now by giving up something else in order to have an improvement in health in the future (Fuchs, 1982).

The imprecise measurement of education may be especially relevant when race is added to the relationship.[5] In the United States, simple counts of years of educational attainment presents problems because historically there have been large differences in the content and quality of education between races. These

[5]Education is generally measured in years of education attained. The effects of education on such outcomes as income are typically not linear. Analogously, flexibility in the form of the effect of education on health should be permitted. For example, attainment could be expressed in categories such as high school graduate, college graduate, and so forth.

differences are probably greatest among the current generation of elderly, many of whom were born into a rigidly segregated society with large racial differences in public investment in education (Smith, 1984).

Financial Resources

The measurement of financial resources presents even more challenges. Most studies in the health literature have measured financial resources with some form of individual or household/family income in the year of or the year before a cross-sectional survey, sometimes called contemporaneous income. There are several potential problems with the use of contemporaneous income as a measure of financial resources. First, income in a single year may not adequately measure the financial resources available to an individual over the lifetime in which decisions affecting health are made. This timing issue is different from the reverse causation question and may be even more important in late life. It may be especially important in assessing the comparative health status of currently older blacks versus whites because of the large changes in the relative income of blacks versus whites that have occurred over their lifetimes.

Second, income may not be the best measure of economic resources among older individuals, especially those who are retired. Instead, wealth may be a far better proxy for their command over economic resources. Income is typically lower after

retirement than before. In the extreme, an older person may be worth a million dollars and simply live off of this principal with no income. Wealth captures an important dimension of financial resources because it may be a indicator of long-run income. The distinction between income and wealth may be especially critical for understanding racial health disparities because racial differences in wealth are even greater than in income.[6]

Some studies have simplified the measurement of financial resources by translating contemporaneous income into a dichotomous variable indicating whether a household's income is above or below the federally defined poverty line. This is in general a mistake because it substitutes a political concept for a scientific construct. One potential problem with this practice is that income effects are known to extend across the spectrum of income even into high-income ranges. Dichotomizing income may lead to incorrect conclusions about the relationships between race, health, and income. For example, blacks are much more likely to have income near the poverty level. Thus, a multivariate analysis that simply includes a poverty dummy may result in a still significant race dummy effect even in the absence of a real racial difference because the range of upper

[6]Finally, regional differences in costs of living (Liberatos et al., 1988) also have an impact on the significance of income. To the extent to which there are racial differences in geographic distribution, failure to control for geographic location may bias estimates of the racial differences

level income and the corresponding variation in health in the wealthier white population are not accounted for.

A final measure of socioeconomic status that has been commonly used, especially by sociologists, is occupation.[7] One reason for this is that occupation is arguably a better measure of long-run economic status than current income is. Whatever the traditional merit of this argument, it is certainly mitigated when data sets contain measures of wealth and long-run time series on income. There are some other problems that may affect the interpretation of occupation. In comparisons across racial groups with different rankings of occupation, a particular occupation may translate into a different status in a community depending on the racial composition of the community. Second, broad groupings of occupation may not capture significant variation within occupational categories. Third, there is controversy over how one measures occupation in late life. For example, for many important occupational health exposures (e.g., the relationship between asbestos and lung cancers), the temporal relationship between the exposure and the outcome is distant. Thus, for studies of racial differences in the relationship between health and occupation in late life, it is especially unclear which occupation is most appropriate. Occupational categories may also present added problems in the context of the

[7]Although occupation has historically been an important measure of socioeconomic status for sociological studies, it has been relatively less important in the economic literature on health.

socioeconomic status-race-health analysis because there may be differences between races in exposures and treatment of persons in the same occupational category.

The Race Connection

The Role of Race

Typically race per se has not been explicitly analyzed in the context of an economic model of health production. The reasons for the failure to explicitly incorporate race into this framework remains unclear. In one standard textbook of health economics, for example, the author concludes that so-called "cultural-demographic variables" are not typically the focus of economic models of health because they do not change rapidly in a population and are not the instrument of public policy (Feldstein, 1983). Clearly, government policy cannot change race, as, for example, government taxation policy can change the income distribution. But race directly or indirectly is often used to target government policies in health care. For example, Healthy People 2000 (U.S. Department of Health and Human Services), the federal government's most comprehensive statement on health objectives for the country, includes numerous race-specific health objectives. Furthermore, race may indirectly have many of the same effects as socioeconomic status has directly, and the government has a major role in policies that affect race-based behaviors such as job discrimination. For

example, racial discrimination in hiring may affect job choices that are in turn associated with risks of injury or toxic exposure, and prevention of racial discrimination in hiring is very much a government policy.

The economic model may serve as a framework for assessing many aspects of the relationships between race, socioeconomic status, and health. For example, race may affect the health production function per se independently of any race-related genetic or biological predispositions to certain diseases. Studies have described subtle racial differences in the effectiveness of certain drugs in the treatment of hypertension, possibly related to racial differences in the pathophysiology of hypertension (see review in Kaplan, 1994). These differences might lead one to predict differences in the demand for these treatments by race by affecting the trade-off between marginal benefits and marginal costs of treatment. Although the actual physiological differences may be minimal, racial differences in the perceptions of efficacy of treatment may lead to similar results.

Race remains an important factor in residential patterns in the United States (Massey and Denton, 1989). Area of residence may in turn determine a range of health-related factors such as supply of and distance to health providers and environmental pollution. Race and racial discrimination may also play a role in other factors such as time preferences and risk aversion,

which may in turn affect investments in health. Clearly, the application of an economic framework may provide new, complementary insights into the relationships among race, socioeconomic status, and health.

The race-health relationship is distinguished from the socioeconomic status-health relationship in two ways. First, legitimately or not, race is often assumed to include at least some biological or genetic component. Most researchers no longer consider genetic or biological differences to be important factors in explaining differences in health among groups of varying socioeconomic status. In support of the position that genetics and biological factors do not play a large role in explaining race differences in health, researchers (Williams et al., 1954; Krienger et al., 1993) point to the literature that has suggested that racial classifications account for only small amounts of the human genetic diversity (e.g., Lewontin, 1972). A frequently mentioned example of a disease that has a genetically based difference in rates between races is sickle cell anemia, but even this example may be flawed. Sickle cell anemia is in fact well described in white populations (Serjeant,1985), and the higher rates in blacks may have more to do with geography than genetics (e.g., Williams, 1994).

The second important distinction is that race has meant more than just socioeconomic status in the United States in light of the extensive degree to which race has determined an

individual's set of life opportunities independently of socioeconomic status as traditionally defined. For example, for many older African Americans high education and even high income did not necessarily translate into differences in how one was treated in daily life in large sections of the country: this might have implications for health via proposed influences of stress. Thus, there are added dimensions to the race-health relationship that are often difficult to measure.

To add an additional layer of complexity to the socioeconomic status-health-race literature, there may be important cohort differences in what race has meant in this county. During the life course of the current population of older African Americans, there have been dramatic changes in the opportunities for and the treatment of African Americans in this society. These changes have produced potentially important cohort effects that may confound other factors--especially age--important to understanding racial differences in health.

Measurement of Race

Over the last several years there has been growing interest in the health literature on how researchers measure race (Williams, Lavizzo-Mourey, and Warren, 1994; LaViest, 1994; Hahn, 1992; Osborne, 1992; Jones, LaVeist, and Lillie-Blanton, 1991; Cooper, 1986). There are two general methods of measuring race: self-report and observation. Most categorizations typically

distinguish between race (usually African American, white, Asian) and ethnicity (usually Hispanic or not). Although there are theoretical arguments that may support the use of self-reports versus observational measures, the number of discordant classifications are probably minimal for data on blacks and whites. Furthermore, the importance of the measurement of race as a potential source of bias may change as the number of acknowledged interracial births grows and the life experiences and attitudes of individuals become more diverse with respect to racial identity (e.g., young people who would be traditionally classified as "black" being raised in entirely white communities and who may or may not identify as black and whose experiences may differ from those of most blacks in terms of stress, etc.).

In the next section we will review recent major studies that have addressed the relationship between health, race, and socioeconomic status and will present new findings from analyses of data from the HRS and the AHEAD surveys.

RACE, SOCIOECONOMIC STATUS, AND HEALTH STATUS: EXISTING EMPIRICAL EVIDENCE

In the this section, we will briefly review key studies that have specifically addressed the role of socioeconomic status in explaining racial differences in health, with a focus on health in late life. Any review of this issue is complicated because health status is multifaceted. Because mortality is

among the broadest and most studied traditional measures of health status, this literature is summarized first. We then review relevant studies that have used other measures of health status in assessing the role of socioeconomic status in explaining racial differences in health. Finally, our findings from analyses of recently available data on health status from the HRS and the AHEAD surveys are presented.

Mortality

The literature on racial comparisons of mortality in the United States dates to over a hundred years ago. In almost every study, African Americans have been shown to have higher rates of mortality than white Americans (Ewbank, 1987).[8] Although even the earliest research proposed socioeconomic status as a major factor explaining racial health disparities, only within the last two decades have there been high-quality longitudinal data sets that provide important information on the temporal relationship between ill health and death and socioeconomic status. Table 1 summarizes the results of some key studies that over the last decade have assessed the contribution of socioeconomic status to racial differences in mortality. All except one are based on longitudinal data. This research varies widely along several dimensions, but the conclusions are similar. Most if not all of the racial differences in mortality appear to be related to

[8]Almost all of the early studies used census data.

differences in socioeconomic status.[9] In several studies in fact, there was no statistically significant racial difference once socioeconomic status was controlled for (Kaplan et al., 1987; Keil et al., 1992; Rogers, 1992; Zick and Smith, 1991).

The uniformity of this conclusion is impressive in light of the enormous diversity in study samples and in measures of socioeconomic status. For example, several data sets were restricted to a single geographic area,[10] and among those with national samples, only one controlled for geographic region and urbanicity (Menchik, 1993). Most projects had total sample sizes of over 1,000, with the percentage black (when it was reported) ranging from 10 percent to over 50 percent. However, the time span covered varied from 1 to 18 years, with the earliest period of observation beginning in 1960. Similarly, these representative research projects differed considerably in how they defined socioeconomic status. While all controlled for at least age, gender,[11] and education, there was considerable variation in proxies for socioeconomic status beyond that. Two studies (Guralnik et al., 1993; Keil et al., 1992) had no measure of financial resources and only one (Menchik, 1993) included net

[9] It was not always possible to estimate from the published results a measure of how much of the racial variation was accounted for by socioeconomic status, but when this was published explicitly, the percentage explained was over 60 percent.

[10] North Carolina in Guralnik et al., 1993; Charleston, South Carolina, in Keil et al., 1992; Alameda County, California, in Kaplan et al., 1987.

[11] Two analyses were restricted to men (Keil et al., 1992; Menchik, 1993).

worth at baseline as a proxy for wealth.

Contemporaneous income for the baseline year computed at the family or household level was the typical income construct (Kaplan et al., 1987; Rogers, 1992; Sorlie et al., 1992; Otten et al., 1990), but some studies apparently used individual incomes (e.g., Menchik, 1993). There was further variation in the measurement of contemporaneous income. For example, some authors adjusted family income by size of household (e.g., Kaplan et al., 1987) while Berman et al. (1991) defined several variables, including personal income, the receipt of Social Security benefits, and the receipt of Supplemental Security Income. However, this diversity in study populations and explanatory variables did not produce great differences in the primary finding across studies confirming the prominent role of socioeconomic status in explaining racial differences in total mortality.

General Health Status and Morbidity

Mortality is at best a crude indicator of the health status of a population because it fails to capture the overall burden of poor health. This limitation may be especially significant for older populations, where rates of poor functional status may be very high. Measures of general health status fall into three broad categories: (1) self-reports of general health or specific dimensions of health or function, (2) observed indicators of

health and function, and (3) the presence of disease (morbidity). Each captures a different dimension of health and raises a unique set of issues. For example, one potential problem with self-reported health is that people may implicitly compare their health with that of those around them. Thus, people who live in communities with poor health may rate their health higher than people with the same general health status in a different community with better average health. Research comparing the health status of different racial groups have used a wide variety of outcome measures, but probably the most common measure of health status is self-reported general health on a scale of excellent, very good, good, fair, and poor. In this review, we will focus on self-reported measures of general health and function in discussing the relative contribution of socioeconomic status to racial differences in health.

By most measures of general health status, blacks in late life have worse health than whites. For example, analysis of the 1986 National Health Interview Survey (NHIS) revealed that blacks over age 65 were more likely to report their health as poor or fair.[12] Comparing black and white elderly in functional status points to similar conclusions. For example, fewer blacks than whites remain independent in activities of daily living and instrumental activities of daily living; this was true for both

[12]The percentages were 44.7 percent and 46.9 percent for black males and females respectively and 29.8 percent and 28.8 percent for white males and females respectively (Mermelstein et al., 1993).

men and women above age 65 (Furner, 1993). Among community residents, black elderly report a larger number of functional impairments (Macken, 1986; Manton et al., 1987; Kington and Smith, in press).

The relative health status of black and white elderly is not uniform across older populations. Gibson reviewed several national studies of racial differences in the health of older adults and noted the frequent finding that the black disadvantage in health and function was greater among younger elderly than among older elderly (Gibson, 1991). For example, using data from the 1982 National Long Term Care Survey, Manton and colleagues found that the black-white ratio for total disability was 1.81 among persons 65 to 74 but only 1.22 among persons 74-84 (Manton et al., 1987). Several potential explanations have been proposed for this race-age interaction, including selective survival of healthier blacks (e.g., see the discussion in Gibson, 1991), but the patterns suggest a more complex story than simply worse health for older blacks compared with whites.

Compared with white elderly, black elderly also have worse health in terms of morbidity. Black elderly have higher rates of several important causes of poor health and poor functioning such as hypertension, diabetes, and arthritis (Furner, 1993; Blesch, 1993). For some conditions, however, black elderly have lower rates than white elderly. For example, a lower rate for broken hips among black women, possibly related to lower rates of

osteoporosis among black women, is well described (Kellie, 1990). A recent analysis of stroke incidence over a year found lower rates for blacks over 75 and higher rates below 75 (Broderick et al., 1992), while prevalence studies have found higher rates of stroke or "cerebrovascular disease" among older blacks (e.g., Schoenberg, 1986).

Relatively few studies have attempted to describe the amount of variation among racial groups in health status that is accounted for by socioeconomic status. Table 2 summarizes results from several cross-sectional studies that have compared general health measures for blacks and whites and that have attempted to assess the contribution of socioeconomic status to the observed racial differences.

The range of measures of general health and function compared with mortality makes it more difficult to succinctly summarize these findings. For example, the variation explained by socioeconomic status often depended on how health status was measured. This research also exhibited diversity along other dimensions, including the measurement of financial resources, the age groups considered, and geographic scope. In general, the literature suggests that a significant amount, but definitely not all, of racial differences in health status are attributable to differences in socioeconomic status.[13]

[13]Unlike the mortality studies, few of these studies were presented in such a way as to allow easy estimation of the amount of the variation that was accounted for by socioeconomic status when a race residual effect remained.

Several national studies are especially noteworthy. First, Mutchler and Burr (1991), using data from the 1984 Survey of Income and Program Participation (SIPP) for people over age 55, compared self-reported general health, limitations in activities of daily living, and a multi-item mobility index for blacks and whites. Age, sex, education, income (defined at the couple level if the person surveyed was married), and net worth accounted for almost all of the racial difference with the exception of general health perceptions. This analysis was unusual because it is one of the few studies of racial differences in general health status that controlled for wealth. Using 1973 data on a sample of people over 65 years old, Ferraro (1987) found persistent racial differences in subjective health and disability after controlling for age, education, illness, and chronic conditions.

Other notable studies in this area have covered the full range of adults from young age to old age. House and colleagues (1990) analyzed data from the 1986 Americans' Changing Lives (ACL) survey. When age, sex, education, marital status, and income were controlled, among adults over age 25, race was not a significant predictor of functional status or limitation in daily activities, but was associated with a larger number of chronic conditions. Satariano (1986), however, found that racial differences in the health status of a sample from Alameda County, California, above age 20 were entirely explained by age, occupation, sex, education, and family income.

RACIAL HEALTH DISPARITIES

In this section, we describe some racial differences in health outcomes using recent HRS and AHEAD data. To start this comparison, Table 3 displays self-reported health status by gender and race. Not surprisingly, people self-rate themselves in better health in the younger HRS sample. As a quick generalization, twice as many HRS respondents in each race-sex group are in excellent health compared with the older AHEAD sample. In both surveys, blacks are considerably more likely to report much poorer health. For example, while almost half of black AHEAD households place themselves in fair or poor health, only one in three white households so respond. More than a third of whites are in excellent or very good health compared with a fifth of black respondents.

Respondents in these surveys were also asked a series of questions about the presence of chronic medical conditions and symptoms and about the use of selected medical services related to specific conditions. Tables 4 and 5 contrast the responses to these questions for black and whites by gender. The emerging racial patterns in disease prevalence are mostly consistent with other published data. In both AHEAD and HRS, blacks had substantially higher rates of hypertension, stroke, and diabetes and lower rates for diseases of the lung and for a heart attack within the previous 5 years (men only). For hip fracture, black women had lower rates (data were collected only in AHEAD). In

AHEAD, blacks had a higher rate of arthritis, while in HRS, the rate was higher only for black women.[14] There were minimal racial differences in rates of several conditions for both surveys including emotional/psychiatric problems and angina.

These relative prevalence rates are influenced by several factors that influence the interpretation of racial differences. These factors include whether a physician was seen for a specific condition, how symptoms are attributed to specific medical diagnoses, and treatment modalities for specific conditions. Prevalence rates derived from self-reported conditions, for example, may confound true health differences with other behaviors, including frequency of contact with physicians and health care utilization. Blacks reported lower rates of cataract surgery, which may reflect lower rates of access to health care rather than lower rates of cataracts. Analysis of data from the Baltimore Eye Survey found that the age-adjusted risk of unoperated cataracts among older blacks was 5.25 times that of whites (Sommer et al., 1991).

Although biological and genetic factors may have a part, socioeconomic status may also play a role in accounting for racial differences in many of these conditions. For example, stress has long been raised as a potential cause for racial

[14]Some differences between the two surveys may reflect differences in the wording of the questions. For example, AHEAD asked whether the respondent had ever been told that he or she had arthritis or rheumatism, while the HRS survey asked about seeing a doctor in the previous 12 months specifically because of arthritis of rheumatism.

differences in hypertension rates (James et al., 1987). A recent analysis of longitudinal data on health and occupational position found that although both blacks and whites who remained in low occupational classes over approximately a 10-year period were more likely to develop uncontrolled hypertension, the odds of developing hypertension for blacks were twice the odds for whites (Waitzman and Smith, 1994).

Perhaps obesity is the most important underlying factor that may be both mediated by socioeconomic status and associated with the incidence of three conditions found in higher rates among blacks (hypertension, diabetes, and arthritis). Racial and ethnic differences in obesity among women are profound.[15] Low socioeconomic status is also clearly associated with a greater likelihood of obesity (Sobal and Stunkard, 1989). The higher prevalence of strokes among blacks also may be possibly mediated by socioeconomic status through such risk factors such as hypertension and diabetes. Access may also explain other differences seen in these data. For example, black women have a similar or lower rate of breast cancer after age 40 compared with white women (Krieger, 1990). Black women, however, are more likely to have breast cancer diagnosed at a later stage and to

[15]Data in the third National Health and Nutrition Examination Survey (NHANES III) revealed an age-adjusted prevalence of overweight of 48.5 percent among non-Hispanic black women between ages 20 and 74 years, while for non-Hispanic and Mexican American white women the prevalence was 32 percent, and for Mexican American women was 47.2 percent. The rates for non-Hispanic black, non-Hispanic white and Mexican American men aged 20 to 74 years were 31 percent, 32 percent, and 39.1 percent respectively (Kuczumarski et al., 1994).

have shorter survival rates as a result (e.g., Eley et al., 1994). This difference is believed to be related to lower mammography screening rates among black women (Caplan et al., 1992). The differential survival may lead to lower prevalence rates for conditions such as cancer in the face of similar incidence rates.

HEALTH AND WEALTH

A key risk to successful aging rests in the complex two-way interactions among income, wealth, and good health. Debates about the direction of causation have made conclusions about the relation of the wealth and health of older populations difficult to pin down. We know that healthier households are wealthier ones. Is that simply because higher incomes lead to better health? Or does poor health restrict a family's ability to accumulate assets by limiting the ability to work or through rising medical expenses? Or perhaps neither direction of influence is important, and the association merely reflects some unobserved factor that makes some people healthier and wealthier. Even to try to answer such questions requires panel data (to average out individual differences) and good health and wealth information to isolate the reasons for the association. With HRS and AHEAD, answering this sort of fundamental scientific question may now be feasible.

Table 6 displays the relation between total household

income and the health of respondents in both HRS and AHEAD. Confirming a number of prior studies, this relationship is largely uniform and quantitatively strong. As a gauge of the quantitative importance of this relationship, Table 7 arrays median household net worth[16] by self-reported health status in both the HRS and the AHEAD samples. The magnitude and consistency of these results are impressive. In virtually every case, each step up in health status is associated with a large increment in household wealth. For example, in the HRS sample, the median middle-aged white man in excellent health possessed $184,000 in wealth compared with $37,250 for the median middle-aged white man in poor health. Although the size of the wealth-health gradient is quite large in both samples, the AHEAD data in Table 7 may suggest some attenuation among older Americans compared with their middle-aged counterparts. While blacks have lower wealth levels than whites in all health categories, the wealth-health gradient may even be quantitatively larger in African-American households, especially when our reference points are households in poor health. In the HRS sample, for example, black male respondents in poor health had only $2,000 of wealth,

[16]In addition to housing, household net worth is built up from the following 11 categories: other real estate; vehicles; business equity; individual retirement account or Keogh; stocks, trusts, or mutual funds; checking, savings, or money market funds; certificates of deposit; government savings bonds or Treasury bills; other bonds; other savings and assets; and other debt. Because of extensive missing values in assets, an innovative method of imputing missing values was developed. For a summary of the details underlying this imputation algorithm, see Smith (1995, in press).

one-thirty-sixth of the wealth of black male respondents in excellent health. For white men, the wealth of those in excellent health exceeds that of those in poor health only by a factor of five. The gradients of these wealth-health relationships are much larger than those previously displayed for income and health.

The real value of these surveys in understanding the health-wealth nexus will only be realized in subsequent rounds as the dynamics of the process unfolds. However, some clues may be gleaned from the baseline by combining information on current status with a question about how health status compares with health a year ago. Table 8 provides the results from that combination.[17] The patterns in this tables are remarkably consistent. Whatever the ultimate resolution of the thorny issue of causality, baseline HRS and AHEAD data confirm earlier findings that the association between contemporaneous health and wealth is not trivial. The relationship is monotonic and quantitatively large-each step down in current health status significantly reduces net worth. In addition, current HRS and AHEAD assets are correlated both with current health levels and with changes in health. Virtually all transitions in Table 8 associated with improved health had higher assets while

[17]For the purposes of this table, we assumed that health would move across only one threshold during a year. For example, those currently in good health with deteriorating health over the last year were considered to be in very good health last year. Similarly, those currently in good health whose health improved during the year were considered to be in fair health last year.

transitions into poorer health had lower assets.

Another unique advantage of HRS and AHEAD is that the detailed health module was given to both spouses. Although owing to data limitations household outcomes are typically related only to the health of one spouse, this is no more justified than defining household income using only one member's income. Episodes of poor health of either spouse may deplete family resources. In addition, families may be better able to cope with the care-giving requirements for a person in fair or poor health if the spouse is in very good or excellent health.

To examine this joint distribution, Table 9 arrays household net worth for married couples by the health of each spouse. Although not without the odd exception, the pattern is remarkably consistent--an increase in the health of either spouse is strongly positively correlated with household net worth. This relationship is also quantitatively strong. Arrayed only against the health of the financial respondent, net worth varies by a factor of about 4 to 1 as the health index moves from poor to excellent health. Table 9 demonstrates, however, that net worth varies by almost 10 to 1 when our health index moves from both spouses' being in poor health to both being in excellent health.

A critical component of how joint spousal health affects savings behavior depends on the correlation in their health outcomes. For a number of plausible reasons, this correlation is likely to be positive. Not only are spouses more likely to be

closer in age (and hence facing similar aging-related health risks), but they have shared similar economic, social, and health environments for some time. Both HRS and AHEAD indicate that this correlation is indeed strongly positive. For example, while only 13 percent of AHEAD financial respondents report themselves in poor health, the odds increase to 1 in 3 if the spouse is also in poor health. On the other extreme on the health spectrum, 1 in 10 AHEAD financial respondents report themselves in good health, a ratio that doubles if the spouse is in excellent health.

One of the most frequently cited reasons for lower savings among the poor is that they have higher time preferences for the present (e.g., shorter horizons). HRS, especially in its panel features, will eventually allow one of the first explicit tests of this hypothesis, but the baseline survey points to its promise. Consistent with persistent speculation, black and Hispanic households are more likely to have very short time horizons. For example, 28 percent of black and Hispanic households, compared with only 17 percent of white households, report a planning horizon of only a few months.

RISK BEHAVIORS

One pathway through which economic status may influence health is behavior typically placed under the label "risk factors." Epidemiological studies have identified the following

as important risk factors associated with mortality and morbidity: smoking, alcohol intake, excess weight, and high cholesterol level. While the diseases through which these risk factors mediate vary—for example, smoking (cancer and heart disease), body mass index (heart disease, diabetes), alcohol (injuries, cirrhosis)—all have the potential of mediating through socioeconomic status. If so, they may explain part of the racial disparities in health outcomes. Both HRS and AHEAD have a rich array of such self-reported risk behaviors. HRS measures include smoking, drinking, light and vigorous physical exercise, current and past exposure to occupational health hazards, and current weight and height. A more limited set of risk factors--smoking, drinking, height, and weight--is available in AHEAD.

Tables 10 and 11 contrast race and sex differences in these health-related risks. Cigarette smoking is perhaps the most well-documented behavioral risk, a leading cause of cancers of the lung. Compared with white men, black men in the HRS age range are more likely to be current smokers and are less successful in quitting smoking. Thirty-eight percent of black men in their fifties are current smokers compared with 23 percent of white men. Among those who ever smoked, 7 in 10 white men had quit compared with slightly less than half of black men. At the same time, black men are less likely to engage in heavy smoking. While less than 1 in 20 HRS black men report that they smoked at least a pack a day, 1 in every 10 white men did. Racial

differences in smoking behavior among women are much less severe than those just described among men. Women in their fifties smoke less than similarly aged men, but there are trivial racial differences in current or past cigarette smoking or in its intensity.

Although smoking is much less common among all groups in the AHEAD sample (ages 70 and above), similar patterns of racial disparities persist. In AHEAD, current smoking prevalence rates are roughly half of those observed in HRS, but black men still smoke at twice the rate of white men. The percentage of these elderly men who were able to quit smoking is higher than that observed among men in their fifties (86% of white and 70% of black men). While these trends could reflect cohort differences in smoking behavior or differential mortality selection (e.g., higher mortality of smokers excludes more of them from the AHEAD sample range), we see it largely as a life-cycle phenomenon where larger and larger numbers of former smokers cease. Presumably, some of them have been told to do so for health reasons. The reason why a life-cycle interpretation appears plausible is that a roughly similar fraction of each birth cohort ever smoked.

Racial differences in drinking behavior are much smaller. While blacks in both samples are somewhat more commonly quite heavy drinkers (five or more drinks a day), the real disparities appear among nondrinkers, who are far more likely to be black. While this finding characterizes each sex in both samples, the

differences are particularly striking among women. In the HRS sample, 56 percent of black women are nondrinkers, 12 percentage points higher than their white counterparts. This racial discrepancy is even larger among older women, where almost 4 in 5 black women are teetotalers compared with 3 in 10 older white women.

Although this problem affects all behaviors contained in these tables, exercise is a risk factor for which it is especially difficult to disentangle cause and effect. While exercise may lower risks associated with heart disease, it is also true that individuals in poor health may simply be unable to engage in vigorous exercise. Whether light or heavy physical exercise is used as the yardstick, blacks are more likely not to engage in any exercise. To use but one example from these tables, two-thirds of black women have no episodes of heavy physical activity compared with only half of white women.

In HRS, respondents were asked whether they ever had been exposed to dangerous chemicals or other hazards at work as well as the number of years of such exposure.[18] While many studies are confined to specific occupations or even job tasks, an advantage of the HRS question is that it provides a population-based estimate, at least for a specific cohort. Black men are less likely than white men to report any work-related

[18]More precisely, the question was, "Have you ever had to breathe any kinds of dusts, fumes, or vapors, or been exposed to organic solvents or pesticides at work?"

occupational exposure or to report an exposure of very long duration. Given women's more sporadic history of labor force attachment, not surprisingly, work-related hazards are far less common among women, with little evidence of any significant racial disparity.

Respondents in both surveys gave self-reports of their heights and weights. Obesity is a well-established risk associated with both heart disease and adult onset of diabetes. Tables 10 and 11 confirm that African Americans are more likely to suffer from being overweight, a problem particularly acute among black women. In both surveys, roughly 42 percent of black women are in the top quartile of body mass index for the entire sample, almost twice the rate observed among white women.

EMPIRICAL MODELS OF SELF-REPORTED HEALTH OUTCOMES

In this section, a series of sequential empirical models explores the relationship between a household's economic resources and health. This section liberally uses material in Smith and Kington (1996). Our central interest in this exploration lies in understanding the reasons underlying the strong correlation between income and health. We begin with an empirical specification that mimics the current standard in the literature. Then, we assess whether this standard can withstand a very aggressive set of tests about the direction of the causal relationship between socioeconomic status and income. All models

are estimated with the recent HRS and AHEAD data. While a number of salient health measures are available in these surveys, only a respondent's self-assessed health status is used as an outcome. Since self-assessed health is a ranked categorical response, ordered probit models are used in estimation. The underlying score is estimated as a linear function of the co-variates and a set of cut points. The probability of observing health status i can be expressed as

$$\Pr(\text{health}=i) = \Pr(k_{i-1} < \beta X + u_j < k_i) \qquad (8)$$

The model estimates the parameter vector β along with the four cut points (k_i).

To establish a baseline, the first and second columns of Tables 12 (for HRS) and 13 (for AHEAD) contain a model that incorporates race, ethnic, and gender demographic controls only. In both samples, blacks and Hispanics report consistently lower health outcomes than whites do. Women rank higher than men in their self-assessed health in the HRS age range, but there are no statistically significant gender differences among older Americans in AHEAD. Blacks and Hispanics each trail whites by half a standard normal deviation in HRS and a slightly smaller amount in AHEAD. The advantage women hold over men is considerably smaller in either survey.

The second and third columns of Tables 12 and 13 extend

this model by adding a standard list of demographic and economic co-variates; current marital status, education, household income and wealth, birth cohort (or, equivalently, age), and location (in AHEAD). In both surveys, more recent birth cohorts exhibit higher self-reported health. Given the cross-sectional nature of the survey, one cannot distinguish between a life-cycle and a cohort interpretation of this relation. Younger respondents may be healthier simply because they are younger and at an earlier stage in the aging process. Alternatively, as for many other forms of human capital, health stocks may be improving for each new generation. At this stage of the analysis, variation in current marital status does not significantly influence current health outcomes.[19] Older residents of standard metropolitan statistical areas and the South have somewhat lower health status than those who live elsewhere.

Three dimensions of economic resources are incorporated into the baseline models in Tables 12 and 13: schooling, total household income, and household net worth.[20] Education is commonly thought to affect health status through a number of channels. First, schooling is an excellent measure of stable long-term economic status. In addition, more educated respondents may have acquired more knowledge about personal

[19]Somewhat puzzlingly, widows are healthier than those with other marital status in the AHEAD sample.

[20]Net worth is well known to contain a significant amount of measurement error. Therefore, these data were trimmed by eliminating observations with the highest and lowest 1 percent net worth values.

behaviors that enhance health or the timely use of preventive health care to stop small negative health shocks from becoming big ones. Because the schooling occurred before current health, many have argued that it is less subject to the confounding effects of reverse causation than other measures of socioeconomic status. While this argument at a minimum is overstated, whatever its substantive interpretation, schooling remains an extremely powerful correlate of current health status.[21] If years of schooling are translated into the additional dollars of household income received, education's effect on health is greater than what can be attributed to this extra income only. The implication is that the beneficial impact of education does not flow only from the additional economic resources schooling buys. Education must in part mediate through information and behavioral adjustments that promote better health.

While its impact is not as quantitatively large as the effect of a person's own education, spousal schooling also raises self-perceived health status. In this formulation, spousal education should have effects on family income that are symmetrical to the effects of a person's own schooling. Therefore, the smaller impact of spousal education implies that some of the beneficial behavioral adjustments associated with schooling are person specific and do not flow over to other

[21]Throughout this paper, education is specified as a set of dummy variables indicating less than a high school degree, a high school degree with no or some college, and a college degree.

family members. In addition to the resource- and information-based interpretations assigned to the effect of a person's own education, spousal schooling may in part capture positive assortative mating in marriage markets as people in better health marry each other.

Both total household income and wealth are associated with higher health status. In the HRS sample, a dollar of wealth has about one-tenth the effect of a dollar of household income. Since income is a flow and wealth a stock, the relative magnitude of these estimated effects are consistent with a 10 percent real interest rate. While this is a little high, there are no strong reasons to suggest that when income and wealth are appropriately dimensioned, they have differential effects on individual health. In contrast, wealth has a quantitatively larger effect than household income does on health status in the older AHEAD sample. Whereas the influence of wealth is similar in the two samples, the estimated effect of income is much smaller in AHEAD, which is about one-third to one-fourth of the HRS estimate. This may reflect shorter life spans of older Americans and higher discount rates for them.

Collectively, these simple economic controls account for a significant part, but certainly not all, of the racial and ethnic disparities in self-reported health status. If we contrast the first two and the second two columns of Table 12, we find that the estimated racial disparity is reduced by 40 percent by these

standard demographic and economic co-variates. Socioeconomic status, as proxied by these variables, accounts for a considerably larger proportion of ethnic health disparities in the HRS sample. While the unadjusted racial and ethnic differences are about the same in the first two columns of Table 12, the estimated Hispanic disparity is almost half as large as the racial coefficient in the third and fourth column.[22] This mimics the result in other applications, such as wages, where observable characteristics such as education explain substantially more of the Hispanic racial deficit (Smith, 1994). These standard demographic and economic variables explain slightly more (60%) of the racial and ethnic disparities in the AHEAD age group.

While modeling risk behaviors is problematic from a micro-behavioral perspective, they are included in the model summarized in the fifth and sixth columns of Tables 12 and 13 to provide comparability with much of the existing health literature. Not surprisingly, health risk factors are powerful co-variates that have statistically significant and well-ordered associations with self-assessed health outcomes. Former smoking (in AHEAD), current smoking, and the intensity of smoking lower self-reported health while all levels of moderate drinking are positively correlated with health status. Consistent with a growing number

[22]Since male and female education levels are about the same and men and women mostly share similar economic resources, it is not surprising that the sex coefficient is not altered much by the inclusion of these simple economic and demographic variables.

of findings in the literature, the "optimal" number of drinks in the HRS sample range is one or two a day, but rise to three or four a day in AHEAD. In these results, we cannot distinguish between those respondents who do not drink at all and those who drink a great deal. Higher regimens of light and heavy physical exercise in HRS are correlated with better current health status in a remarkably well-ordered way. Even though these are self-reported episodes and durations, this analysis provides statistically significant evidence that exposure to work-related health risks as well as the duration of that exposure is associated with lower self-reported health. Finally, obesity is a negative marker of poor health in both samples.

While these HRS risk factors are statistically important, their collective impact on racial and ethnic health disparities is relatively modest. Indeed, Hispanic health deficits in the model with risk factors are almost identical to those estimated without risk behaviors. The racial health disparity is smaller, but only one-sixth of the deficit was eliminated by these risk factors. The dominant risk factor in lowering the racial deficit was the body mass index, which by itself accounted for half the observed reduction in the racial health disparity. The collective influence of the AHEAD risk factors is somewhat larger, reducing the unexplained racial disparity by a third and the Hispanic deficit by less than one-fifth. One mechanism through which these risk factors may operate is socioeconomic

status. However, these risk behaviors are largely independent of socioeconomic status. Even in the model with risk factors included, the estimated effects of socioeconomic status are approximately as large as they were without risk factors in the model.

We also estimated one model for married households that adds a set of variables measuring the identical set of risk factors for the spouse. For most of the HRS risk factors--drinking, exercise whether light or vigorous, or the body mass index--we are unable to detect any indirect effect of the spouse's behavior on the respondent's health. The two possible exceptions involve years of exposure to an occupational hazard and smoking. There appears to be a statistically significant effect of spousal occupational exposure, although the mechanism by which this has an impact on the respondent's health is unclear. We do estimate a negative effect of spousal smoking that is 70 percent as large as the direct effect. This estimate has little precision, however, so we are unable to reject the hypothesis that secondhand smoking has no effect on health. The parallel AHEAD results are much easier to summarize. There is no evidence that any of the spousal risk factors have any association with the respondent's self-assessed health status.

The last 2 columns of Tables 12 and 13 test for nonlinearity in income and wealth effects on probability scores by including linearly splined terciles of total household income

and wealth. In both samples and for both income and wealth, there is strong evidence of nonlinearity. Income and wealth affect self-perceived health status throughout the entire range of the income and wealth distributions. Consequently, one cannot interpret, as is often done, the beneficial effects of income or wealth as differentiating poverty level families from those who are above the poverty line. However, the size of income and wealth effects on health status do decay as one moves up the income and wealth distribution. For example, in the HRS sample, the estimated effect in the lowest income tercile is 16 times larger than the effect in the highest tercile, and the effect of the lowest wealth tercile is 53 times larger than the effect in the highest tercile. In the AHEAD sample, the lowest tercile's income and wealth coefficients exceed the highest tercile estimates by approximately 25 to 1.

Including only linear terms in income and wealth turns out to be a serious misspecification of the relationship between economic resources and health status. In particular, it results in a quantitatively large overstatement of the unexplained racial and ethnic health disparities. To illustrate, the racial coefficient in the HRS sample is reduced by a quarter and the ethnic coefficient by one-half when nonlinearities are permitted. Even more dramatic results are obtained in the AHEAD sample, where there are now no statistically significant racial or ethnic

disparities remaining.[23]

Measurement of Household Resources

In health outcomes and health services research, total household income is the conventional empirical proxy for aggregate economic resources. It is often the only option available as health surveys typically expend little survey time attempting to measure household resources. If we place a high priority on understanding why socioeconomic status has such a quantitatively strong association with a variety of health outcomes, reliance on such a simple summary statistic as total household income is surely a mistake. One reason is that

[23]There are a number of simple stratifications of these basic models by marital status, sex, and race or ethnicity that are illuminating. Both the unadjusted and the adjusted racial and ethnic disparities in this fully interacted model are smaller among HRS married couples than among HRS nonmarried individuals. However, this ranking is reversed in the AHEAD sample. While there are some exceptions, the general pattern of results that have been just described for the combined sample carries over to both the married and the nonmarried samples separately.

In large part, the conclusions summarized thus far carry over with surprisingly few exceptions to race-ethnic and sex-specific models. In particular, the effects of our socioeconomic status variables--education, household income, and net worth--are quite similar for men and women in HRS, but the household income effect may be smaller for women in AHEAD. In the separate estimates for men and women, racial and particularly ethnic deficits are larger among women in HRS whereas there appears to be little gender difference in AHEAD. While the HRS racial health disparity is two-thirds as large among men compared with women, the truly dramatic difference takes place among Hispanics. Whereas there exists a large health disparity between Hispanic and white women, there exists no statistically significant HRS difference between Hispanic and white men. Among the risk factors, obesity appears to be a more salient risk factor for women. The final comparisons are separate runs by race and ethnicity. The major persistent pattern in the two samples is that the beneficial effects of spousal characteristics such as education appear to be confined to the white sample.

household income is built up from conceptually unique subcomponents, many of which influence health or are affected by health in distinct ways. For openers, there may be multiple income recipients in a household. While standard economic theory blends all income into an indistinguishable homogeneous amalgam, more recent theoretical models argue that the way in which household resources are spent may be affected by who controls resources. These models suggest that at a minimum, it is essential to distinguish the effect of a person's own income on his or her own health from that of the income of other family members. Secondly, the receipt of some income sources may be consequences rather than determinants of poor health. For example, respondents in the HRS sample who are recipients of either pension or Social Security income are mostly retired. Since early retirees may well have retired because of their poor health, the causality for this component of income more plausibly runs from poor health to income. Similarly, recipients of welfare income are generally in poorer health, and their poor health condition leads to the receipt of this income.

To test these speculations, Table 14 summarizes the estimated effects of different types of household income on self-assessed health outcomes.[24] Coefficients of the other co-

[24]The models partially summarized in Table 14 contained the same list of co-variates as those presented in Tables 12 and 13. To highlight the main points, only the coefficients on the income and wealth variables (and the race, ethnic and gender indicators) are listed in this table.

variates, not listed in Table 14, were not significantly altered by the experiments performed in this table. HRS household income is separated into six distinct conceptual components. For each spouse, these components are market earnings,[25] retirement-related income (pensions, Social Security, and annuities), and welfare-related income (Supplemental Security Income, unemployment or workers' compensation, and welfare). The seventh component--defined only at the household level--consists of interest and dividends, rent, trusts or royalties, and income from businesses and partnerships. In the AHEAD sample, a slightly different classification is used. For each spouse, earnings remains a distinct category. Because of its fundamental importance within this age range, Social Security and other retirement income (private pensions and annuities) are placed in separate categories. Finally, welfare and asset income are defined at the household level.

The empirical estimates listed in the first two columns of Table 14 strongly support our earlier conjectures. While earnings of either spouse are positively correlated with better health in both samples, additional welfare income is actually strongly associated with lower self-assessed health status. Per dollar of income received, the negative effect of welfare income actually exceeds the positive effect of earnings. The most intriguing results occur with retirement income, which has a

[25]Current market earnings are the sum of wages and salary, bonuses, overtime, tips, commissions, and self-employment income from all jobs.

negative association with health status in the HRS but a strongly positive one in AHEAD. We interpret the negative coefficient in HRS as capturing a causal mechanism from poor health to early retirement. However, virtually all AHEAD respondents are past the normal retirement age so that this possible reverse causation is largely inoperative.

Our arguments are taken a step further in the third and fourth columns of Table 14, which add a set of variables indicating zero receipt of each income source. This specification suggests that the effect of each income type is not continuous at zero and that nonreceipt of income is particularly informative about why health and socioeconomic status may be correlated. In both samples, for example, the absence of any earnings is a signal of health problems that constrain a respondent's ability to work. Once again, the more plausible causality runs from poor health to nonwork to non-income. Controlling for positive earnings reduces the positive effect of a person's own earnings on current health status by a third. More dramatically, the entire positive effect of a person's own earnings on self-assessed health in the AHEAD sample is due to this reverse correlation. Similarly, the presence of either HRS or AHEAD welfare income is associated with lower current health status, a causation more readily interpreted from health to income.

A more complex set of results are obtained for the

retirement variables, the effect of which varies in a systematic way across the two samples. These differences reflect the quite distinct character of retirement in the two samples. While virtually all AHEAD respondents have retired, retirement in HRS generally implies early retirement. For example, having no retirement income in HRS is positively correlated with current health, but once there is retirement income, additional retirement income is associated with better health status. This combination supports our interpretation that early retirement is in part a consequence of poor health. Rather than capturing any effect of socioeconomic status on health, the receipt of retirement income in this age group is a marker of health problems of respondents. However, given that a household has some such income, wealthier households, through either higher accumulations of Social Security or private pensions, have better self-assessed current health status. In contrast, the positive effects of the retirement variables are largely unaffected by the inclusion of the zero-income controls.

The final step in the decomposition of income involves separating earnings into its wage and labor supply components. The level of work effort is especially vulnerable to reverse causality problems since poor health may be an important limitation on the ability to work for long periods of time. In Table 15, the specifications of the HRS section of Table 14 are repeated with weekly wages substituted for annual earnings.

Because this problem is relevant only for samples in which market work is relatively common, these equations are estimated only with the HRS sample. When the presence of zero for each income component is not controlled for (the first two columns of the table), respondent weekly wages remain positively correlated with self-assessed health status. However, evaluated at a work effort of 50 weeks, the weekly wage coefficient is about half as large as that on annual earnings. Most important, when we control for zero weekly wages in the second column, the weekly wage effect is not significantly different than zero.

In this section, we have demonstrated that conventional estimates of the effects of household income on current health most likely seriously overstate the direct effect of household resources on health outcomes, particularly in working populations. Different sources of household income clearly have quite distinct associations with health. Variation in many of these income components reflects the influence of health on income rather than the influence of socioeconomic status on health. The size of this bias stemming from reverse causation may not be trivial. For example, after the receipt and size of the components of household income are controlled for, the estimated effect in HRS of a person's own earnings on current health status is half as large as the estimated effect of total household income on his or her own health. Moreover, even this estimated effect of a person's own earnings completely disappears

when the more appropriate weekly wage measure is used.

Changes in Health Outcomes

The real analytical power of HRS and AHEAD will be realized only when many subsequent waves are available. With multiple health and economic measurements, researchers will be better able to control for unobservable factors that jointly influence both outcomes. However, a tentative step in that direction can be achieved even with the baseline surveys. In both HRS and AHEAD, respondents were asked not only their current health status but also whether it had improved over the last year. By combining these two questions, we can approximate the last and current period's self-assessed health status. In Table 16, ordered probit models are summarized where the outcomes range from a great improvement in health over the last year to a great deterioration.[26] In addition to variables measuring previous year's health status, the other co-variates parallel those included in the cross-sectional models with total household income and total household wealth as our measure of economic resources.[27] Tables 17 contains change models with a decomposition of household income similar to what was presented in Tables 14 and 15.

[26]There are five possible categories in HRS (improved a great deal, improved somewhat, stayed the same, deteriorated somewhat, deteriorated a great deal), but only three categories in AHEAD (improved, stayed the same, deteriorated).

[27]We are unable to find any evidence of nonlinearity in the effects of wealth or income in the change in health specification.

One advantage of this specification is that the analytical spotlight focuses exclusively on changes in health, conditional on the stock of health in the last period. The stock of health at any point is determined by the entire history of past health behaviors (drinking, exercise, smoking) as well as the complete lifetime history of purchased medical services. No data set, including those used in this study, can meet that demanding information requirement. For example, excessive drinking in the past may have led to a deterioration in an individual's health. This health deterioration may in turn have produced a complete cessation of drinking, perhaps under doctor's orders. In this case, an analysis of current health as a function of current drinking would produce quite biased estimates of the health effects of drinking. The change formulation with the past stock of health as a co-variate offers a partial solution to this problem since the past health stock serves as a summary statistic for all past health behaviors and purchased medical inputs.

The empirical estimates summarized in Table 16 generally support our interpretation of the change model. All current-period risk factors--smoking, drinking, and exercise--have their predicted impact on changes in health. As expected, their quantitative impact on changes in health is smaller than their accumulated effect on the current health stock. For example, the better health associated with moderate drinking maximizes at one or two drinks a day. But now very heavy drinking is associated

with worse outcomes for improvements in health than not drinking at all. This seems a more reasonable result than that observed in the static cross-sectional analysis, suggesting that the previous period's health may well control for some of the biases obtained from not observing past values of behavioral or input variables. In a similar vein, those who are currently divorced or separated in HRS have less health improvement than those respondents currently married.

Our principal interest in these change models concerns the economic resource variables, especially total household income. In the models contained in Table 16, total household income has a statistically significant positive association with health improvements. However, the strength of this relationship signals some reasons for concern. In addition to the influence of permanent income, income shocks may lead to health changes for two reasons. First, transitory income may affect the ability to purchase health care and lower health. Second, income shocks may revise expectations of permanent income as people see their future lot as better than they did in the past. As with other commodities, this upward revision in wealth may lead to the purchase of additional medical services. For a number of reasons, this is not a very reasonable scenario. First, in the age groups we are analyzing, income shocks are relatively unimportant since lifetime economic prospects have been largely determined. Second, as emphasized earlier, revisions in the

health stock are by no means instantaneous, and current investments may take years to alter the stock. While income shocks are diminishing in importance in this age range, health shocks are becoming increasingly common. In contrast to our skepticism on the income side, health shocks may have relatively large and quick effects on income prospects. The estimates contained in Table 17 generally confirm the cross-sectional estimates. Estimates of the effects of earnings on changes in health status virtually disappear in both samples when we eliminate labor supply effects. Welfare income also largely mirrors reverse causality from health to income.

When no co-variates are included in these models (the first two and the fifth and sixth column of Table 16), there are statistically significant racial and ethnic disparities in health trajectories in both samples. Hispanics and blacks are more likely than nonblacks to experience health declines in either age group. These disparities in health trajectories are remarkably similar in size for blacks and Hispanics within and across the two samples. However, after co-variates are controlled for, there are no significant racial or ethnic effects in the differenced formulation. Given the large racial and ethnic health disparities that exist among these middle-aged or older respondents, there is no further racial and ethnic divergence among "similar" people as they age.

Long-Run Measures of Economic Resources

The results thus far demonstrate that regressing current health status on current economic resources hopelessly confuses cause and effect for working-age samples. The short-run reverse causality from health to socioeconomic status is simply too strong. A more promising avenue to pursue is to model short-run health dynamics as a function of long-term household economic status that predates current health transitions. Fortunately, we are able to do this in the part of the HRS sample that is linked to Social Security records. These records contain the complete history of a respondent's Social Security earnings.[28] Two proxies for Social Security wealth are used in this research. The first measures the sum of the household's Social Security earnings up to age 50, the starting age of the HRS sample. The second construct sums household Social Security earnings up to age 40. The advantage of the second measure is that it predates HRS health measurement by at least 10 years, effectively eliminating short-run reverse causality from health to economic status.

The empirical estimates summarized in Table 18 do suggest that long-term wealth as measured by Social Security earnings affect health trajectories of mature men and women. This effect

[28]The use of these data creates a number of issues. First, in only two-thirds of all households did the respondent and spouse agree to the Social Security linkage. All estimates in this section are confined to this subsample. Second, Social Security earnings are capped at the limit.

is present whether we sum past earnings to age 50 or age 40. While both spouses' Social Security have positive effects, the impact of own Social Security is larger. While these estimates are less subject to short-run reverse causality problems, they are not immune from long-run problems. If individuals work and earn less as a result of poorer health in the past, causation may still flow from health to economic status.

CONCLUSIONS

This paper has critically explored the role that socioeconomic status plays in explaining racial and ethnic differences in health outcomes of Americans during their middle and old age. Although our results are consistent with other research suggesting an important role for socioeconomic status as a factor accounting for racial and ethnic differences, our results indicate that the relationship among race and ethnicity, socioeconomic status, and health is far more complex than many current analyses recognize. We focus attention on the complexity involved in accounting for economic status as an underlying factor in health status. First, there are two important dimensions of economic status—income and wealth—each with distinct conceptual and empirical associations with health. Second, the association of some common measures of socioeconomic status with health status is highly non-linear. For example, the association of both income and wealth with self-reported general

health status is strongest among the poorest households and is relatively weak among the most affluent members of our society. Both of these issues may affect how we account for racial and ethnic differences in health in later life. Finally, there is compelling evidence that the feedbacks from health to current socioeconomic status are quantitatively strong and should not be ignored in empirical investigations. In particular, the entire association between current household income and health among households with a member in his or her fifties appears to reflect causation from health to income rather than from income to health. As new longitudinal data sets with more detailed and varied measures of economic status and heal status become available, future research should progress toward a more complete understanding of the pathways linking race and ethnicity, socioeconomic status, and health across the lifespan.

REFERENCES

Berman, J.R, R. Sickles, P. Taubman, and A. Yazbeck
1991 Black-white mortality inequalities. Journal of Econometrics 50:183-203.

Broderick, J.P., T. Brott, T. Tomsick, G. Huster, and R. Miller
1992 The risk of subarachnoid and intracerebral hemorrhages in blacks as compared with whites. New England Journal of Medicine 326:733-736.

Caplan, L.S., B.L. Wells, and S. Haynes
1992 Breast cancer screening among older racial/ethnic minorities and whites: Barriers to early detection. Journal of Gerontology 47:101-110.

Cooper, R.
1986 The biological concept of race and its application to public health and epidemiology. Journal of Health Politics, Policy Law 11(1):97-116.

Dardanoni, V., and A. Wagstaff
1987 Uncertainty, inequalities in health and the demand for health. Journal of Health Economics 6:283-390.

DaVanzo, J., and P. Gertler
1990 Household production of health: A microeconomic perspective on health transitions. An unpublished paper presented at workshop on the Measurement of Health Transition Concepts in London, June 7-9, 1989; N-3014-RC. RAND, Santa Monica, CA.

Dowd, J.J., and V.L. Bengtson
1978 Aging in minority populations: An examination of the double jeopardy hypothesis. Journal of Gerontology 33:427-436.

Eley, J.W., H.A. Hill, V.W. Chen, D.F. Austin, M.N., Wesley, H.B. Muss, R.S. Greenberg, R.J. Coates, P. Correa, C.K., Redmond, C.P. Hunter, A.A. Herman, R. Kurman, R. Blacklow, S. Shapiro, and B.K. Edwards.
1994 Racial differences in survival from breast cancer: Results of the National Cancer Institute black/white cancer survival study. Journal of the American Medical Association 272:947-954.

Ewbank, D.C.
1987 History of black mortality and health before 1940. Milbank Quarterly 65:100-128.

Feldstein, P.J.
1983 Health Care Economics. 2nd. ed. New York: Wiley Medical Publication.

Ferraro, K.F.
1987 Double jeopardy to health for black older adults. Journal of Gerontology 42:528-533.

Fuchs, V.R.
1982 Economic Aspects of Health. Chicago: University of Chicago Press.

Furner, S.E.
1993a Health care use and its cost. Vital and Health Statistics 3(29):21-36.

1993b Special topics. Vital and Health Statistics 3(29):37-55.

Garber, A.
1989 Pursuing the links between socioeconomic factors and health: Critique, policy implications, and directions for future research. In Pathways to Health: The Role of Social Factors, J.P. Bunker, D.S. Gomby, and B.H. Kehrer, eds. Menlo Park, CA: Henry J. Kaiser Family Foundation.

Gibson, R.C.
1991 Age-by-race differences in the health and functioning of elderly persons. Journal of Aging Health 3:335-351.

Grossman, M.
1972 The Demand for Health: A Theoretical and Empirical Investigation. New York: National Bureau of Economic Research.

Guralnik, J.M., K.C. Land, D. Blazer, G.G. Fillenbaum, and L.G. Branch

1993 Educational status and active life expextancy among older blacks and whites. New England Journal of Medicine 329(2):110-116.

Hahn, R.A.
1992 The state of federal health statistics on racial and ethnic groups. Journal of the American Medical Association 267(2):268-271.

House, J.S., R.C. Kessler, A.R. Herzog, R.P. Meto, A.M. Kinney, and M. J. Breslow
1990 Age, socioeconomic status, and health. Milbank Quarterly 68:383-411.

James, S.A., D.S. Strogatz, S.B. Wing, and D.L. Ramsey
1987 Socioeconomic status, John Henryism, and hypertension in blacks and whites. American Journal of Epidemiology 126:664-673.

Haan, M.N., and G.A. Kaplan
1985 The contribution of socioeconomic position to minority health. Report to the NIH Task Force on Black and Minority Health. Besthesda, MD: NIH.

Jones C.P., T.A. LaVeist, and M. Lillie-Blanton
1991 "Race" in the epidemiologic literature: An examination of the American Journal of Epidemiology. American Journal of Epidemiology 134(10):1079-1084.

Kaplan, G.A., T.E. Seeman, R.D. Cohen, L.P. Knudsen, and J. Guralnik
1987 Mortality among the elderly in the Alameda County study: Behavioral and demographic risk factors. American Journal of Public Health 77:307-312.

Kaplan, N.M.
1994 Ethnic aspects of hypertension. Lancet 344:450-452.

Keil, J.E., S.E. Sutherland, R.G. Knapp, and H.A. Tyroler
1992 Does equal socioeconomic status in black and white men mean equal risk of mortality? American Journal of Public Health 82:1133-1136.

Kellie, S.E., and J.A. Brody
1990 Sex-specific and race-specific hip fracture rates. American Journal of Public Health 80(3):326-328.

Kington, R., and J.P. Smith
In pressSocioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. American Journal of Public Health.

Krieger, N.
1990 Social class and the black/white crossover in the age-specific incidence of breast cancer: A study linking census-derived data to population-based registry records. American Journal of Epidemiology 131:804-814.

Krieger, N., D.L. Rowley, A.A. Herman, B. Avery, and M.T. Phillips
1993 Racisim, sexism, and social class: Implications for studies of health, disease, and well-being. American Journal of Preventive Medicine 9:82-122.

Kuczmarski, R.J., K.M. Flegal, S.M. Campbell, and C.L. Johnson
1994 Increasing prevalence of overweight among U.S. adults. Journal of the American Medical Association 272:205-211.

LaViest, T.A.
1994 Beyond dummy variables and sample selection: What health services researchers ought to know about race as a variable. Health Services Research 29:1-16.

Lewontin, R.C.
1972 The apportionment of human diversity. Evolutionary Biology 6:381-398.

Liberatos, P., B.G. Link, and J.L. Kelsey
1988 The measurement of social class in epidemiology. Epidemiology Reviews 10:87-121.

Macken, C. L.
1986 A profile of functionally impaired elderly persons living in the community. Health Care Financing Review 7:33-49.

Manton, K.G., C.H. Patrick, and K.W. Johnson
1987 Health differentials between blacks and whites: Recent trends in mortality and morbidity. Milbank Quarterly 65:129-199.

Massey, D., and N. Denton.
1989 Hypersegregation in U.S. metropolitan areas: Black and Hispanic segregation along five dimensions. Demography 26(3):373-441.

Menchik, P.L.
1993 Economic status as a determinant of mortality among black and white and older men: Does poverty kill? Population Studies 47:427-436.

Mermelstein, R., B. Miller, T. Prohaska, V. Benson, and J.F. Van Nostrand
1993 Measures of health. Vital Health Statistics 3(27):9-21.

Mutchler, J.E., and J.A. Burr
1991 Racial differences in health and care service utilization in later life: The effect of socioeconomic status. Journal of Health and Social Behavior 32:342-356.

Muurinen, J.M., and J. Le Grand
1985 The economic analysis of inequalities in health. Social Science and Medicine 20:1029-1035.

Osborne, N.G., and M.D. Feit
1992 The use of race in medical research. Journal of the American Medical Association 267(2):275-279.

Otten. M.W., S.M. Teutsch, D.F. Williamson, and J.S. Marks
1990 The effect of known risk factors on the excess mortality of black adults in the United States. Journal of the American Medical Association 263:845-850.

Preston, S.E., and P. Taubman.
1994 Socioeconomic Differences in Adult Mortality and Health Status. In Demography of Aging, L.G. Martin, and S.H. Preston, eds. Washington, DC: National Academy Press.

Rogers, R.G.
1992 Living and dying in the U.S.A: Sociodemographic determinants of death among blacks and whites. Demography 29:287-303.

Rosenzweig, M.R., and T.P. Schultz
1983 Estimating a household production function: Heterogeneity, the demand for health inputs, and their effects on brith weight. Journal of Political Economy 91(5):723-746.

Satariano, W.A.
1986 Race, socioeconomic status and health: A study of age differences in a depressed area. American Journal of Preventive Medicine 2:1-5.

Schoenberg, B.S., D.W. Anderson, and A.R. Haerer
1986 Racial differentials in the prevalence of stroke. Archives of Neurology 43:565-568.

Selden, T.M.
1985 Uncertainty and health care spending by the poor: The health capital model revisited. Journal of Health Economics 12:109-115.

Serjeant, G.R.
1985 Sickle Cell Disease. New York: Oxford University Press.

Smith, J.P.
1984 Race and human capital. American Economic Review 74(4):685-698.

1994 Hispanics and the American dream. Unpublished manuscript. Santa Monica, CA: RAND.

1995 Racial and ethnic differences in wealth using the Health and Retirement Study. Journal of Human Resources 30:S158-S183.

In pressWealth inequality among older Americans. Journal of Gerontology.

Smith, J.P., and R. Kington
1996 Demographic and Economic Correlates of Health in Old Age. Santa Monica, CA: RAND, DRU-1316-NIA.

Sommer, A., J.M. Tielsch, J. Katz, H.A. Quigley, J.D. Gottsch, J.C. Javitt, J.F. Martone, R.M.. Royall, K.A. Witt, and S. Ezrine.
1991 Racial differences in the cause-specific prevalence of blindness in East Baltimore. New England Journal of Medicine 325:1412-1417.

Sorlie, P., E. Rogot, R. Anderson, N.J. Johnson, and E. Backlund
1992 Black-white mortality differences by family income. Lancet 340:346-350.

Strawbridge, W.J., G.A. Kaplan, T. Camacho, and R.D. Cohen
1992 The dynamics of disability and functional change in an elderly cohort: Results from the Alameda County study. Journal of the American Geriatric Society 40:799-806.

U.S. Deptartment of Health and Human Services
1990 Healthy People 2000: National Health Promotion and Disease Prevention Objectives. Washington, DC: U.S. Department of Health and Human Services.

Wagstaff, A.
1986 The demand for health: Theory and applications. Journal of Epidemiology and Community Health 40:1-11.

Waitzman, N.J., and K.R. Smith
1994 The effects of occupational class transitions on hypertension: Racial disparities among working-age men. American Journal of Public Health 84:945-950.

Williams, D.R.
1994 The concept of race in *Health Services Research*: 1966 to 1990. Health Services Research 29(3):261-274.

Williams, D.R., R. Lavizzo-Mourey, and R.C. Warren
1993 The concept of race and health and status in America. Paper from the CDC-ATSDR Workshop on the use of Race and Ethnicity in Public Health Surveillance. Public Health Report 109(1):26-41.

Zick, C.D., and K.R. Smith
1991 Marital transitions, poverty, and gender differences in mortality. Journal of Marriage and the Family 53:327-336.

TABLE 1 Race, Socioeconomic Status and Health in Late Life: Selected Studies of Total Mortality and Life Expectancy

Author/Year	Data Set	Outcome/ Statistical Method	Explanatory Variables	Racial Differences Explained
Guralnik et al. (1993)	PHSE 1986-1988; N = 4057 55% black; age ≥ 65 yrs at baseline	Total life expectancy; multi-state life tables stratified	Age, education, gender	most
Menchik (1993)	NLSMM 1966-1983; N = ~4000 male; mean age 51 yrs. at baseline	Total mortality; logistic regression	Age, marital status, parent ed., net worth (1966), # yrs. in poverty region, urban, health status (1966)	75%
Keil et al. (1992)	CHS 1960-1988; N = 1088 40% black; age 35-74 yrs. at baseline	Total mortality; age-adjusted deaths/1000 person-years stratified	Age, high/low SES (education and occupation)	100%
Rogers (1992)	Merged NHIS 1986; N = 37,917 and NMFS 1986; N = 18,733 ~11% black; age ≥ 25 yrs.	Total mortality 1986; logistic regression	Age, gender, marital status, family size, family income (5 categories)	100%
Sorlie et al. (1992)	NLMS 1978-1985; N = > 550,000 10% black; age ≥ 25 yrs. at baseline	Total mortality; Cox proportional hazards by age, gender	Age, sex, labor force participation, family income	≥ age 65, 100%
Berman et al. (1991)	RHS 1969-1976;	Total mortality;	Age, education, marital status,	60-80%

	N = 1384 50% black; age 58-63; at baseline	several alternative hazard models	personal inc. (1977), social security benefits, benefits, SSI, dep. children	
Zick and Smith (1991)	PSID 1968-1984; ~7-8% black; mean age ~50 yrs. (among person years)	Total mortality; logistic regression	Age, education, sex, employed, marital status, poverty focus of	No race difference in multi- variate analysis (race not study)
Otten et al. (1990)	NHANES I 1971-1984; N = 8806 14% black; age 25-77 at baseline	Total mortality; Cox proportional hazard	Age, sex, family income, risk factors: smoking, alcohol, BP, DM, chol., BMI	69% (income and risk factors)
Kaplan et al. (1987) [also Haan and Kaplan (1985)]	HPL's Alameda County Study 1965-1982; N = 4174□ age 60-94 yrs. at baseline	Total mortality; Cox proportional hazard	Age, sex, house- hold size adjusted total income	No racial difference adjusted or unadjusted

□ unable to determine percentage by race in sample
PHSE - Piedmont Health Survey of Elderly
NLSMM - National Longitudinal Survey of Mature Men
CHS - Charleston Heart Study
NHIS - National Health Interview Survey
NMFS - National Mortality Followback Survey
NLMS - National Longitudinal Mortality Study
RHS - Retirement History Survey
PSID - Panel Study of Income Dynamics
NHANESI - National Health and Nutrition Examination Survey I
HPL - Human Population Laboratory
SES is socioeconomic status

TABLE 2 Race, Socioeconomic Status, and Health in Late Life: Selected Cross-Sectional Studies of General Health and Functional Status

Author/Year	Data Set	Outcome/ Statistical Method	Explanatory Variables	Racial Differences Explained
Mutchler and Burr (1991)	SIPP 1984; N = 9803 9% black; age ≥ 55 yrs.	Self-reported general health, mobility index; ADL's, bed days; logitic and Tobit regressions	Age, sex, education, income (for couple if married), net worth, region	100% for mobility index, ADL's, bed days; less for general health
House et al. (1990)	ACL 1986; N = 3617 age ≥ 25 yrs.' (oversampled blacks, ≥ 60 yrs.) NHIS 1985; N = 55690 age ≥ 25 yrs.'	ACL: chronic medical conditions; functional status index; self-rated health limitations NHIS: chronic conditions, limitations on major activities scale; ordinary least squares regressions	Age, sex, marital status, education, income	ACL: 100% for functional status index; less for medical conditions; no unadjusted difference in limitations NHIS: reported 'similar' results (regressions not presented)
Ferraro (1987)	CPS subsample of SLIAD 1973; N = 3183 10% black; age ≥ 65 yrs. (low and middle income only)	Self-reported general health; and physical disability index; OLS regressions	Age, sex, education, chronic conditions, serious illness	Blacks worse health after controls
Satariano (1986)	Survey Alameda County, CA 1979-1980;	Self-reported general health index; ANOVA	Age, sex, occupation, education, family income	100% with income adjustment

Author/Year	Data Set	Outcome/ Statistical Method	Explanatory Variables	Racial Differences Explained
	N = 906 35% blacks; age ≥ 20 yrs. (27% ≥ 60 yrs.)			
Dowd and Bengtson (1978)	Survey LA County, CA 1974; N = 1269 age ≥ 45 yrs.; 32% black, 35% Mexican American	Self-reported general health; Multiple Classifica-tion Analysis	Age, sex, occupational prestige (Duncan), family income	Blacks, Mexican Americans in worse health after controls

 unable to determine percentage by race in sample
HPL - Human Population Laboratory
SIPP - Survey of Income and Program Participation
ACL - Americans Changing Lives Survey
NHIS - National Health Interview Survey
CPS - Current Population Survey
SLIAD - Survey of Low-Income Aged and Disabled
SES is socioeconomic status

TABLE 3 Distribution of Population by Self-Assessed Health Status

Self-Assessed Health Status	Men		Women		
	White (%)	Black (%)	White (%)	Black (%)	
	HRS (Ages 51-61)				
Excellent	23.3	13.5	25.1	9.8	Very good
	27.9	20.8	29.5	22.4	
Good	28.8	30.6	25.8	33.1	
Fair	12.3	22.5	14.3	22.7	Poor
	7.7	12.6	6.7	12.0	
	AHEAD (Ages 70 and Over)				
Excellent	11.7	7.6	11.5	4.8	Very
good	22.9	14.0	24.4	18.1	Good
	32.0	28.0	30.1	27.6	Fair
	21.0	30.0	22.5	29.7	Poor
	12.5	20.4	11.5	19.7	

SOURCE: Health and Retirement Survey (HRS) data for 1993 and data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 4 Prevalence of Medical Conditions by Race and Sex, HRS Sample (Ages 51-61)

	Men		Women	
Medical Condition	White (%)	Black (%)	White (%)	Black (%)
High blood pressure	39.1	53.3	30.7	55.6
Diabetes	10.0	17.2	7.5	17.9
Cancer	3.8	3.4	7.8	5.4
Diseases of the lung	8.8	4.5	8.2	7.7
Heart condition	16.9	15.2	9.8	12.8
Heart attack in last 5 years	9.3	8.5	2.5	4.8
Heart surgery	4.8	2.6	0.9	1.3
Stroke	3.1	6.7	1.9	3.2
Emotional or psychiatric problems	7.4	6.5	13.1	12.5
Arthritis, rheumatism in last year	33.2	33.5	40.7	45.8
Asthma	5.2	6.7	6.7	7.7
Back problems	34.2	30.5	35.8	33.6
Kidney, bladder	8.2	12.2	11.4	13.1
Stomach ulcers	8.9	11.6	8.5	11.8
High cholesterol	23.1	15.2	24.7	23.0
Eyeglasses	92.8	73.8	93.9	88.8

SOURCE: Health and Retirement Survey (HRS) data for 1993.

TABLE 5 Prevalence of Medical Conditions by Race and Sex, AHEAD Sample (Ages 70 and Over)

	Men		Women	
Medical Condition	White (%)	Black (%)	White (%)	Black (%)
High blood pressure	42.2	59.7	50.8	67.2
Diabetes	12.8	21.0	10.0	22.9
Cancer	16.4	14.8	13.3	7.0
Diseases of the lung	14.3	10.8	10.5	4.4
Heart condition	37.2	25.5	28.1	26.1
Heart attack in last 5 years	9.2	4.5	5.2	7.4
Stroke	9.3	13.9	7.3	8.8
Emotional or psychiatric problems	8.4	8.8	12.4	12.2
Arthritis, rheumatism in last year	17.3	30.6	25.5	40.9
Broken hip	3.2	5.4	6.0	4.0
Cataract surgery	23.3	20.4	29.0	26.4
Often bothered by pain	27.4	31.2	35.1	36.3
Pain keeps person from activities	53.0	58.5	59.9	59.7

SOURCE: Health and Retirement Survey (HRS) data for 1993.

TABLE 6 Median Household Income by Self-Reported Health Status

Self-Reported Health Status	Men's Median New Worth		Women's Median Net Worth	
	White ($)	Black ($)	White ($)	Black ($)
	HRS (Ages 51-61)			
Excellent	55,740	42,150	51,260	33,000
Very good	49,950	38,788	43,000	31,000
Good	41,500	32,950	36,700	25,000
Fair	31,200	25,530	26,300	16,512
Poor	23,900	13,166	16,372	9,106
	AHEAD (Ages 70 and Over)			
Excellent	26,892	12,342	21,888	11,512
Very good	24,977	17,145	19,212	10,134
Good	21,295	16,423	15,850	9,380
Fair	19,531	13,598	13,252	8,651
Poor	16,223	10,798	10,117	7,386

SOURCE: Health and Retirement Survey (HRS) data for 1993 and data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 7 Median Net Worth by Self-Reported Health Status

Self-Reported Health Status	Men		Women	
	White ($)	Black ($)	White ($)	Black ($)
HRS (Ages 51-61)				
Excellent	184,000	72,500	183,950	69,075
Very good	156,000	61,500	141,000	53,750
Good	120,000	41,000	100,300	35,800
Fair	86,000	26,875	59,975	12,750
Poor	37,250	2,150	25,000	23
AHEAD (Ages 70 and Over)				
Excellent	194,500	29,000	141,000	21,000
Very good	162,500	50,000	124,900	32,600
Good	135,000	38,000	100,000	20,900
Fair	97,500	32,100	65,000	11,150
Poor	74,500	18,000	33,892	1,500

SOURCE: Health and Retirement Survey (HRS) data for 1993 and data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 8 Mean Net Worth by Changing Health Status, HRS and AHEAD

Last Year	Current Year	Median Net Worth ($)
	HRS	
Excellent	Excellent	370,842
Excellent	Very good	224,083
Very good	Excellent	316,274
Very good	Very good	269,267
Very good	Good	200,645
Good	Very good	266,434
Good	Good	199,555
Good	Fair	160,338
Fair	Good	189,008
Fair	Fair	136,656
Fair	Poor	51,281
Poor	Fair	165,525
Poor	Poor	93,658
	AHEAD	
Excellent	Excellent	285,213
Excellent	Very good	216,551
Very good	Excellent	157,703
Very good	Very good	226,881
Very good	Good	148,890
Good	Very good	188,836
Good	Good	166,962
Good	Fair	98,334
Fair	Good	154,512
Fair	Fair	108,880
Fair	Poor	85,360
Poor	Fair	92,411
Poor	Poor	77,405

SOURCE: Health and Retirement Survey (HRS) data for 1993 and data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 9 Mean and Median HRS Net Worth by Health Status of Spouses

Health of Financial Respondent	Health of Spouse: Excellent ($)	Very Good ($)	Good ($)	Fair ($)	Poor ($)
			Mean		
Excellent	220,250	201,000	149,500	90,000	121,500
Very good	218,000	164,110	128,800	84,000	46,400
Good	175,070	135,000	97,800	83,075	37,369
Fair	146,000	116,600	69,900	63,200	61,650
Poor	99,250	55,800	40,550	34,030	19,000
			Median		
Excellent	330,000	220,200	170,000	192,000	115,000
Very good	189,750	220,750	168,500	131,000	123,900
Good	201,000	185,000	143,800	127,000	63,000
Fair	319,000	142,600	90,000	66,500	60,500
Poor	121,225	101,000	115,000	35,500	41,000

TABLE 10 Risk Behaviors and Factors, by Race and Sex, HRS Sample (Ages 51-61)

	Men		Women	
Risk Behavior or Factor	White (%)	Black (%)	White (%)	Black (%)
Smoking				
Currently smoking	23.1	38.0	25.9	25.6
Formerly smoked	51.3	35.8	27.8	29.7
Never smoked	25.5	26.2	46.3	44.7
(Number of cigarettes per day)				
1-10	5.4	17.3	7.8	16.0
11-20	10.9	16.0	12.1	7.8
21-30	4.3	2.3	3.1	0.7
> 30	6.4	2.2	2.8	0.5
Alcohol (Drinks per Day)				
0	31.7	36.2	43.5	55.7
< 1	44.7	40.4	47.2	37.2
1-2	14.2	12.7	7.1	5.6
3-4	6.2	6.5	1.9	1.1
5+	3.0	3.9	0.4	0.5
Light Physical Activity				
Never	9.3	16.2	8.7	16.1
Less than once a month	6.5	5.3	8.2	9.6
1-3 times a month	7.8	7.6	10.1	9.5
1-2 times a week	20.2	17.5	22.6	20.4
3 or more times a week	55.9	53.4	50.3	44.2
Heavy Physical Activity				
Never	45.6	57.5	49.1	66.5
Less than once a month	19.6	14.7	20.3	16.0
1-3 times a month	8.9	6.4	8.5	5.0
1-2 times a week	10.3	9.3	10.2	6.0

	Men		Women	
3 or more times a week	15.5	11.8	11.7	6.2
Exposure to Hazardous Materials at Work				
Ever exposed to work hazard	50.5	42.0	23.7	21.6
Years of exposure				
1-10	6.0	6.9	6.3	4.1
11-20	6.0	5.9	4.1	4.3
21+	15.8	11.3	2.8	3.1
Body Mass Index				
0-23.7	20.5	23.0	35.6	14.3
23.8-26.5	29.4	26.4	22.8	20.8
26.6-29.6	28.5	25.0	18.6	22.3
29.7+	21.6	25.6	23.0	42.6

SOURCE: Health and Retirement Survey (HRS) data for 1993.

TABLE 11 Risk Behaviors and Factors by Race and Sex, AHEAD Sample (Ages 70 and Over)

Risk Behavior or Factor	Men		Women	
	White (%)	Black (%)	White (%)	Black (%)
Smoking				
Currently smoking	11.2	21.6	9.0	8.1
Formerly smoked	65.3	53.3	28.9	28.1
Never smoked	23.4	25.1	62.0	63.8
(Number of cigarettes per day)				
1-10	3.6	13.3	4.1	5.2
11-20	3.9	5.5	3.9	2.5
21 or more	1.5	1.2	0.9	0.1
Alcohol (Drinks per Day)				
0	42.3	63.6	56.4	78.0
< 1	39.6	25.4	35.8	18.4
1-2	13.9	5.8	6.8	3.2
3-4	3.4	3.4	0.9	0.1
5+	0.7	1.6	0.1	0.3
Body Mass Index				
1st quartile	17.4	19.2	30.4	14.4
2nd quartile	27.0	23.8	24.6	19.5
3rd quartile	31.3	28.6	20.4	20.7
4th quartile	23.7	25.8	23.4	41.6

SOURCE: Data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 12 Ordered Probit Analysis of Self-assessed Health Status, HRS Sample (Ages 51-61)

Co-variate	Parameter	z	Parameter	z	Parameter	z	Parameter	z
Black	-.5278	17.60	-.2977	9.49	-.2402	7.50	-.1763	5.43
Hispanic	-.5037	12.90	-.1774	4.11	-.1626	3.94	-.08101.94	
Female	.0700	3.67	.0770	4.11	.0489	2.20	.0527	2.39
Marital Status								
Never married			.0739	1.18	.0140	0.22	.1577	2.46
Separated			-.0736	1.03	-.1478	2.06	.0419	0.57
Divorced			-.0043	0.11	.0304	0.75	.1007	2.41
Widowed			.0375	0.75	.0483	0.96	.1731	3.37
Education								
Individual education								
12-15 years			.4327	17.50	.3240	12.92	.2568	10.04
16 or more years			.6639	19.01	.4609	12.83	.3880	10.72
Advanced degree			.2106	1.45	.1726	1.18	.1752	1.19
Spousal education								
12-15 years			.1332	5.02	.0828	3.09	.0378	1.39
16 or more years			.1738	5.15	.0983	2.59	.0739	1.93
Advanced degree	-.1280	0.78	-.1848	1.11	-.1666	1.00		
Income and Wealth								
Total income[a]			.0034	11.30	.0025	8.34		
Income 1st tercile							.0153	7.46
Income 2nd tercile							.0046	3.41
Income 3rd tercile							.0009	2.64
Total wealth[a]			.0003	8.83	.0002	5.80		
Wealth 1st tercile							.0059	7.42
Wealth 2nd tercile							.0009	3.07
Wealth 3rd tercile							.0001	2.73
Cohort								
1935-1937			.1235	4.67	.1217	4.56	.1300	4.86

1938+	.2166	9.63	.2128	9.26	.2289	9.87
Risk Factors						
Smoking						
Current smoker			-.0903	2.39	-.0770	2.04
Cigarettes smoked per day			-.0034	2.31	-.0027	1.85
Drinking						
< one drink per day			.2127	9.69	.1920	8.70
1 or 2			.2560	7.26	.2397	6.77
3 or 4			.2015	3.79	.1874	3.51
5 or more			-.0580	0.72	-.0293	0.36
Light Exercise						
3 times per week			.4368	12.10	.4098	11.28
1-2 times per week			.3845	9.74	.3443	8.68
1-3 times per month			.3832	8.31	.3463	7.49
< once a month			.2786	5.84	.2469	5.22
Vigorous Exercise						
3 times per week			.5110	15.45	.4926	14.88
1-2 times per week			.3864	11.01	.3603	10.22
1-3 times per month			.3266	8.72	.3107	8.28
< once a month			.2774	10.43	.2610	9.74
Occupational hazard						
Ever exposed			-.0805	1.92	-.0721	1.71
Years exposed			-.0046	3.59	-.0049	3.79
Body mass index						
BM1			-.0077	-0.78	-.0126	1.27
$BM1^2$			-.0034	2.15	-.0003	1.59
Cut point 1	-1.5562	-.8239	-1.0245		-.6471	
Cut point 2	-0.9116	-.1231	-.2701		.1228	
Cut point 3	-0.1110	.7474	.6567		1.0612	
Cut point 4	0.6922	1.6073	1.5624		1.9708	

[a]Expressed in thousand dollar units.

SOURCE: Health and Retirement Survey (HRS) data for 1993.

TABLE 13 Ordered Probit Analysis of Self-Assessed Health Status, AHEAD Sample (Ages 70 and Over)

Co-variate	parameter	z	parameter	z	parameter	z	parameter	z
Black	-.4005	9.91	-.1633	3.83	-.1169	2.71	-.0560	1.28
Hispanic	-.4038	6.76	-.1642	2.65	-.1313	2.11	-.0304	0.48
Female	-.0159	0.64	.0592	2.20	.0772	2.65	.0907	3.10
Marital Status								
Never married			.1259	1.67	.1007	1.33	.2288	2.96
Separated or Divorced			.0524	0.84	.0665	1.06	.2078	3.22
Widowed			.1090	3.17	.1004	2.91	.2137	5.78
Education								
Individual education								
12-15 years			.3011	10.62	.2627	9.18	.1975	6.70
16 or more years		.4876	10.83		.4212	9.26	.3339	7.18
Advanced degree		.1081	0.88		.1225	1.00	.1310	1.07
Spousal education								
12-15 years			.1140	3.07	.0882	2.37	.0654	1.73
16 or more years		.1979	3.48		.1406	2.46	.1347	2.34
Advanced degree		-.0268	0.18		.0052	0.03	.0027	0.18
Income and Wealth								
Total income[a]			.0008	2.63	.0009	2.85		
Income 1st tercile							.0126	1.83
Income 2nd tercile							.0023	5.74
Income 3rd tercile							.0005	1.40
Total wealth[a]			.0006	8.32	.0005	7.05		
Wealth 1st tercile							.0050	5.12
Wealth 2nd tercile							.0005	1.20
Wealth 3rd tercile							.0002	2.40
Cohort								
1919-1923			.2053	5.11	.2001	4.84	.1402	3.35
1914-1918			.0490	1.18	.0501	1.19	-.0071	0.17
1909-1913			.0098	0.23	.0109	0.25	-.0226	0.52
Living in a Standard Metropolitan Statistical Area			-.0582	1.97	-.0782	2.64	-.0769	2.58
Region								

Northeast	-.0613	1.51	-.0759	1.86	-.0594	1.46
North Central	-.0080	0.22	-.0062	0.17	-.0176	0.48
South	-.1274	3.52	-.0852	2.34	-.0776	2.12
Risk Factors						
Smoking						
Ever smoked			-.1427	5.08	-.1492	5.30
Currently smoke			-.1285	2.00	-.1191	1.85
Number of cigarettes			-.0057	1.66	-.0058	1.71
Drinking						
< one drink per day			.3531	12.82	.3212	11.64
1 or 2 drinks			.4475	9.62	.4167	8.92
3 or 4 drinks			.6192	6.55	.5666	5.98
5 or more drinks			.3551	1.50	.3152	1.41
Body mass index						
BM1			.0873	5.68	.0821	5.34
$BM1^2$			-.0017	6.09	-.0016	5.71
Cut point 1	-1.2193	-.7866	.361		.6348	
Cut point 2	-.4138	.0316	1.200		1.4832	
Cut point 3	-.3581	.8678	2.054		2.3445	
Cut point 4	1.1845	1.7302	2.931		3.2247	

[a]Expressed in thousand dollar units.

SOURCE: Data from Assets and Health Dynamics of Oldest Old (AHEAD) for 1994.

TABLE 14 Ordered Probit Models with Alternative Measures of Income[a]

Co-variate	Parameter	z	Parameter	z
	HRS Sample (Ages 51-61)			
Individual				
Earnings	.0018	4.41	.0012	2.69
Retirement income	-.0036	2.40	.0100	4.95
Welfare income	-.0347	5.21	-.0220	2.33
Earnings = 0			-.0734	2.86
Retirement income = 0			.2875	7.89
Welfare income = 0			.0788	1.58
Spouse				
Earnings	.0040	8.45	.0013	2.57
Retirement income	-.0087	5.41	.0003	0.14
Welfare income	-.0436	5.78	-.0170	0.92
Earnings = 0			-.3197	11.52
Retirement income = 0			.0604	1.55
Welfare income= 0			.0170	0.29
Household				
Asset income	-.0001	0.19	.0010	1.57
Asset income = 0			.0839	3.86
Wealth				
Wealth 1st tercile	.0070	8.95	.0065	8.26
Wealth 2nd tercile	.0010	3.38	.0013	4.49
Wealth 3rd tercile	.0001	2.67	.0014	3.24
Black	-.1807	5.56	-.1980	-6.07
Hispanic	-.1169	2.81	-.1268	-3.05
Female	.0730	2.99	.0871	3.55
	AHEAD Sample (Ages 70+)			
Individual				
Earnings	.0073	4.90	.0002	0.14
Social Security income	.0083	1.97	.0096	2.01
Retirement income	.0031	1.61	.0024	1.08
Salary = 0			-.3820	8.66
Social Security = 0			.1088	1.62
Retirement income = 0			-.0391	1.28
Spouse				

Earnings	.0037	2.27	.0038	1.95
Social Security income	.0046	0.90	.0078	1.29
Retirement income	.0044	1.96	.0042	1.34
Salary = 0			.0219	0.40
Social Security = 0			.1121	1.38
Retirement income = 0			-.0306	0.75
Household				
Welfare income	-.0444	3.01	.0105	0.53
Welfare = 0			.3219	4.75
Asset income	.0004	0.48	.0002	0.17
Other income			-.0811	2.78
Net worth wealth 1st tercile	.0050	5.14	.0034	3.38
Net worth wealth 2nd tercile	.0010	2.62	.0009	2.33
New worth wealth 3rd tercile	.0002	1.73	.0002	1.95
Black	-.0490	1.13	-.0328	0.74
Hispanic	-.0095	0.15	.0286	0.08
Female	.0978	2.82	.1087	3.07

[a]Continuous income and asset coefficients expressed in thousand dollar units.

SOURCE: Health and Retirement Survey (HRS) data for 1993 and data from Assets and Health Dynamics of the Oldest Old (AHEAD) for 1994.

TABLE 15 Ordered Probit Models With Alternative Measures of Weekly Wages,[a] HRS Sample (Ages 51-61)

Co-variate	Parameter	z	Parameter	z
Individual				
Weekly wages	.0467	4.39	.0061	0.66
Retirement income	-.0050	3.42	.0108	5.40
Welfare income	-.0355	5.34	-.0184	1.96
Weekly wages = 0			-.3663	13.5
Retirement income = 0			.2915	8.01
Welfare income = 0			.0756	1.51
Spouse				
Weekly wages	-.0032	0.37	-.0199	2.27
Retirement income	-.0118	7.47	-.0022	1.05
Welfare income	-.0479	6.34	-.0442	4.23
Welfare wages= 0			.0549	1.89
Retirement income= 0			.0541	1.39
Welfare income= 0			-.0213	0.37
Household				
Asset income	-.0005	0.93	.0005	0.89
Asset income = 0			.0781	3.59
Wealth				
Wealth 1st tercile	.0072	9.27	.0061	7.82
Wealth 2nd tercile	.0011	3.84	.0014	4.66
Wealth 3rd tercile	.0002	3.57	.0002	3.79
Black	-.1766	5.56	-.1946	-5.96
Hispanic	-.1266	2.81	-.1222	-2.94
Female	.0251	2.99	.0438	1.89

[a]Continuous wage and asset coefficients expressed in thousand dollar units.

TABLE 16 Ordered Probit Analysis of Self-Assessed Health Status Change, HRS and AHEAD Samples

	HRS Sample				AHEAD Sample			
Co-variate	Parameter	z	Parameter	z	Parameter	z	Parameter	z
Black	-.1500	4.42	-.0008	0.02	-.1456	3.21	.0114	0.23
Hispanic	-.1686	3.90	-.0060	0.71	-.1626	3.94	.0424	0.61
Female	.0436	2.04	.0566	2.29	.0172	0.62	.0431	1.31
Marital Status								
Never married			-.0182	0.25			.1091	1.28
Separated			-.1672	2.12			.0413	0.59
Divorced			-.0884	1.94				
Widowed			.0026	0.05			.0457	1.17
Individual Education								
12-15 years			.1347	4.71			.1533	4.73
16 or more years	.1719	4.25			.1899	3.69		
Advanced degree			-.1059	0.67			-.0529	0.39
Spousal Education								
12-15 years			.0912	3.01			.0485	1.15
16 or more years	.0730	1.72			.0252	0.39		
Advanced degree			-.2611	1.39			.0471	0.28
Income and Wealth								
Total income[a]			.00160	5.07			.0007	1.88
Total wealth[a]			.00005	1.23			.0002	2.48
Cohort								
1935-1937[b] (1919-1923)[c]			.0631	2.09			.3164	6.78
1938+ (1914-1918)			.0839	3.24			.2481	5.24
(1909-1923)							.1759	3.62
Risk Factors								
Smoking								
Ever smoked			-.0718	2.26				
Current smoker			-.0427	1.01			-.1202	1.66
Cigarettes smoked per day			-.0031	1.92			-.0018	0.48

Drinking								
< one drink per day			.0668	2.69			.1558	4.97
1 or 2			.1134	2.85			.0539	1.02
3 or 4			.0869	1.44			.0912	0.86
5 or more			-.1540	1.73			-.2081	0.83
Light exercise								
3 times per week		.5541	13.77					
1-2 times per week			.4554	10.35				
1-3 times per month			.3989	7.72				
< once a month			.2613	4.90				
Vigorous exercise								
3 times per week		.3721	10.07					
1-2 times per week			.2138	5.37				
1-3 times per month			.2276	5.33				
< once a month			.1788	5.82				
Occupational hazard								
Ever exposed			-.0266	0.57				
Years exposed			-.0047	3.21				
Body mass index								
BM1			.0221	2.01			.0753	4.51
$BM1^2$			-.0005	3.17			-.0015	4.92
Prior year's health								
Excellent	-1.387	28.2	-1.876	35.2	-1.597	24.5	-1.792	26.4
Very good	-1.138	24.3	-1.525	30.7	-1.456	25.0	-1.636	27.2
Good	-1.089	23.5	-1.347	28.0	-1.447	25.7	-1.565	27.2
Fair	-1.084	22.2	-1.201	24.1	-1.423	24.7	-1.485	25.5
Cut point 1	-2.509		-2.561		-2.202		-1.046	
Cut point 2	-1.686		-1.735		-.153		1.048	
Cut point 3	-0.755		.710					
Cut point 4	1.409		1.607					

[a]Expressed in thousand dollar units.
[b]Cohort category for HRS sample.
[c]Cohort category for AHEAD sample.

TABLE 17 Ordered Probit Analysis of Health Change with Alternative Measures of Income[a]

Co-variate	Parameter	z	Parameter	z	Parameter	z
HRS Sample (Ages 51-61)						
Individual						
Earnings	.0018	4.06	.0008	1.58		
Weekly wages					.0084	0.86
Retirement income	-.0011	0.68	.0085	3.84	.0079	3.56
Welfare income	-.0187	2.49	-.0009	0.09	.0029	0.27
Earnings=0			-.1528	5.35		
Weekly wages=0					-.1584	3.94
Retirement income=0	.1723	4.23	.1308	3.20		
Welfare income=0			.1048	1.88	.0620	1.11
Spouse						
Earnings	.0021	4.16	.0008	1.40		
Weekly wages					-.0134	1.34
Retirement income	-.0007	0.36	.0062	2.63	.0089	3.77
Welfare income	-.0271	3.27	-.0022	1.94	-.0018	1.57
Earnings=0			-.1675	5.36		
Weekly wages=0					.1190	2.89
Retirement income=0	.0704	1.60	.0866	1.96		
Welfare income=0			.0224	0.35	-.0021	0.03
Asset income	-.0001	0.19	.0012	1.93	.0007	1.07
Asset income = 0			.0502	2.12	.0404	1.70
Wealth	.0001	1.63	.0001	2.42	.0001	2.86
Black	-.0027	0.07	-.0127	-0.35	.0111	0.30
Hispanic	-.0045	0.10	-.0061	-0.13	.0043	0.09
Female	.0643	2.36	.0679	2.47	.0917	3.42
AHEAD Sample (Ages 70 and Over)						
Individual						
Earnings	.0049	3.01	.0001	0.04		
Social Security	.0042	0.89	.0065	1.21		
Other retirement income	.0020	0.91	.0014	0.55		
Earnings = 0			-.2675	5.37		
Social Security = 0			.1166	1.54		
Other retirement income = 0			-.0280	0.81		
Spouse						

Earnings	-.0001	0.06	-.0009	0.42
Social Security	.0042	0.72	.0096	1.43
Retirement income	.0043	1.73	.0028	1.00
Earnings = 0			-.0236	0.39
Social Security = 0			.1917	2.09
Retirement income = 0			-.0491	1.07
Asset income	.0003	0.75	.0003	0.69
Asset income = 0			-.0184	0.58
Welfare income			-.0194	0.90
Welfare income = 0			.2329	3.17
Wealth	.0001	1.81	.0001	1.63
Black	.0346	0.71	.0457	0.92
Hispanic	.1165	1.61	.1376	1.89
Female	.0476	1.22	.0487	1.22

[a]All continuous income and wealth coefficients expressed in thousands of dollars.

TABLE 18 Ordered Probit Analysis of Health Change with Alternative Measures of Social Security Earnings Histories, HRS Sample (ages 51-61)

Characteristic	Parameter	z	Parameter	z	Parameter	z
			Social Security Earnings to Age 50			
Total income[a]	.0011	2.18	aa		aa	
Wealth[a]	.0001	1.27	.0001	2.11	.0001	2.12
Social Security Earnings[a]						
Household	.0002	3.95	.0001	2.93		
Respondent					.0002	2.98
Spousal					.0001	1.15
Black	-.0456	0.92	-.0680	-1.30	-.0673	1.34
Hispanic	.0465	0.68	.0403	0.58	.0398	0.57
Female	.0339	1.00	.0324	0.64	.0111	0.26
			Social Security Earnings to Age 40			
Total income	.0012	2.36	aa		aa	
Wealth	.0001	1.27	.0001	2.14	.0001	2.15
Social Security Earnings						
Household	.0004	4.30	.0003	3.41		
Respondent					.0003	3.25
Spousal					.0002	1.69
Black	-.0413	0.83	-.0639	-1.30	-.0635	1.26
Hispanic	.0533	0.76	.0476	0.68	.0471	0.67
Female	.0392	0.76	.0377	1.00	.0207	0.63

[a]All continuous income and asset coefficients expressed in thousands of dollars.

[aa]For last four columns, the model includes all income components and non-receipts of income components.