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THE SIGNIFICANCE OF SOCIOECONOMIC STATUS IN EXPLAINING THE RACIAL GAP IN CHRONIC HEALTH CONDITIONS

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Black Americans live fewer years than whites and live more years with chronic health problems. The origins of this racial gap are ambiguous. This study examines the pervasiveness of this gap across chronic medical and disabling conditions among middle-aged persons. Alternative hypotheses about how fundamental social conditions of disease differentiate the health of blacks and whites are also examined. Results show that the racial gap in health is spread across all domains of health, and that socioeconomic conditions, not health risk behaviors, are the primary origins of the racial stratification of health. No evidence was found in support of the idea that blacks and whites differ in their ability to transform socioeconomic resources into good health. The results point to the importance of continued research on how health and achievement processes are linked across childhood, adolescence, adulthood, and old age. Such studies are needed to enrich work on the inequality of health and life cycle achievement.

DEATH truncates the lives of black Americans at younger ages than whites, with greater racial differences observed for men than women. National life table estimates for 1996 predict a life expectancy at birth for black men of 66 years compared with almost 74 years for white men (Ventura et al. 1997). Much of this difference is due to the racial disparity in mortality rates prior to age 65. Should blacks

survive to old age, their mortality rates converge toward those for older whites, although blacks remain disadvantaged (Elo and Preston 1994).

The racial gap in mortality during the prime adult ages points to the need to understand chronic health problems of middle-aged blacks and whites. Middle age, defined here as ages 51 to 63, designates the life-cycle period when the racial gap in health is potentially at its greatest (House et al. 1994). Our overall goal is to identify racial differences in "life without health problems" to better specify the pathways that lead to racial differences in mortality and to differences in the quality of life lived. We define health problems broadly to include the major fatal and nonfatal chronic diseases, conditions, and impairments, functional difficulty, and disability.

Two basic questions guide our analysis. First, are blacks consistently disadvantaged relative to whites across all major chronic

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diseases and disabling conditions, or is the effect of race selective? This speaks to the issue of racial differences in "life *without* disease" as well as racial differences in "life without a *particular* disease." Second, focusing on fatal chronic diseases, how do fundamental social conditions influence the racial gap in health (Link and Phelan 1995)? As part of this assessment, we evaluate how the proximal causes of disease (e.g., lifestyle behaviors and major life stressors) operate as pathways by which distal social conditions influence health. We also address whether socioeconomic resources equally benefit the health of blacks and whites (Krieger 1987; Krieger et al. 1993; Williams, Lavizzo-Mourey, and Warren 1994). This analysis attempts to identify the multifarious ways in which race can channel the risks of health problems through various forms of socioeconomic disadvantage.

THEORETICAL BACKGROUND

RECENT EMPIRICAL RESEARCH

In the United States, blacks can expect to live fewer years than any other racial/ethnic group, and they can expect to live more years with chronic health problems (Hayward and Heron 1999). At age 20 in 1990, for example, black men could expect to live 47 years including almost 9 years spent with a disabling condition. Asian American men anchored the other end of the mortality/morbidity continuum with 6.5 of their 59 years of expected life spent in poor health. White non-Hispanic men, the comparison group used in this analysis, were more like Asian Americans than blacks. White men at age 20 in 1990 could expect to live 54.6 years, living almost 8 years chronically impaired. Thus, both the length of life and the years lived in good health are segmented along racial/ethnic lines.

Racial differences in healthy and unhealthy life point to the importance of investigating how race is differentially associated with chronic diseases and impairments—conditions that underlie disability and death. All of the major causes of death and disability after middle age are chronic diseases whose onset is usually recognized decades after subclinical development. Chronic dis-

eases generally develop slowly, and while some of the diseases' pernicious effects can be mitigated, chronic diseases cannot be completely cured. The importance of increasing our understanding of how race is related to chronic disease is amplified by the fact that "a long life in good health" is not a hypothetical construct but an empirical fact for some racial groups in the population.

Recent estimates of the prevalence of chronic conditions among middle-aged Americans suggest that race may be selective on specific diseases (Smith and Kington 1997). This stands in contrast to the pervasive effects of socioeconomic status across the broad range of chronic conditions for middle-aged persons (Kington and Smith 1997). Black males aged 51 to 61, for example, have a higher prevalence of hypertension, stroke, diabetes, kidney and bladder problems, and stomach ulcers. White middle-aged males, however, have higher prevalence of heart conditions, chronic obstructive pulmonary disease, back problems, high cholesterol, and eye problems. Although blacks do not appear to be consistently disadvantaged across all diseases and impairments, the prevalence of functional limitation is nonetheless substantially higher than that for whites (Hayward and Heron 1999; Kington and Smith 1997).

We extend the descriptive analysis of the health experiences of middle-aged blacks and whites by considering differences in both the prevalence and incidence of health problems. A focus on incidence—the onset of new cases of health problems—captures the recent health experiences of middle-aged blacks and whites and points to possible trajectories of healthy life after middle age. Moreover, it allows us to investigate how exogenous socioeconomic conditions, as well as lifestyle, are associated with subsequent health experiences.

Prevalence—the percentage of a population experiencing a health problem at a point in time—is more commonly used as an indicator of disease experience, but it has limitations. Prevalence differences not only reflect the experiences of blacks and whites during middle age but they also embody disease experiences at earlier ages that have left their mark on the population (Freeman and Hutchinson 1980; Hayward,

Friedman, and Chen 1996; Schoen 1988). For example, the greater prevalence of hypertension among middle-aged blacks indicates higher incidence rates among blacks at *younger* ages (i.e., prior to middle age). Moreover, mortality differences by race among persons with hypertension determine how many blacks and whites with the disease are still alive during middle age. Because prime-aged blacks have higher rates of cardiovascular mortality than whites (National Center for Health Statistics 1999) as a consequence of differential rates of hypertension at younger ages, the prevalence of hypertension among blacks may be *less* than it would be if blacks had the same mortality as whites, all else being equal. The basic point is that prevalence rates of middle-aged persons and racial differences in those rates are not easily interpreted given the interaction of incidence and duration at earlier ages. Additional problems of interpretation arise when examining associations between explanatory variables and prevalence rates because of the differences in the timing of health problems.

In this investigation, both incidence and prevalence are examined to present a more complete picture of racial differences in life-cycle health. Note that incidence rates refer to the number of new cases over some time period among persons who had never experienced the condition at the beginning of the period. By middle age, many persons have already experienced the onset of a chronic condition and are thus excluded from an analysis of incidence rates—particularly when longitudinal information is available only from middle age on. By extension, we expect that some of those socioeconomic factors influencing racial differences in chronic health problems already occurred prior to middle age. Moreover, some of these effects may be reflected in the differential mortality rates of blacks and whites prior to middle age. Associations with prevalence rates thus are presumed to summarize the historical relationship between socioeconomic conditions and the presence of a health condition *by the time of* middle age. Associations with incidence rates show the influence of socioeconomic circumstances on the occurrence of health problems *during* middle age.

THE CONCEPT OF RACE IN STUDYING HEALTH

The concept of race in examining health has a thorny legacy. Until recently, race was thought to identify homogenous groups linked by a common biological inheritance (Krieger et al. 1993; Williams 1997). Different disease experiences across racial/ethnic groups were interpreted solely as the result of different genetic constitutions. With the advent of improved social science data, statistical and biological methods, and a growing appreciation for gene-environment interactions, this simplistic biological portrait of race has become an anachronism.

Research now recognizes the multidimensional qualities of race. Race represents the “confluence of biological factors and geographic origins, culture, economic, political and legal factors, as well as racism” (Williams 1996). Race is thus largely a socially constructed concept created by institutional and ideological forces defining and maintaining racial superiority. Race, in this context, becomes a construct that must be measured with a wide array of covariates.

An appreciation for the socio/political/economic meanings of race can also be gained from the fact that the racial gap in chronic conditions is too large in most cases for genetic differences to supply the dominant explanation. Small genetic differences do exist that predispose members of one race or another to a few specific diseases (e.g., malignant melanoma develops primarily among light-complexioned persons; sickle cell anemia is predominately a disease among persons of African and Mediterranean origins). However, genetic variation within a group substantially outstrips between-group variation (Lewontin 1974), indicating that racial differences in the vast majority of chronic health conditions have little to do with genetic differences.¹

¹ This does not negate the importance of gene-environment interactions in accounting for race differences in chronic disease. The environment, acting at critical periods in the life cycle, is the controlling influence on gene expression. Residential segregation, for example, may differentially expose blacks and whites to conditions that allow for genetic factors to influence disease more for one race than another.

Biology's major role is to define the array of possible physiologic responses to the social, economic, and environmental conditions associated with the increased risk of morbidity and mortality. These conditions influence the expression of genetic susceptibility, although the specific relationships are not well documented. Adverse social conditions also evoke physiological responses in the allostatic system as physiology seeks to maintain all systems in equilibrium (McEwen 1998; McEwen and Stellar 1993). The allostatic system integrates regulatory parts of the nervous system (controlling blood pressure, heart rhythm, and other physiological functions), the endocrine system (hormones), and other metabolic control functions. The price that is exacted by responding to adverse social or environmental conditions over the life cycle has been termed allostatic load, or the wear and tear on the body that occurs from chronic overactivity or underactivity of the allostatic systems. The prolonged activation of the allostatic system, in turn, predisposes persons to chronic (as well as infectious) diseases. At each stage of the life cycle, the prevalence of socioeconomic conditions associated with a stress response is greater among blacks than among whites. The cumulative biological result is higher allostatic load levels among blacks than among whites, resulting in greater risks of chronic disease problems for blacks.

A SOCIOECONOMIC PERSPECTIVE ON RACIAL DIFFERENCES IN HEALTH

It is difficult to overstate the role that race plays in patterning Americans' life fortunes. Childhood poverty, inadequate education, marginal employment, low income, and segregated living conditions are all more likely to be features of black Americans' lives than of white Americans' lives (Farley 1984; Jargowsky 1994; Massey and Denton 1993). These features of socioeconomic stratification define what has been termed the fundamental social causes of disease (Link and Phelan 1995). These causes affect the ability to control everyday life circumstances, stress, social ties, diet and health-risk behaviors, the nature of work and the work environment, and the availability of health care (Behrman et al. 1991; Feinstein 1993;

Garber 1989; Smith and Kington 1997; Williams 1990). Some have suggested that the black population may have lower "health literacy" or be less efficacious in health care usage, perhaps because of an inability to communicate with health care workers or to understand the importance of filling prescriptions and using them as prescribed (Kail 1992). These are some of the major proximal factors linking the differential social positions of blacks and whites with health, but how and why race is linked to specific chronic diseases and impairments through these mechanisms is not well understood.

By their very nature, chronic conditions typically grow out of socioeconomic conditions over a lengthy life-cycle period rather than from circumstances at a single point in time. Thus, it is important to think of the fundamental causes of disease in life-cycle terms. For many persons, the social conditions of childhood (i.e., social origins) are mirrored in adulthood. For others, however, social mobility differentiates adulthood and childhood experiences as well as adulthood experiences at younger and older ages.

How social origins combine with adult social conditions to affect chronic health conditions is unclear. Also ambiguous is whether social conditions have strong or weak associations with disease, depending on *when* in the life cycle a person is exposed (Hayward, Pienta, and McLaughlin 1997; Moore and Hayward 1990). Socioeconomic status is often conceptualized in the literature without regard to changing life-cycle circumstances, drawing on the Weberian conception of social position—class, status, and party. Preston and Taubman (1994) provide an excellent overview of the evidence on socioeconomic differences in morbidity and mortality. Although some attention has been given to the differential health effects of socioeconomic conditions in childhood and adulthood (Blackwell, Hayward, and Crimmins forthcoming; Elo and Preston 1992), the common approach assumes that socioeconomic status is highly persistent and that circumstances at the time of measurement (typically once) reflect one's position over a lifetime.

Recasting socioeconomic status in life-cycle terms allows us to have a more cogent framework of the possible pathways by

which racial differences in health arise. Childhood socioeconomic conditions reflected in educational attainment, for example, shape preferences toward the major lifestyle behaviors of smoking, drinking, diet, and exercise (Winkleby et al. 1992). Children's households, as well as their peer networks, differentially expose them to health risks (e.g., ambient hazards such as secondhand smoking, nutrition, and infectious disease) and medical care. Early life circumstances also influence health via differential socialization toward risk-taking, deferred gratification, and a sense of autonomy and control over one's surroundings (Elo and Preston 1992).

The completion of education is a major marker of the transition to adulthood. And, with adulthood come additional factors reinforcing the link between social position and health. The work career fashions income trajectories, exposure to stressful or hazardous working conditions, and the availability of health care through health insurance. Income (or the lack of it) can be an important stressor, but income also provides the means to mitigate the effects of other stressors in the environment (Hayward, Pienta, and McLaughlin 1997). Stressful or hazardous working conditions can have a direct impact on health (Moore and Hayward 1990). And, the absence of health insurance can discourage the use of medical services, particularly in the early and more treatable stages of a health problem (Rice and Winn 1990). Family events such as marriage and divorce can serve both as stressors and as buffers to other stressors in the environment (Lillard and Waite 1995).

Our basic point is that these mechanisms can combine to affect racial differences in health in myriad ways. For any particular disease (e.g., cancer), racial differences are likely to be the result of differences in *combinations* of experiences over the life cycle. Given different disease etiologies, different sets of mechanisms may come into play according to the particular disease. As yet, the specific health consequences of the aforementioned life-cycle mechanisms are unknown. Prior research examining racial differences in health has defined health either generally (e.g., global self-report measures of health status) or has focused on single disease outcomes (e.g., hypertension) without

investigating whether particular social conditions or mechanisms affect a range of health outcomes.

The evidence of some racial specificity of disease (Kington and Smith 1997) suggests that the gap in health cannot be explained simply in terms of socioeconomic status. Krieger (1993, 1987) and Williams (1997, 1994) argue, for example, that racism and discrimination, typically latent constructs, can exacerbate or constrain the effects of social conditions for blacks compared with whites. Race channels blacks and whites differentially into positions of social advantage, but race can also transform the meaning of socioeconomic conditions.

The quality of education available to blacks, for example, is likely to lag behind that for whites owing to poorer schools and tracking into less academically challenging classrooms. Racial differences in the quality of education, therefore, may minimize education's returns to health for blacks as compared with whites. Economic resources also may have a different meaning for blacks relative to whites. Not only are there enormous racial differences in income and wealth but there are also differences in economic security and the costs of goods and services. For example, blacks' lower wealth, compared with whites at equivalent levels of income, suggests that blacks have fewer resources protecting them against the effects of income decline. Moreover, residential segregation has fostered the withering away of high-quality goods and services, including health services, eroding the purchasing power of blacks compared with whites earning the same income (Williams 1996). Economic resources used to purchase health care, for example, may have lower benefits for blacks compared with whites because of racial discrimination in the quality of care (Blendon et al. 1989). Thus, race may influence the degree of exposure to adverse socioeconomic circumstances and transform the meaning of these circumstances affecting health.

DATA AND METHODS

DATA

Our analysis of the racial gap in health is based on the 1992 and 1994 waves of the

Health and Retirement Survey (HRS) (Juster and Suzman 1995). The HRS collected a range of social, economic, and health information on a nationally representative sample of persons aged 51 to 61 at the baseline ($N = 9,741$). The ages of these respondents correspond to those years of life in which socioeconomic differences in health tend to be the greatest and rates of deterioration in health begin to escalate for disadvantaged persons (House et al. 1994).²

The HRS offers a powerful data set for examining racial differences in health for several reasons. It oversamples African Americans and Hispanics (although Hispanics are excluded from the present analysis). It monitors changes in several dimensions of health including self-reported health, diseases, impairments, disability status, and mortality. It contains a range of information about the mechanisms hypothesized in the literature to link social position with health. And the HRS captures the health changes that are currently occurring for the group of persons soon to enter prime retirement years.

Our analysis is based on 8,231 (unweighted) age-eligible non-Hispanic respondents in 1992 (1,587 blacks and 6,644 whites). These numbers reflect the elimination of 402 whites and 95 blacks from our sample due to missing data on the covariates considered in the modeling of health outcomes. Of respondents retained, approximately 6.4 percent (399 whites and 130 blacks) attrited from the sample prior to observation in 1994 and approximately 1.7 percent (99 whites and 43 blacks) died during the observation interval. All statistical models are estimated using person-analysis sampling weights standardized to approximate the original sample size in 1992.

DEPENDENT VARIABLES. In contrast to the many sociological studies of health that focus on global self-report measures of health status or on bundled measures of health, such as a person's number of chronic

conditions (House et al. 1994; Ross and Wu 1995), we focus on specific diseases, impairments, and disabilities. Verbrugge and Jette (1994) provide an organizing framework for these aspects of health, which constitute the disablement process. Roughly hierarchical, disablement typically begins with the onset of a chronic disease, which may have a cascading effect such that a loss in physical functioning occurs. If physical functioning problems result in difficulty in performing normal social activities, disability results. Although we do not systematically trace disablement experiences from one stage to another, the examination of the effects of race on the broad range of health outcomes is an important beginning in understanding the types of health experiences that differentiate the lives of middle-aged blacks and whites. Moreover, it allows us to evaluate the gap in health as health problems take on an increasingly social definition.

Our analysis focuses first on the prevalence and incidence of the major fatal chronic diseases: heart disease, hypertension, stroke, diabetes, chronic obstructive pulmonary disease (COPD; e.g., emphysema), and cancer. These diseases represent the leading causes of death in the 51 to 61 age range: heart disease and cancer account for about 70 percent of deaths, while stroke, diabetes, and COPD account for another 9 percent. Respondents in the HRS were asked whether a doctor ever told them that they have a particular disease. Note that this self-report measure hinges on health care use: Blacks' lower level of health care use than whites, with the exception of emergency room care, is expected to bias the racial gap in some health conditions in the direction of equality, making our estimates of racial differences in health conservative.

In our analysis, disease classification (e.g., diabetes, hypertension) generally rests on the responses given to the single disease items (e.g., has a doctor told you that you have hypertension?). The exception is heart disease. Heart disease includes persons who have had a heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems. The prevalence rate of heart disease refers to the proportion of persons at baseline reporting any of these heart conditions. Incidence rates of heart disease

² Of the 9,741 age-eligible respondents in 1992, 166 persons died before the resurvey in 1994, and 879 persons attrited from the sample. Censoring is handled in the hazard modeling of the health status changes by adjusting exposure within the two-year observation interval; censored respondents are assumed to leave the sample midway through the observation interval.

track whether any of these types of events occurred over the two-year observation interval among persons who report no experience with heart disease at baseline. The prevalence and incidence of the other major chronic diseases is determined similarly. Table 1 lists the disease categories and presents the unweighted prevalence of each condition in the sample ($N = 8,231$) and the number of unweighted health events that occurred between 1992 and 1994.

We examine racial differences in the major nonfatal diseases and impairments, because these aspects of health can have significant consequences for quality of life. The measurement of arthritis and emotional problems is based on whether a doctor has ever told the respondent that he or she has a problem. Information about the other diseases and impairments is based on items in which the respondent reports whether he or she has a particular type of health problem. Depression, when considered as a health outcome, is measured by a single item—how much of the time the respondent felt depressed in the past week. If respondents report “all or almost all,” they are scored as depressed. Depression as an *antecedent* of other health outcomes is measured using a modified Center for Epidemiologic Studies Depression (CESD) scale ranging from 1 to 12 and is treated as a continuous variable. The depression scale is scored according to persons’ reports of having experienced a problem “all or almost all” of the time in the week prior to the interview (see Table 2, note e for the CESD items).

Disability (i.e., difficulties in carrying out normal social activities because of health problems) is measured for two social domains—work and home. Work disability refers to whether the person’s health limits the kind or amount of paid work he or she can do. Home disability refers to limits in the kind or amount of work done around the house. Disability with respect to function refers to mobility (difficulty in at least one of the following activities—walking several blocks, getting up from a chair, or climbing stairs), strength and dexterity (difficulty in at least one of the activities—lifting or carrying weights over 10 pounds, stooping/kneeling/crouching, or picking up a dime from the table), and activities of daily living

Table 1. Prevalence and Incident Events of Health Conditions for the Baseline Sample: Blacks and Whites from the Health and Retirement Survey, Ages 51 to 61

Health Condition	Prevalence ^a	Incident Events ^b
<i>Major Fatal Condition</i>		
Hypertension	40.2	317
Diabetes	10.6	165
Cancer	5.8	99
Chronic obstructive pulmonary disease	8.5	163
Heart	13.5	218
Stroke	2.8	57
<i>Nonfatal Diseases and Impairments</i>		
Emotional	10.9	234
Arthritis	39.0	565
Asthma	6.3	126
Back	35.0	584
Foot and leg	35.4	764
Kidney	10.6	304
Stomach	9.3	233
Pain	24.1	821
Vision	11.8	571
Hearing	13.4	431
Depression	4.9	889
<i>Disability</i>		
Work	20.9	646
Home	24.6	678
Mobility	60.0	583
Strength	49.4	675
Activities of daily living	9.3	211

Note: Data are unweighted; $N = 8,231$.

^a Percentage of the population in 1992 with the health condition.

^b Number of new cases of health condition among previously unaffected persons that occurred between 1992 and 1994.

(ADL) (difficulty in at least one of the following activities—getting in and out of bed, bathing, eating, and dressing without help).

INDEPENDENT VARIABLES. Our independent variables center on those mechanisms traditionally thought to link an individual’s social position with health. Race, by virtue of its importance in differentially defining an

individual's social position throughout the life cycle, may have multifarious effects stemming from experiences in childhood through adulthood.

Education, measured as years of school completed, marks young adulthood achievement and reflects childhood social class circumstances. Education shapes preferences toward major lifestyle behaviors of smoking, drinking, diet and exercise (Winkleby et al. 1992), and it influences health via socialization toward risk-taking, deferred gratification, and a sense of autonomy and control over one's surroundings (Elo and Preston 1992). Education also anchors the trajectory of life cycle socioeconomic achievement.

Midlife socioeconomic position is referenced by occupation and two financial characteristics measured at the time of the baseline survey—household income and net household wealth. Occupation may expose workers to unhealthful conditions arising from the nature of work or work environment. Occupational position is measured in terms of job autonomy, stress, and physical demands—work conditions influencing morbidity and mortality (Karasek 1990; Karasek, Thorell, and Schwartz 1988; Moore and Hayward 1990). Income provides access to health-enhancing goods and services—better food, housing in less polluted or dangerous areas and in areas with excellent services, health insurance, and physician and hospital services. Income, however, can be transitory over the life cycle and thus may not be the best marker of economic resources. We therefore examine the sensitivity of health to (net) household wealth. Wealth reflects both the household's earnings (and savings) over the life cycle and inheritances, and thus is more representative of the idea of permanent income and social class position—resources available over the long term that mitigate health problems (Williams 1996).

Life stressors, social support, and health behaviors sometimes arise from objective socioeconomic conditions, thereby serving as mechanisms linking socioeconomic circumstances and health. In contrast to many sociological studies of health, we consider the effects of a range of health behaviors—exercise, weight (body mass index), drinking, and smoking. Life stressors and social support are indicated by marital status and

satisfaction with one's financial situation, friendships, and handling problems in life.

Whether a person has private health insurance is included in our models, because blacks are less likely than whites to have health insurance coverage (National Center for Health Statistics 1999, table 130). We also control for rural/urban residence and region. Region captures the possible effects of migration in and out of the South. Individuals are cross-classified according to whether their birthplace and current residence is in the South. Some scholars have suggested that black migrants from the South may have a health disadvantage due to the loss of community support systems (Williams et al. 1994).

Table 2 identifies racial differences in the demographic characteristics and socioeconomic circumstances of the blacks and whites in our sample. In terms of socioeconomic factors, blacks aged 51 to 61 years have comparatively less education, income, and wealth. Blacks also have higher rates of financial dissatisfaction and friendship dissatisfaction and lower rates of marriage. We observe few racial differences in job demands, although blacks are significantly less likely to have private health insurance coverage. In terms of health behaviors, a black respondent is marginally more likely to be a current smoker, nondrinker, overweight, and physically sedentary (i.e., exercise less often). Given the associations among health, socioeconomic circumstances, and health behaviors, blacks generally exhibit characteristics that should place them at greater risk of experiencing chronic health problems.

METHODS

We analyze racial differences in disease prevalence based on wave 1 (1992) information, and we analyze racial differences in the onset of health problems based on health status changes observed between waves 1 and 2 (1992 and 1994). Logistic regression is used to estimate disease prevalence. These models represent the structure of inequality in health among persons who survived to midlife. Disease incidence models, estimated using a hazard modeling approach, represent the trajectories of health deterioration and denote whether the racial gap in

Table 2. Means/Percentages for Demographic, Social, and Economic Variables Used in the Analysis: Blacks and Whites from the Health and Retirement Survey, Ages 51 to 61, 1992

Variable	Blacks	Whites	Variable	Blacks	Whites
Age (average, in years)	56.87	56.99	Exercise:		
Female	57 ***	53	Often (3 times per week)	49	} +†† { 54 38 8
Education (average, in years)	11.41 ***	12.75	Seldom	35	
Unmarried	40 ***	19	Never	16	
Lives in Metropolitan Statistical Area	86 ***	72	Household income (in \$1,000s)	35.07	55.84
Birthplace and Current Residence:			Household Net Wealth (in \$1,000s):		
Born and lives in South	47	} +†† { 23 5 63 9	Negative (< \$0)	22	} +†† { 4 13 23 28 32
Born South, lives North	32		Low (\$0 to \$30.2)	26	
Born and lives in North	18		Medium Low (\$30.2 to 96.5)	30	
Born North, lives South	3		Medium High (\$96.5 to 230)	16	
Smoking Status:			High (> \$230)	6	
Never smoked	36	} +† { 35 27 38	Financial satisfaction ^a	2.92 ***	2.28
Current smoker	31		Friendship satisfaction	1.54 ***	1.45
Past smoker	33		Satisfaction with way of handling life problems	1.72	1.74
Alcohol Consumption:			No health insurance	23 ***	17
None	46	} +†† { 34 61 5	Job Demands:		
Moderate (1 to 2 drinks/day)	49		Physical demands ^b	4.11	4.16
Heavy (3 or more drinks/day)	5		Job control ^c	1.37	1.39
Body Mass Index:			Job stress ^d	1.66 ***	1.97
Low (< 5%)	5	} +†† { 5 6 16 26 25 22	Out of labor force	37 ***	29
Quantile 1 (5 to 20%)	3		Depression scale ^e	2.2 ***	1.55
Quantile 2 (21 to 40%)	9		Number of cases	1,587	6,644
Quantile 3 (41 to 60%)	21				
Quantile 4 (61 to 80%)	26				
Quantile 5 (> 80%)	36				

^a The satisfaction variables are based on the stem: "Are you very satisfied (= 1), somewhat satisfied (= 2), about evenly satisfied (= 3), somewhat dissatisfied (= 4), or very dissatisfied (= 5) with...." The variables are scored as interval variables.

^b Physical demands is based on the added scores for three items: (1) my job requires lots of physical effort; (2) my job requires lifting heavy loads; and (3) my job requires stooping, kneeling, or crouching. All of the job demand items were scored as not working (= 0); none or almost none of the time (= 1); some of the time (= 2); most of the time (= 3); and all or almost all of the time (= 4).

^c Job control is based on the item: "I have a lot of freedom to decide how I do my own work." The item is scored like physical demands.

^d Job stress is based on the item: "My job involves a lot of stress." The item is scored like physical demands.

^e During the past week "I felt depressed"; "I felt that everything was an effort"; "My sleep was restless"; "I was happy" (reverse coded); "I felt lonely"; "I felt people were unfriendly"; "I enjoyed life" (reverse coded); "I felt sad"; "I felt that people disliked me"; "I could not get going"; "I did not feel like eating"; "I felt tired."

p* < .01 *p* < .001 (two-tailed *t*-tests for difference between means)

+†*p* ≤ .01 +††*p* ≤ .001 (chi-square tests for difference between bracketed percentage distributions)

health is growing or subsiding over this part of the life cycle.

In both the prevalence and incidence models, diseases are treated as independent outcomes. At this point, we ignore prevalence structures that almost assuredly consist of

overlapping or co-morbid disease states (i.e., a person may have more than one disease or functional problem at a particular time), and disease trajectories in which multiple diseases occur relatively close together. When estimating disease onset, however, we take

account of disease experience at baseline to partially address the issue of co-morbidity. For example, we assess whether the presence of hypertension at baseline heightens the risk of stroke, given that the person had not previously experienced a stroke. Thus, the incidence models estimating the effects of the life-cycle mechanisms test for the effects of social conditions on disease onset, net of possible co-morbid conditions. The prevalence models are estimated in a similar fashion.

We also consider whether the effects of race on health are contingent on gender. Although racial differences in active life expectancy appear to be similar for males and females (Hayward and Heron 1999), it is less clear whether the racial gap for specific chronic conditions holds for the two sexes. When appropriate, we present the results for males and females to show sex differences in the magnitude and pattern of the effects of race on the chronic conditions.

Our primary goal is straightforward: to identify the total effect of race on disease and then determine whether the effect of race is reduced after introducing the life-cycle mechanisms into the model. Reduction in the effect of race on disease suggests that differential life-cycle trajectories and experiences of blacks and whites are the fundamental causes of the racial gap in health. If the race effect is not reduced, however, this would suggest the need to consider alternative mechanisms not explicitly considered in this analysis.

We also test a variety of models to assess whether socioeconomic resources have the same benefits for blacks and whites. Interactions of race with education, family income, wealth, residence in a metropolitan area, and the life-satisfaction measures are added to the full main effects models, stepping variables in and out one variable at a time. In this way, we evaluate whether these traditional socioeconomic resources differentially affect the health of blacks and whites.

FINDINGS

Evaluating the racial gap in morbidity in middle age requires that individuals survive to these ages. Blacks' lower chances of survival to middle age compared with whites suggests that the stratification mechanisms

influencing the health of middle-aged blacks and whites also operate at younger ages. By extension, blacks' lower chances of survival also suggest that black survivors in middle age are more likely than whites to be beset by health problems (Hayward and Heron 1999).³

The enormity of the gap in survival to middle age is illustrated in Table 3 which presents cohort survival rates to ages 50 and 60 based on data from the Social Security Administration (Bell, Wade, and Goss 1992, table 6) and the National Center for Health Statistics (1997, table 6-4). The left panel presents survival rates of the actual birth cohorts (without regard to race) bracketing the cohorts represented in the HRS. Approximately 81 percent of all men born in 1930 (persons aged 62 at the time of the survey), for example, survived to age 50. Almost 73 percent of men in this birth cohort survived to age 60. Approximately 85 percent of men born in 1940 survived to age 50 and 77 percent are projected to survive to age 60. Although race-specific estimates are not available for the two birth cohorts, the period survival rates shown in the right panel illustrate the possible magnitude of the racial differences among the HRS respondents' probability of survival to middle age. In 1970, for example, presuming that the mortality rates observed in that year persisted through a cohort's life, 73 percent of black men born in that year would be expected to survive to age 50 compared with 88 percent of white men—a difference of about 15 percentage points. Panning across the years, the racial gap in men's survival to age 50 ranges from approximately 22 percentage points in 1930 to 11 percentage points in 1993. The gap for women ranges from 24 percentage points in 1930 to 5.5 percentage points in 1993. These period cohort differences demonstrate, for the birth cohorts sampled in the HRS, that blacks are much less likely than whites to survive to middle age.

³ Some scholars might argue that differential survival implies an increase in the robustness of the frailest group and a decline in the gap in morbidity among survivors. The mortality crossover hypothesis (i.e., the reversal of black/white mortality rates in old age) is an example of this idea. Recent work raises doubts about this hypothesis (Elo and Preston 1994).

Table 3. Birth Cohort and Period Cohort Survival Rates to Ages 50 and 60 (Percentages), by Sex and Race, from Various Data Sources

Birth Cohort/ Period	Birth Cohort Survival Rate ^a				Period Cohort Survival Rate ^b							
	Male (All races)		Female (All races)		Male				Female			
					Black		White		Black		White	
	Age 50	Age 60	Age 50	Age 60	Age 50	Age 60	Age 50	Age 60	Age 50	Age 60	Age 50	Age 60
1930	81.1	72.9	86.8	81.8	51.7	36.7	74.3	61.8	54.9	38.8	78.6	68.4
1940	84.8	77.2 ^c	90.1	85.5 ^c	60.5	43.8	80.5	67.8	64.9	48.9	85.3	76.2
1950	—	—	—	—	NA	NA	85.6	73.1	NA	NA	90.7	83.2
1960	—	—	—	—	NA	NA	87.4	75.5	NA	NA	92.5	86.3
1970	—	—	—	—	73.3	57.5	87.6	76.0	84.1	72.8	92.9	86.7
1980	—	—	—	—	80.1	64.9	90.1	80.6	89.6	80.3	94.7	89.5
1993	—	—	—	—	79.7	66.4	91.2	83.6	90.2	82.1	95.7	91.1

Note: NA indicates that estimates of mortality for blacks are not available.

^a Rates were obtained from Bell, Wade, and Goss (1992, table 6).

^b Rates were obtained from National Center for Health Statistics (1997, table 6-4).

^c Estimate is based on the actual mortality experience of the birth cohort up to 1990 and projected mortality after 1990 (see Bell et al. 1992).

How do the health conditions of blacks and whites differ in middle age? The estimates in Table 4, derived from statistical models, confirm that blacks' higher mortality is also reflected in higher morbidity during middle age. Blacks have significantly higher prevalence rates of hypertension, stroke, and diabetes. For example, approximately 53 percent of black men and 61 percent of black women have hypertension compared to 38 percent of white men and 34 percent of white women. The prevalence of diabetes among blacks is roughly twice that among whites. Only in the case of COPD are whites more likely than blacks to have the disease, and this pattern is largely confined to men. Blacks are also more likely than whites to have multiple fatal disease conditions compared to whites: Approximately 6.5 percent of black males and 9.8 percent of black females report having two or more fatal conditions; among whites, 5.3 percent of males and 4.8 percent of females report having two or more fatal conditions.

The two-year incidence rates for the fatal chronic diseases suggest that blacks' health disadvantages with regard to hypertension, diabetes, and stroke are likely to increase, on average, as individuals age. Blacks' rate of hypertension onset is approximately 1.7

times that for whites. Despite the fact that heart disease death rates for blacks exceed those for whites at these ages by a factor of two or more (National Center for Health Statistics 1999, table 37), we do not observe any significant racial difference in self-reported heart disease. We suspect that lower rates of health care use among blacks result in underdiagnosis, however, and thus health problems for blacks may be underreported in the HRS. The findings for heart disease are consistent with this argument.

The general pattern of black disadvantage in health carries over to nonfatal diseases and health impairments. Blacks in midlife have significantly higher prevalence rates for asthma, foot and leg problems, kidney problems, stomach ulcers, pain, vision problems, and depression. The major exception to this pattern is back problems, for which whites have a higher prevalence of impairment.⁴ The incidence rates indicate that blacks are likely to experience signifi-

⁴ The racial gap in co-morbidity also extends to the nonfatal conditions. The percentage of blacks reporting two or more nonfatal conditions is 30.7 for males and 40.5 for females. The percentage of whites reporting two or more conditions is 27.0 for males and 34.7 for females.

Table 4. Estimated Prevalence at First Interview (1992) and Two-Year Incidence Rates (1992–1994) of Disease, Impairments, and Disability, by Race and Sex: Blacks and Whites from the Health and Retirement Survey, Ages 51 to 61

Conditions	Black				White			
	Male		Female		Male		Female	
	Prevalence	Incidence	Prevalence	Incidence	Prevalence	Incidence	Prevalence	Incidence
<i>Major Fatal Conditions</i>								
Hypertension ^{a,b,c,d}	52.5	4.9	60.8	5.7	38.4	2.8	33.5	3.3
Diabetes ^{a,c,d}	16.1	3.0	18.9	2.2	9.8	1.0	7.8	.7
Cancer ^b	2.4	.5	6.2	.5	3.3	.7	8.3	.7
Chronic obstructive pulmonary disease ^{a,b,c}	4.2	1.4	8.3	1.4	8.7	1.0	9.0	1.0
Heart ^c	14.7	2.0	14.3	1.7	15.7	1.7	10.7	1.4
Stroke ^{a,b,d}	5.1	.9	3.9	.6	2.6	.3	1.9	.2
<i>Nonfatal Diseases and Impairments</i>								
Emotional problems ^b	7.8	1.5	12.7	1.7	8.3	1.5	13.5	1.7
Arthritis ^{b,d,e}	33.5	5.8	47.2	9.5	30.9	4.3	44.2	7.1
Asthma ^{a,b,e}	6.8	.7	8.8	1.1	5.1	.7	6.5	1.1
Back ^{a,b}	30.6	5.8	33.2	5.9	34.1	6.0	36.9	6.1
Foot and leg ^{a,b,d,e}	36.0	9.1	45.6	10.8	28.9	6.9	37.8	8.1
Kidney ^{a,b,e}	9.4	2.4	14.8	3.1	7.5	1.8	11.9	2.4
Stomach ^a	11.6	1.8	12.6	2.3	8.2	1.3	8.9	1.7
Pain ^{a,b,e}	22.9	7.2	28.7	9.0	20.2	6.4	25.5	8.0
Vision ^{a,d,e}	23.5	8.7	24.1	10.6	8.4	2.9	8.6	3.5
Hearing ^{b,d,e}	18.8	6.0	8.5	2.8	18.8	4.2	8.4	1.9
Depression ^{a,b,d,e}	6.7	8.9	9.6	12.1	3.3	4.6	4.8	6.3
<i>Disability</i>								
Work ^{a,d,e}	28.0	6.1	27.9	7.5	19.2	4.5	19.1	5.5
Home ^{b,d,e}	29.1	6.5	31.6	7.6	21.9	5.2	24.0	6.1
Mobility ^{b,c,e,f}	51.4	5.6	73.0	18.4	50.2	8.7	65.6	11.0
Strength ^{a,b,e,f}	42.6	6.8	61.4	13.9	37.8	7.9	56.6	9.7
Activities of daily living ^{a,b,c,d}	12.0	3.6	16.9	3.2	7.6	1.2	7.7	1.0

Note: The prevalence and incidence figures are estimates derived from statistical models. In the case of prevalence, logistic regression models are estimated by regressing the log odds of a health problem on race, sex, and a race × sex interaction. The specification of the incidence models is the same except the estimates are obtained from a hazard model. Parameter estimates are used to calculate predicted rates.

^a $p < .05$ (two-tailed tests for main effect of race on prevalence)
^b $p < .05$ (two-tailed tests for main effect of sex on prevalence)
^c $p < .05$ (two-tailed tests for interaction effect of race × sex on prevalence)
^d $p < .05$ (two-tailed tests for main effect of race on incidence)
^e $p < .05$ (two-tailed tests for main effect of sex on incidence)
^f $p < .05$ (two-tailed tests for interaction effect of race × sex on incidence)

Table 5. Cumulative Probability of Disease Onset (Percent) by Age 63 for Persons Age 51 without the Disease, by Race, Sex, and Years of Education: Blacks and Whites from the Health and Retirement Survey, 1992

Sex and Condition	Years of Education					
	Black			White		
	8	12	16	8	12	16
<i>Males</i>						
Hypertension ^{a,b}	57.6	47.1	38.5	36.0	29.8	24.0
Diabetes ^{a,b}	65.5	38.7	22.7	27.3	16.0	9.4
Cancer ^c	4.0	5.3	7.0	5.4	7.2	9.5
Chronic obstructive pulmonary disease ^b	24.0	13.4	7.5	23.1	12.9	7.2
Heart ^{b,c}	33.8	25.2	18.8	31.5	23.5	17.5
Stroke ^{a,b}	17.9	12.1	8.1	7.9	5.3	3.6
<i>Females</i>						
Hypertension ^{a,b}	66.4	54.3	44.7	41.6	34.0	27.8
Diabetes ^{a,b}	49.0	28.9	16.9	20.3	11.9	7.0
Cancer ^c	4.1	5.5	7.3	5.6	7.5	10.0
Chronic obstructive pulmonary disease ^b	24.0	13.4	7.4	23.0	12.8	7.1
Heart ^{b,c}	29.0	21.7	16.1	27.0	20.2	15.0
Stroke ^{a,b}	13.1	8.8	5.9	5.8	3.9	2.6

Note: The cumulative probabilities are calculated from the parameter estimates of hazard models. Each hazard model regresses the log of the risk of a disease onset on age, race, sex, and education. Note that nonsignificant coefficients, such as the effects of sex, appear to have substantive implications on the cumulative probability of acquiring a disease over the 12-year period. Race \times sex interactions were tested but none was statistically significant. The cumulative probabilities are based on main effects parameter estimates including nonsignificant coefficients.

^a $p < .05$ (two-tailed tests for main effect of race)

^b $p < .05$ (two-tailed tests for main effect of education)

^c $p < .05$ (two-tailed tests for main effect of age)

^d $p < .05$ (two-tailed tests for main effect of sex)

cantly increased health problems for three conditions for which blacks are already disadvantaged by midlife—foot and leg problems, vision problems, and depression. In the case of hearing problems and arthritis, for which few differences exist at midlife, the higher incidence rates among blacks are predictive of a divergence in these problems in later life.

Not surprisingly, given the weight of evidence of black disadvantage in both fatal and nonfatal conditions, all forms of disability except mobility-related problems are more prevalent among blacks relative to whites. Blacks also have significantly higher incidence rates of work and domestic disability, and activities of daily living (ADL) impairment. The results suggest that health concerns severely limit blacks' ability to engage

in productive economic and domestic activities during this peak earning period in the life cycle—a pattern also observed in other recent studies (Bound, Schoenbaum, and Waidmann 1996; Hayward et al. 1996).

The prevalence and incidence rates shown in Table 4 capture two distinctly different aspects of the racial gap in health during middle age. Prevalence rates measure the burden of illness on the total population, regardless of time lived with the condition. Incidence rates measure the appearance of *new* cases between the first interview and the two-year follow-up. Within all three health domains—fatal diseases, nonfatal diseases, and disability—blacks have a significantly greater percentage of persons with existing illnesses (prevalence) at middle age, and they also have a greater

chance of acquiring new health problems (incidence). The increasing disadvantage of blacks resulting from the higher level of disease incidence during midlife is seen more directly in Table 5. Table 5 presents the hypothetical disease experiences during middle age (between ages 51 and 63) of blacks and whites of each sex who have survived to middle age without a disease. If we assume that individuals reach middle age (age 51 in this case) without a disease and that the incidence rates observed in the sample continue unchanged through time, we can estimate the probability of acquiring a condition by a specified age (in this case, age 63) for the two races. These estimates are broken down by education and sex to illustrate how socioeconomic status and gender combine with race to influence disease experience during middle age.

Like the estimates shown in Table 4, Table 5 shows that the onset of hypertension, stroke, and diabetes is significantly influenced by race. The substantive implications of these rates for blacks and whites differentially acquiring a disease condition during middle age are considerable. Among black women with an eighth-grade education who survive to age 51 without hypertension, approximately 66 percent are expected to acquire the disease by age 63. Education helps to delay the onset of hypertension: about 45 percent of black women with 16 years of education who are at risk will acquire the condition by age 63. Note that whites with an eighth-grade education are less likely to experience the onset of hypertension in middle age than are blacks with 16 years of education. Thus, while education helps to overcome the disadvantage of blacks relative to whites with regard to hypertension, it does not erase the racial gap. This pattern is also characteristic of stroke. For diabetes, highly educated blacks are marginally advantaged compared to poorly educated whites. The key point, however, is that the health gap between blacks and whites increases substantially during middle age, exacerbating the observed unequal health of blacks and whites by middle age.

The results in Table 5 raise the question of the extent to which racial differences in chronic health conditions reflect the generally unequal social circumstances of blacks

and whites. We address this issue by focusing again on the incidence rates of health problems in middle age to demonstrate how temporally prior conditions are associated with the acquisition of health problems. Table 6 presents the results for models in which we introduce an extensive array of mechanisms linking social class position and health for blacks and whites. Model 1 shows the overall effect of race on the incidence of major diseases, impairments, and disabilities. Model 2 adds education (our early life cycle socioeconomic status marker) to the basic model (Model 2 is the same model used in Table 5 to calculate the expected cumulative probabilities of disease onset). Model 3 adds the major diseases as covariates to take account of co-morbidity. Although only persons without a given disease are at risk of its onset, they may have other diseases or impairments that put them at greater risk of a second (or third or more) disease. The traditional behavioral determinants of chronic disease are introduced in Model 4—variables typically targeted in public health initiatives and viewed as changeable in order to improve health in the population. Finally, Model 5 incorporates social structural circumstances of adult life. Model 6 deletes the major diseases from Model 5. Parameter estimates are available on request from the authors.

Results for Model 1 parallel the incidence findings noted in Table 5. Comparing Models 1 and 2 shows that education is an important factor differentiating the health of blacks and whites: Introducing education alone substantially reduces the race effect for diabetes, stroke, vision impairment, hearing impairment, depression, work disability, and activities of daily living. Model 3 reveals that co-morbidity partially accounts for the remaining residual relationship between race and disease onset for the fatal diseases. For example, the race effect for stroke declines 17 percent when the covariates are introduced in this fashion, although the effect remains statistically significant (the magnitude of the decline in the race effect is necessarily contingent on model specification). The race effect for diabetes declines by 20 percent. The presence of other diseases, however, does not account for the effect of race on hypertension. Co-

Table 6. Relative Risk of Disease Onset for Blacks Relative to Whites: Health and Retirement Survey Respondents, Ages 51 to 61, 1992

Condition	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Major Fatal Diseases</i>						
Hypertension	1.74*	1.64*	1.56*	1.47*	1.38	1.34
Diabetes	3.10*	2.46*	2.07*	1.88*	2.16*	2.29*
Cancer	.67	.74	.75	.78	.62	.63
Chronic obstructive pulmonary disease	1.36	1.05	.93	.88	.77	.74
Heart	1.22	1.08	.89	.86	.73	.78
Stroke	2.70*	2.29*	2.00*	2.00*	1.80	1.59
<i>Major Nonfatal Diseases and Impairments</i>						
Emotional problems	.99	.87	.83	.82	.58*	.51*
Arthritis	1.36*	1.23	1.09	1.05	1.07	1.11
Heart attack	1.37	1.05	.84	.79	.66	.63
Asthma	1.01	.90	.93	.93	.81	.63
Back	.96	.88	.83	.84	.95	.94
Foot and leg	1.32*	1.28*	1.19	1.11	1.21	1.15
Kidney or bladder	1.33	1.22	1.12	1.12	.86	.86
Stomach or intestinal ulcers	1.34	1.25	1.18	1.10	.97	.89
Pain	1.12	1.03	.96	.92	.74*	.71*
Vision impairment	3.01*	2.31*	2.19*	2.12*	1.58*	1.46*
Hearing impairment	1.44*	1.12	1.05	1.04	1.05	1.03
Depression	1.92*	1.55*	1.61*	1.56*	1.15	1.04
<i>Disability</i>						
Work disability	1.36*	1.16	1.16	1.12	.98	.89
Home disability	1.26	1.10	1.06	1.04	.94	.86
Activity limitation	1.17	1.07	1.01	.97	.86	.81
Mobility	1.13	.96	.92	.87	.73*	.70*
Strength	1.14	.99	.97	.89	.76	.73*
Activities of daily living	3.06*	2.71*	2.44*	2.41*	1.89*	1.77*

Note: Model specification: Model 1 includes age, race, sex; Model 2 adds education to Model 1; Model 3 adds major diseases to Model 2; Model 4 adds health behaviors to Model 3; Model 5 adds stress/support, job characteristics, household income, wealth, and availability of health insurance to Model 4; Model 6 deletes major diseases from Model 5.

* $p < .05$ (two-tailed tests for race difference)

morbidity also has modest implications for the racial gap in the nonfatal diseases and disability. When fatal chronic diseases are introduced into the models for the nonfatal conditions and disability, the race effect is reduced somewhat for foot and leg problems, vision impairment, hearing problems, and activities of daily living. Not surprisingly, the fatal chronic diseases serve as biomedical pathways linking race with nonfatal health outcomes. Note, however, that in the case of foot and leg problems, vision, de-

pression, and activities of daily living, race continues to have a statistically significant association, even after the introduction of the fatal conditions.⁵

Introducing the health behaviors in Model 4 has only a negligible impact on the race effect for any of the health conditions. Ra-

⁵ Our evaluation of the changes in the effects of race is substantive and not statistical; we have not tested whether the coefficients themselves changed significantly.

cial differences in smoking, drinking, body mass, and exercise do not appear to be the primary conduit accounting for racial differences in disease onset in middle age.

Taking account of socioeconomic circumstances in Model 5 produces some reduction in the effect of race for hypertension, pain, vision problems, and depression. Large reductions in the effects of race (in terms of changes in the magnitude of the effect) also are observed for mobility-related disability and activities of daily living. Somewhat surprisingly, the race effect increases marginally for diabetes onset when social conditions are included in the model. For pain onset, the development of an increasingly rich model un.masks an effect of race in which blacks are less likely to experience the onset of pain, all else being equal. Similarly, controlling for a rich set of explanatory variables results in blacks being less likely to experience mobility and strength limitations.

Our discussion of Table 6 has assumed that co-morbidity effects are exogenous to how race influences chronic disease via adult socioeconomic circumstances. We made this assumption because we are unable to establish the temporal ordering of co-morbidity and the socioeconomic explanatory variables. In essence, we have stacked the deck against identifying the socioeconomic conditions that differentiate the health of blacks from the health of whites. To gauge the implications of this assumption, we estimated the full model omitting co-morbid conditions (Model 6 in Table 6). This allows us to determine whether race influences the risk of chronic disease via co-morbid conditions, *after* taking account of the socioeconomic effects. In this specification, co-morbidity is cast as an endogenous explanation of the effects of race on the risk of disease.

Comparing Models 5 and 6, the results suggest that the association of race and the risk of chronic disease is not primarily a function of co-morbid conditions. The effect of race is relatively stable regardless of whether co-morbid conditions are included as explanatory factors. In the full set of results (not shown), very little change was observed in the other effects in the models. Our modeling efforts suggest that it matters little whether co-morbid conditions are assumed

to be largely exogenous or endogenous when modeling how racial differences in disease during middle age come about.

Results in Table 6 support the idea that socioeconomic circumstances rather than health behaviors are the primary mechanisms accounting for blacks' general health disadvantages. The largest changes in the effects of race come after adding education and the set of adult socioeconomic circumstances to the models. Indeed, when education alone is introduced into the model (compare Models 1 and 2), the effect of race is strikingly reduced in the case of diabetes, arthritis, vision impairment, hearing impairment, depression, and work disability. This suggests that early life-cycle socioeconomic resources frequently differentiate the chronic health problems of blacks and whites.

Of the 10 health conditions for which blacks and whites differ significantly in terms of incidence (see Model 1 in Table 6), the race effect is reduced to nonsignificance for 7 conditions after measures of socioeconomic circumstances are included. The race effects remain significant for diabetes, vision impairment, and activities of daily living—note, however, the enormous drop in the race effect for these conditions across Models 1 to 5. For three conditions, the race effect becomes statistically significant after controlling for adult socioeconomic circumstances: Once the adult life circumstances of blacks and whites are statistically homogenized, blacks are significantly *less* likely to experience the onset of emotional problems, pain, and mobility limitations.

Based on the main effects models, we next included interaction terms estimating whether the effects of socioeconomic circumstances differ for blacks and whites. Our general expectation is that blacks should see fewer benefits from socioeconomic resources than do whites. The specific interaction terms considered are race \times central city residence, \times family income, \times education, \times wealth, \times difficulties in handling life problems, \times dissatisfaction with friendships, \times financial dissatisfaction, \times health insurance, \times job stress, and \times the physical demands of the job. Each interaction was entered separately for each chronic health problem, resulting in 220 models. Of the 220 models, only three

interactions were statistically significant.⁶ Further, for the majority of models with non-significant results, the pattern of the interactions indicated that blacks derive *greater* health benefits than do whites from socioeconomic resources. This pattern may reflect the fact that blacks' base level of resources lags so far behind that of whites. Our results provide little evidence that blacks derive fewer health benefits from socioeconomic resources than do whites and, in fact, the opposite may be true.

CONCLUSIONS

We have posed the question whether the effect of race was selective on the type of chronic health condition. In general, it appears that racial differences in the prevalence of health problems in middle age are pervasive across all major domains of health. Blacks are more afflicted than whites by hypertension, diabetes, and stroke, and blacks are more likely than whites to have most of the nonfatal diseases and impairments. Blacks have higher rates than whites of almost all forms of disability. Differences between the races in the incidence rates defining the onset of health problems in middle age generally mirror racial differences in prevalence, although fewer of the race effects are statistically significant. The fact that blacks and whites differ more dramatically in terms of prevalence rather than incidence suggests that the greater prevalence of health problems among middle-aged blacks is the outcome of a long-term and cumulative process of health disadvantage over the life cycle. This idea is reinforced by the racial disparity in survival to middle age. Racial differences in chronic health problems among middle-aged persons, therefore, are not the simple product of a sudden bifurcation in health at middle age.

⁶ The significant race interactions were: (a) Job stress significantly increases the risk of diabetes among blacks, but no association is found for whites; (b) blacks with health insurance have a lower risk of asthma than do blacks without health insurance, but no effect of health insurance is observed for whites; and (c) difficulty in handling life problems places whites at greater risk of depression, but no association is observed for blacks.

The health experiences of blacks and whites in middle age continue and reinforce the life cycle trajectory of inequality in health already present. The magnitude of the disparities between blacks and whites in health that arise during middle age is substantial, as demonstrated in our simulations of the racial differences in the cumulative probability of experiencing the onset of fatal chronic diseases during middle age (a 12-year period) among persons who survive to middle age free of the disease. Chronic disease is a defining facet of life in middle age—particularly for blacks.

If white Americans are the "gold standard" of aging, black Americans experience extraordinary rates of premature aging. These results reinforce the recent findings by Hayward and Heron (1999) that blacks experience truncated lives and extended periods of life with disabling conditions. Our results also indicate that the years of life spent with a chronic condition arise from a broad range of chronic health conditions. In this sense, it is not easy to envision straightforward, short-term solutions to resolving the racial gap in health.

Our second aim was to investigate the role of health behaviors and social structural circumstances in the link between race and health. The idea is that the effect of race on health operates through life-cycle socioeconomic advantages and disadvantages. Overall, we found support for the idea that social structural circumstances operate as mechanisms connecting race with chronic health problems. Of particular importance is the role of education—an early life-cycle marker of socioeconomic achievement. Even for those few health conditions for which the race effect remained statistically significant, social structural circumstances played a dominant role in accounting for the total effect of race.

We found less evidence that health risk behaviors play a substantial role in accounting for racial differences in chronic health conditions, suggesting that the disparity between races in health is rooted in what Link and Phelan (1995) call the fundamental social conditions of disease rather than behavioral differences. Although this finding is important for understanding the conditions defining the health chances of blacks and

whites, it indicates that resolving racial differences in chronic disease is less amenable to short-term public health policies focused on smoking, alcohol consumption, obesity, and exercise. While public health policies *in general* are important for improving population health, such policies are not likely to be an effective means of resolving *racial inequality* in health.

Some researchers (Williams 1996, 1997) have suggested that blacks and whites differ in their ability to transform socioeconomic resources into good health. It is argued that institutional racism devalues blacks' socioeconomic resources by imposing inferior educational quality, economic uncertainty, and discrimination. Our results provide little support for this position—at least with regard to how socioeconomic resources influence the onset of chronic health conditions during middle age. Instead, the evidence indicates that blacks and whites are differentially channeled into socioeconomic circumstances over the life cycle in a way that deprives blacks of good health relative to whites. The fundamental meaning and importance of socioeconomic circumstances in influencing chronic health problems, however, is the same for blacks and whites. Does institutional racism influence the health of blacks and whites? Our results suggest it does, but that institutional racism may operate indirectly through trajectories of socioeconomic achievement rather than through a transformation of the value of socioeconomic achievement for health for middle-aged blacks.

Increasingly, researchers document the enormous disparities in health and mortality separating blacks and whites in the United States (Bound et al. 1996; Geronimus 1996; Hayward and Heron 1999; LeClere, Rogers, and Peters 1997; Peek, Coward, and Henretta 1997). We have focused intensively on racial differences in morbidity during middle age, although our results point to disparities occurring more broadly across the life cycle. This echoes Hayward and Heron's (1999) recent study in which blacks' were observed to have both a greater chance of chronic health problems over the entire adult life cycle and a greater chance of dying young. Chronic health problems and mortality combine to truncate

the lives of blacks relative to whites and engender a life cycle fraught with a significant number of years spent in poor health. Our analysis, as well as other recent research (LeClere et al. 1997), establishes that these differences are rooted in the fundamental social conditions of life.

Future research should identify how different circumstances experienced over the life cycle stratify the chronic health experiences of blacks and whites. Our focus has primarily been on the effects of the socioeconomic conditions of adult life as the mechanisms linking race with chronic health problems. Some evidence suggests that much of chronic disease experience is also rooted in childhood (e.g., low birth weight, inadequate nutrition, childhood poverty, and childhood illnesses; see Barker 1997a, 1997b; Blackwell et al. forthcoming; Elo and Preston 1992). Other evidence identifies the substantial effects of the work environment at different points in the career (Mare 1990; Moore and Hayward 1990; Pavalko, Elder, and Clipp 1993), mid- and late-adulthood social and economic circumstances (Hayward et al. 1997; Kington and Smith 1997; Ross and Wu 1995), and community environment (LeClere et al. 1997). Chronic health conditions, therefore, are not simply an outcome of biological aging or reflective of one's health behaviors and social circumstances at a particular stage of life. Rather, chronic health conditions in middle and late life appear to be sensitive to socioeconomic conditions over the entire life cycle (Kuh and Ben-Shlomo 1997). What remains ambiguous is how various conditions experienced at different points in the life cycle result in particular health outcomes. The difficulty in establishing these effects is compounded by the fact that health also affects life-cycle achievement. A growing body of evidence suggests that life-cycle wealth, income, and labor force attachment are aspects of individuals' socioeconomic circumstances that may be influenced by health (Bound et al. 1996; Hayward et al. 1996; Shea, Miles, and Hayward 1996; Smith and Kington 1997).

It is increasingly clear that health and achievement are intertwined over the life cycle, although research spanning broad portions of the life cycle is largely absent. Miss-

ing is research on how health and achievement processes are linked *across* childhood, adolescence, adulthood, and old age. Such a perspective would not only enrich current studies of the racial inequality in health, but it would introduce health into life-cycle achievement models where health is largely absent as an explanatory factor. This is especially important for gaining a fuller understanding of differences in both the life-cycle achievements and health of black Americans and white Americans.

Mark D. Hayward is a Professor of Sociology and Demography, and the Director of the Population Research Institute at The Pennsylvania State University. Presently, he is engaged in a collaborative study with Eileen Crimmins of how socioeconomic conditions from childhood through late life combine to influence the morbidity and mortality experiences of older Americans. His recent publications have focused on racial inequality in active life expectancy and the connections among childhood diseases, childhood social class, and chronic disease-based morbidity decades after childhood.

Eileen M. Crimmins is Edna M. Jones Professor of Gerontology at the Andrus Gerontology Center of the University of Southern California. She is also the Director of the USC/UCLA Center on Biodemography and Population Health. Her work in recent years has focused on the determinants of a variety of health problems in old age. Together with Mark Hayward much of this work has been oriented to clarifying the mechanisms through which healthy life expectancy can be extended.

Toni P. Miles is Professor in the Department of Family and Community Medicine at the University of Texas Health Science Center, San Antonio. Her analyses use a biopsychosocial model to identify factors associated with the development of frailty in older adults across a variety of populations. Her recent work has included studies of frailty, a biohistorical analysis of syphilis among black Americans, and studies of black elderly twins.

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REFERENCES

- Barker, David J. 1997a. "The Long-Term Outcome of Retarded Fetal Growth." *Clinical Obstetrics and Gynecology* 40:853-63.
- . 1997b. "Maternal Nutrition, Fetal Nutrition, and Disease in Later Life." *Nutrition* 13:807-13.
- Behrman, Jere, Robin Sickles, Paul Taubman, and Abdo Yazbeck. 1991. "Inequalities in Black-White Mortality." *Journal of Econometrics* 50:183-204.
- Bell, Felicitie C., Alice H. Wade, and Stephen C. Goss. 1992. *Life Tables for the United States Social Security Area 1900-2080*. Actuarial Study No. 107. Office of the Actuary, Social Security Administration, Washington, DC.
- Blackwell, Debra, Mark D. Hayward, and Eileen M. Crimmins. Forthcoming. "Does Childhood Health Affect Chronic Morbidity in Later Life?" *Social Science and Medicine*.
- Blendon, Robert J., Linda H. Aiken, Howard E. Freeman, and Christopher R. Corey. 1989. "Access to Medical Care for Black and White Americans: A Matter of Continuing Concern." *Journal of the American Medical Association* 261:278-81.
- Bound, John, Michael Schoenbaum, and Timothy Waidmann. 1996. "Race Differences in Labor Force Attachment and Disability Status." *The Gerontologist* 36:311-21.
- Elo, Irma T. and Samuel H. Preston. 1992. "Effects of Early-Life Conditions on Adult Mortality: A Review." *Population Index* 58:186-212.
- . 1994. "Estimating African-American Mortality from Inaccurate Data." *Demography* 31:427-58.
- Farley, Reynolds. 1984. *Blacks and Whites: Narrowing the Gap?* Cambridge, MA: Harvard University Press.
- Feinstein, Jonathan S. 1993. "The Relationship between Socioeconomic Status and Health: A Review of the Literature." *Milbank Quarterly* 71:279-322.
- Freeman, Jonathan and George B. Hutchinson. 1980. "Prevalence, Incidence, and Duration." *American Journal of Epidemiology* 112:707-23.
- Garber, Alan M. 1989. "Pursuing the Links between Socioeconomic Factors and Health: Critique, Policy Implications, and Directions for Future Research." Pp. 271-313 in *Pathway to Health: The Role of Social Factors*, edited by J. P. Bunker, D. S. Gomby, and B. H. Kehr. Menlo Park, CA: Henry J. Kaiser Family Foundation.
- Geronimus, Arline T. 1996. "Black/White Differences in the Relationship of Maternal Age to Birthweight: A Population-Based Test of the

- Weathering Hypothesis." *Social Science and Medicine* 42:589-97.
- Hayward, Mark D., Samantha Friedman, and Hsinmu Chen. 1996. "Race Inequities in Men's Retirement." *Journals of Gerontology: Social Sciences* 51(B):S1-10.
- Hayward, Mark D. and Melonie Heron. 1999. "Racial Inequality in Active Life among Adult Americans." *Demography* 36:77-91.
- Hayward, Mark D., Amy Pienta, and Diane K. McLaughlin. 1997. "Inequality in Men's Mortality: The Socioeconomic Status Gradient and Geographic Context." *Journal of Health and Social Behavior* 38:213-34.
- House, James S., James M. Lepkowski, Ann M. Kinney, Richard P. Mero, Ronald C. Kessler, and Regula A. Herzog. 1994. "The Social Stratification of Aging and Health." *Journal of Health and Social Behavior* 35:213-34.
- Jargowsky, Paul A. 1994. "Ghetto Poverty among Blacks in the 1980s." *Journal of Policy Analysis and Management* 13:288-310.
- Juster, Thomas and Richard Suzman. 1995. "Overview of the Health and Retirement Study." *Journal of Human Resources* 30:S7-56.
- Kail, Barbara. 1992. "Drugs, Gender, and Ethnicity: Is the Older Minority Woman at Risk?" Pp. 1-36 in *Special Problems on Non-Compliance among Elderly Women of Color*, edited by B. Kail. Lewiston, NY: Edwin Mellen.
- Karasek, Robert A. 1990. "Lower Health Risk with Increased Job Control among White-Collar Workers." *Journal of Organizational Behavior* 11:171-85.
- Karasek, Robert A., Tores Thorell, and Joseph E. Schwartz. 1988. "Job Characteristics in Relation to the Prevalence of Myocardial Infarction in the US Health Examination Survey (HES) and the Health and Nutrition Examination Survey (HANES)." *American Journal of Public Health* 78:910-18.
- Kington, Raynard S. and James P. Smith. 1997. "Socioeconomic Status and Race and Ethnic Differences in Functional Status Associated with Chronic Disease." *American Journal of Public Health* 87:805-10.
- Krieger, Nancy. 1987. "Shades of Difference: Theoretical Underpinnings of the Medical Controversy on Black/White Differences in the United States, 1830-1870." *International Journal of Health Services* 17:259-78.
- Krieger, Nancy, Diane L. Rowley, Allen A. Herman, Bylye Avery, and Mona T. Phillips. 1993. "Racism, Sexism, and Social Class: Implications for Studies of Health, Disease, and Well-Being." *American Journal of Preventive Medicine* 9:82-122.
- Kuh, Diana and Ben Ben-Shlomo. 1997. *A Life Course Approach to Chronic Disease Epidemiology*. New York: Oxford University Press.
- LeClere, Felicia B., Richard G. Rogers, and Kimberley D. Peters. 1997. "Ethnicity and Mortality in the United States: Individual and Community Correlates." *Social Forces* 76: 169-98.
- Lewontin, Richard C. 1974. *The Genetic Basis of Evolutionary Change*. New York: Columbia.
- Lillard, Lee A. and Linda J. Waite. 1995. "'Til Death Do Us Part: Marital Disruption and Mortality." *American Journal of Sociology* 100:1131-56.
- Link, Bruce G. and Jo Phelan. 1995. "Social Conditions as Fundamental Causes of Disease." *Journal of Health and Social Behavior* 36:80-94.
- Mare, Robert D. 1990. "Socio-Economic Careers and Differential Mortality among Older Men in the United States." Pp. 362-87 in *Measurement and Analysis of Mortality: New Approaches*, edited by J. Vallin, S. D'Souza, and A. Palloni. Oxford, England: Clarendon.
- Massey, Douglas S. and Nancy A. Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, MA: Harvard University.
- McEwen, Bruce S. 1998. "Protective and Damaging Effects of Stress Mediators." *New England Journal of Medicine* 338:171-79.
- McEwen, Bruce S. and Eliot Stellar. 1993. "Stress and the Individual." *Archives of Internal Medicine* 153:2093-101.
- Moore, David E. and Mark D. Hayward. 1990. "Occupational Careers and Mortality of Elderly Men." *Demography* 27:31-53.
- National Center for Health Statistics. 1999. *Health, United States, 1999*. Hyattsville, MD: National Center for Health Statistics.
- Pavalko, Eliza K., Glen H. Elder, and Elizabeth C. Clipp. 1993. "Worklives and Longevity: Insights from a Life Course Perspective." *Journal of Health and Social Behavior* 34:363-80.
- Peek, Chuck W., Raymond T. Coward, and John C. Henretta. 1997. "Differences by Race in the Decline of Health Over Time." *Journals of Gerontology: Social Sciences* 52(B):S336-44.
- Preston, Samuel H. and Paul Taubman. 1994. "Socioeconomic Differences in Adult Mortality and Health Status." Pp. 279-318 in *Demography of Aging*, edited by L. G. Martin and S. H. Preston. Washington, DC: National Academy Press.
- Rice, Mitchell F. and Mylon Winn. 1990. "Black Health Care in America: A Political Perspective." *Journal of the National Medical Association* 82:429-37.
- Ross, Catherine E. and Chia-Ling Wu. 1995. "The Links between Education and Health." *American Sociological Review* 60:719-45.
- Schoen, Robert. 1988. *Modeling Multigroup*

Populations. New York: Plenum.

Shea, Dennis G., Toni P. Miles, and Mark D. Hayward. 1996. "The Health-Wealth Connection: Racial Differences." *The Gerontologist* 36:342-49.

Smith, James P. and Raynard Kington. 1997. "Demographic and Economic Correlates of Health in Old Age." *Demography* 34:159-70.

Ventura, Stephanie J., Kimberley D. Peters, Joyce A. Martin, and Jeffrey D. Maurer. 1997. "Births and Deaths: United States, 1996." *Monthly Vital Statistics Report* 46(1):S2.

Verbrugge, Lois M. and Alan M. Jette. 1994. "The Disablement Process." *Social Science and Medicine* 38:1-14.

Williams, David R. 1990. "Socioeconomic Differentials in Health: A Review and Redirection." *Social Psychology Quarterly* 53:81-99.

———. 1996. "Race/Ethnicity and Socioeconomic Status: Measurement and Methodological Issues." *International Journal of Health Services* 26:483-505.

———. 1997. "Race and Health: Basic Questions, Emerging Directions." *Annals of Epidemiology* 7:322-33.

Williams, David R., Risa Lavizzo-Mourey, and Rueben C. Warren. 1994. "The Concept of Race and Health Status in America." *Public Health Reports* 109:26-41.

Winkleby, Marilyn A., Darius E. Jatulis, Erica Frank, and Stephen P. Fortmann. 1992. "Socioeconomic Status and Health: How Education, Income, and Occupation Contribute to Risk Factors for Cardiovascular Disease." *American Journal of Public Health* 82:816-20.

ERRATUM

VOLUME 65, NUMBER 3, JUNE 2000

Kanazawa, Satoshi. A New Solution to the Collective Action Problem: The Paradox of Voter Turnout.

Page 439, Figure 1: In the June 2000 issue, "Yes" and "No" were reversed in Figure 1. The corrected figure appears below:

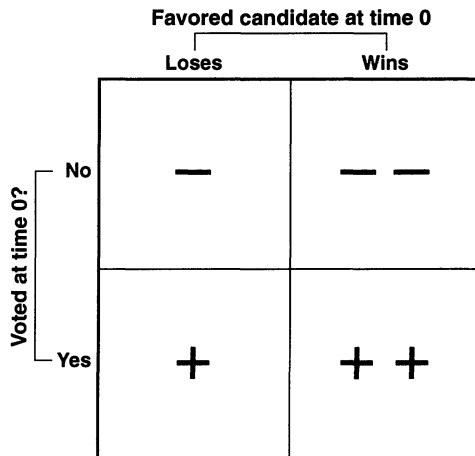


Figure 1. Relative Likelihood of Voting at Time 1