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Global Health and Mortality

# Adult Mortality and the Intersection of Race and Socioeconomic Status in the United States

Research into the social causes of health and mortality disparities have shown that both race and socioeconomic status play key roles. Minorities and the poor tend to live sicker and die younger (Gadson 2006), while whites and the affluent enjoy relatively long and health lives. Research has traditionally measured socioeconomic status in terms of education or income, but has overlooked the role that wealth may play in determining mortality. This paper will examine whether wealth mediates the relationship between race and mortality, and whether blacks are equally able to translate increases in SES into lower mortality.

## Race and Health

Much research into the effect of social conditions on mortality focuses on identifying the mechanisms through which social status affects health. Link and Phelan (1995), however, argue that this research should instead focus on the social conditions themselves, maintaining that they are the 'fundamental causes' of disease, and that the health effects that result from socioeconomic status can't be eliminated by addressing the individual mechanisms that link them to the disease. They define fundamental social causes as "resources like knowledge, money, power, prestige, and social connections that strongly

influence people's ability to avoid risks and to minimize the consequences of disease once it occurs" (Link and Phelan 1995:472).

In arguing for the existence of fundamental social causes, they note that the links between socioeconomic status and health and mortality have long been known, and while the mechanisms through which socioeconomic status appeared to operate have been addressed, the relationship has not disappeared or become weaker over time. They maintain that this is because the diseases, treatments, and risk factors impacting health and mortality change over time, and as these changes occur, people with higher levels of socioeconomic status are better able both to be aware of risks and to have the resources to protect themselves. They argue that "inequalities in health will exist as long as social inequalities do, and the greater the social inequality, the greater the health inequality. It follows that if we truly wish to reduce inequalities in health, we must address the social inequalities that so reliably produce them" (Link and Phelan 1995:472).

Although Link and Phelan refer primarily to measures of socioeconomic status in their description of fundamental social causes, they also note that race should be considered a fundamental social cause of disease. They argue that some social statuses, such as race and sex, "are so closely tied to resources like money, power, prestige, and/or social connectedness that they should be considered as potential fundamental causes of disease as well" (p. 87). The history of race relations in America clearly demonstrates this connection between race and socioeconomic status. Centuries of institutional- and individual-level discrimination have resulted in a society in which blacks are at great disadvantage and whites experience significant advantage. These inequalities take many

forms, but include the residential segregation, barriers to education and employment, and disparities in health status and death rates that are evident in American society.

The literature has revealed substantial evidence of racial disparities in health and mortality. Black Americans live more years with chronic illness and die at younger ages than do white Americans (Hayward et al. 2000). Hayward et al. (2000:926) argue that "[i]f white Americans are the 'gold standard' of aging, black Americans experience extraordinary rates of premature aging." Satcher (2005) reports that the black-white standardized mortality ratio remained virtually unchanged between 1960 and 2000, and accounted for approximately 83,500 excess black deaths in 2002. Hummer and Chinn (2011) find that blacks' mortality rates are 36% higher than whites, and that controlling for socioeconomic status reduces this gap to 11%. They also note that the black-white mortality gap is largest for young adults. Race clearly structures both the health and the mortality of individuals in America.

## Socioeconomic Status and Health

Socioeconomic status has also been shown to have a clear effect on almost all health outcomes (Crimmins, Hayward, and Seeman 2004). Gradients exist between socioeconomic status and life expectancy, activity limitation, health status, diabetes, coronary heart disease, and obesity (Braveman et al. 2010). These gradients have been observed worldwide: Mackenbach and colleagues (2008) reveal relationships between socioeconomic status and self-reported health and death rates in many countries in Europe, and Sastry (2004) finds that mothers' education is a key factor in determining child mortality rates. Socioeconomic resources throughout the life course have also been shown

to be important: Hayward and Gorman (2004) find that childhood socioeconomic status have an indirect effect on mortality through their effect on adult health behaviors and achievement.

The effect of socioeconomic status also varies depending on the measure being used. Potential measures include education, income, and wealth. There are both advantages and disadvantages associated with each measure, and it is therefore recommended that multiple measures of socioeconomic status be used (Adler and Rehkopf 2008). Education, for instance, provides a stable measure of socioeconomic status over time, but therefore cannot give information about how changes in socioeconomic status affect health. Because of this stability, however, it is less vulnerable to concerns about reverse causality: although income may be affected by health, as ill or disabled individuals are unable to work to their full potential, education is typically completed before debilitating health conditions would occur. Income, on the other hand, is more volatile than other measures of socioeconomic, and therefore allows the dynamic nature of socioeconomic status to be studied. Because of its volatility, however, it is more susceptible to criticisms of reverse causality. Furthermore, measures of income are likely to have much missing data (Williams and Collins 1995).

Wealth is a third measure of socioeconomic status. Although income and wealth are related, they are two separate dimensions of socioeconomic status (Huie et al. 2003). Income represents short-term earnings that may fluctuate considerably over time, and it is usually used primarily to purchase day-to-day necessities such as food and shelter. Wealth, on the other hand, is a more stable resource that can act as a "hedge against downward fluctuations in income, a fund for extraordinary expenses, and resources for consumption

in retirement'' (Kennickell, 2001:1). Wealth is also more consistent over the lifetime than income; it represents cumulative lifetime socioeconomic conditions, rather than yearly socioeconomic status. Furthermore, wealth inequalities are much larger than income inequalities (Huie et al. 2003). Because of these differences, studies that look only at income may be missing an important aspect of socioeconomic status that can have significant impacts on mortality.

## Intersection of Race and Wealth

The concept of wealth is also particularly important in understanding racial disparities. Although income inequality has been declining with time, racial wealth inequality remains stark. While blacks earn sixty-two cents for every dollar of income earned by whites, middle-class blacks own only 25 cents for every dollar owned by middle-class whites (Shapiro 2006). In 2009, the median wealth of white households was about 20 times greater than the median wealth of black households (Kochhar, Fry, and Taylor 2011). Furthermore, wealth has intergenerational effects, since it is passed from one generation to the next, compounding historical disadvantage (Huie et al. 2003). These findings indicate that failing to control for wealth may overlook a portion of socioeconomic status that is especially relevant to racial disparity.

Research has also shown that socioeconomic status may operate differently for blacks than for whites (Braveman et al. 2010). Crimmins, Hayward, and Seeman (2004) find that socioeconomic status has a stronger effect on health for whites than for other races. With age, whites reap increasingly greater returns to education than do blacks, and blacks receive fewer benefits in terms of health from increasing socioeconomic status (Shuey and

Willson 2008). There are several reasons why the effect of socioeconomic status may differ by race. Traditional measures of socioeconomic status may not capture the full status differences between houses of different races. Substantial wealth gaps exist even within levels of income, so that blacks and whites with equal incomes have access to very different resources. Evidence of educational disparities indicates that blacks receive lower quality education that whites, indicating that an equal level of education may not have equal meaning across races (Williams and Collins 1995:365). Racism may also result in disparate effects of socioeconomic status on health across races. Racism may limit the quality and quantity of health care, public education, housing, and recreational opportunities available to blacks, resulting in poor health outcomes even for those of high socioeconomic status.

## Mechanisms through which Race and SES Affect Mortality

Although the fundamental social cause theory argues that it is essential to focus on the root social causes of inequality, rather than emphasizing the ever-changing mechanisms through which social causes affect health, it can be helpful to consider some of the ways in which race and socioeconomic status may operate to affect mortality. Access to quality health care is a key concern, and blacks and those with low socioeconomic status may be unable to access or afford such health care (Williams and Collins 1995). Health behaviors, such as cigarette smoking, are also important. The prevalence of smoking is higher for blacks than for whites, and although they start smoking later and smoke fewer cigarettes per day than whites, they have higher rates of lung cancer than do whites (Richardson 1997).

There are also important differences in the physical environments in which people of different races live and work. Williams and Collins (1995) note that people with low socioeconomic status are more likely to work in environments with bad working conditions and higher risk of exposure to toxic materials. Adler and Rehkopf (2008:245) note that "[p]hysical and social environments, including a person's home, school, work, neighborhood, and community, vary by SES and affect the likelihood of individuals' exposure to both health-damaging conditions and health-protecting resources. Health-damaging exposures within these pathways include early life conditions, inadequate nutrition, poor housing, exposure to lead and other toxins, inadequate health care, unsafe working conditions, uncontrollable stressors, social exclusion, and discrimination"

Another commonly cited mechanism is stress. Exposure to stress may also differ by race and socioeconomic status: Adler and Rehkopf (2008:245) note that "[d]isadvantaged environments expose individuals to greater uncertainty, conflict, and threats for which there are often inadequate resources to respond effectively. These experiences cumulate to create chronic stress." The "allostatic load" model of health maintains that repeated exposure to stress alters the systems involved in stress response, including the cardiovascular, endocrine, metabolic, and immune systems, and leads to disease (McEwen and Seeman 1999).

Finally, early life socioeconomic status can have lasting effects on adult health and mortality through their effects on physical development and achievement (Hayward and Gorman 2004; Elo and Preston 1992). Early socioeconomic status can affect childhood health, and childhood diseases and disabilities can continue to adulthood, or can weaken organ systems leaving people more vulnerable to disease in adulthood (Williams and

Collins 1995). In utero conditions have also been shown to have an effect on diseases in adulthood, with maternal nutrition linked to adult heart disease, diabetes, and stroke (Barker 1997; Perry 1997).

## Current Research Focus

Although previous research has investigated the effects of race and socioeconomic status on mortality, there are several important limitations to this research. While women are underrepresented among the poor, studies of the association between socioeconomic status and health have frequently overlooked women, and "the nature of the association between SES and women's health status is not well understood" (Williams:1995:357). This is partly due to poor measures of socioeconomic status for women: because women were historically unlikely to work outside the home, they were often assigned the socioeconomic status of their husband, or their father if they were unmarried. With the rise in female employment, this has become a less obvious concern, but there is still reason to question whether the knowledge about the association between socioeconomic status and health gained from studies of men will apply equally to women.

Another significant oversight in the literature relates to measures of financial wellbeing. In spite of the important distinctions between wealth and income, very few national studies have considered the impact of wealth on adult mortality (Huie et al. 2003). Some studies claim to discuss the "wealth-health" gradient while using only measures of income (see Deaton 2002). Research that fails to control for wealth may be overlooking an important piece of the relationship between socioeconomic status and health.

This study aims to address these gaps in the literature. I address two primary questions: whether wealth mediate the relationship between race and mortality, and whether blacks are able to translate increases in SES into lower mortality. The data used contains a sample of women who were part of the first generation to be commonly employed outside the home, offering important insight into the association between socioeconomic status and mortality among women. I also employ measures of net family wealth, in addition to standard measures of education and income, to assess the effect of socioeconomic status on mortality.

# Data and Methods

## Data

My data come from the National Longitudinal Surveys (NLS), a series of longitudinal studies of cohorts of men and women in the United States since the 1960s. I use data from the Older Men cohort, a national sample of 5,034 men who were between the ages of 45 and 59 in 1966, and the Mature Women cohort, a national sample of 5,083 women who were between the ages of 30 and 44 in 1967. These cohorts were interviewed roughly every two years for several decades. The regular interviews with the Older Men cohort ended in 1983, but a recontact study was conducted in 1990. The Mature Women cohort was followed through 2003.

The NLS data contains more than 35 years of longitudinal data for the Mature Women and 24 years of data for the Older Men. Surveys were typically conducted through face-to-face interviews, although mail surveys were used in some years. The surveys contain a

wealth of information relating to work, family, and income processes throughout adulthood, as well as early childhood socioeconomic status. The NLS also oversampled black Americans, and retention of blacks was high, with 39% of the original sample remaining by 2003.

Although mortality information had been collected for some respondents in the NLS cohorts, the information available was limited. Mortality information was gathered for the Older Men cohort during the recontact study in 1990, but this could only be gathered for the 54% of the sample who had died by 1989. Furthermore, because men would have been at most between the ages of 68 and 82 in 1990, this mortality information also represents relatively early adult mortality. Comparable information was not obtained for the Mature Women cohort.

This limitation has recently been addressed through a project by Melissa Hardy and Eliza Pavalko, which matched survey records with mortality information through 2008 from the National Death Index. This adds an additional 20 years of mortality information to the Older Men cohort, and obtains comparable mortality information for the Mature Women cohort. The dataset now contains mortality information for the 93% of the Older Men cohort who have died, and the 40% of the Mature Women cohort that have died.

Table 1 displays the distribution of age at death for men and women. A smaller percentage of the Mature Women have died as of 2008 because the Mature Women were sampled at younger ages than the Older Men. By 2008 the Older Men would be between the ages of 87 and 101, while the Mature Women would only be between 71 and 85. Therefore, this mortality information reflects only early adult mortality for women, but gives a more complete picture of mortality for men. Because of this difference in age

distribution, as well as well-established differences in male and female mortality processes, I model mortality for men and women separately.

Table 1: Age at Death by Sex

| | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Alive | 361 | 7.2% | 3,064 | 60.4% | 3,425 | 34.0% |
| Died before age 50 | 28 | 0.6% | 105 | 2.1% | 133 | 1.3% |
| Died between age 50-59 | 439 | 8.8% | 275 | 5.4% | 714 | 7.1% |
| Died between age 60-69 | 1,060 | 21.2% | 579 | 11.4% | 1,639 | 16.3% |
| Died between age 70-79 | 1,544 | 30.9% | 821 | 16.2% | 2,365 | 23.5% |
| Died at age 80 or older | 1,570 | 31.4% | 232 | 4.6% | 1,802 | 17.9% |
| *Total* | *5,002* | *100.0%* | *5,076* | *100.0%* | *10,078* | *100.0%* |

## Sample Selection Bias

One limitation of the National Longitudinal Studies, and all studies that sample respondents in adulthood, is that they are unable to include individuals who die at young ages. In order to be selected for participation in the NLS, respondents had to survive to ages 45 to 59 for men, and ages 30 to 44 for women. There may be substantial differences between people who survive to middle age, relative to those who die in childhood or young adulthood. The probability of dying before middle age is also likely to be closely related to race and socioeconomic status. If so, this may have important effects on the conclusions in this study. The effect of race and socioeconomic status on mortality is likely to be underestimated, because I am unable to account for early life mortality. These conclusions should therefore be interpreted as the effects of mortality among a nationally representative sample of men and women *who survive to middle age.*

## Measures

The dependent variable used in this analysis is age at death. This includes all known deaths through 2008. My independent variables include the following demographic and socioeconomic measures. Summary statistics for these variables are available in Table 2.

**Race:** Due to the lack of oversampling procedures for other races, the analytic sample is restricted to white or black respondents. This measure is a binary indicator of whether the respondent is black.

**Age:** This measure gives the respondent's age at the first survey wave. This would be age in1966 for the Older Men cohort, and age in 1967 for the Mature Women cohort. This variable is mean centered.

**Southern Residence:** This variable is measured as a time-constant indicator of whether the respondent lived in the south. Because information is not available at a level detailed enough to include this variable as time-varying in a Cox model, I measure this as a time-constant indicator of the region in which the respondent lived for the most number of surveys.

**Education:** I measure education as the highest grade of schooling completed. It ranges from 0, or no education, to 18, or six or more years of college.

**Income:** In this analysis, income is measured as a time-constant variable.[1] I measure income as the average amount of net family income while the respondent was between the

[1] Although income data was collected from respondents at each survey, there are many periods of time for which income data is not available for each respondent (for example, between 1983 and 1990 for men, or during the interval between surveys). While Cox models allow time-varying measures to be included, they require that the variable be measured at every time point in which a respondent experiences the event of interest. In order to satisfy this requirement, I would need to have measures for income at every date on which a

ages of 50 and 60. This provides a summary of income during the peak earning years of life, and an average provides a more stable estimate of income than single-year data.

This variable represents the average logged family income in constant 1983 dollars. Because negative values for income were possible, I added $100,000 to each value, ensuring that all values were positive, prior to taking the natural log. There was a substantial amount of missing data for this variable, especially among women: 584 men and 1,870 women were missing. In order to avoid excluding these cases, I assigned them a value of 0 and created a dummy variable to indicate whether or not respondents were missing income data.

**Wealth:** The wealth measure is constructed in a similar way to the income measure. It represents the average amount of net wealth for the respondent's household between ages 50 and 60. This age range was selected to avoid measuring wealth too early in life, when respondents may not have accumulated the majority of their wealth, as well as to avoid measuring wealth too late in life, when respondents may have begun to spend down their assets during retirement.

The wealth variable is measured in logged 1983 dollars. Because negative values were possible, I again added $100,000 to each value prior to taking the natural log. A substantial amount of missing data was present for this variable as well (678 cases for men, 2003[2] cases for women). Again, I assigned these cases a value of 0 for wealth (prior to adding $100,000 and logging), and use this variable in models in conjunction with an indicator of missing values on wealth.

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respondent died. Because that is not feasible with this data, I measure income as a time-constant variable instead.

[2] In future analyses, I will explore reasons for the high amount of missing data for wealth among women, as well as alternative methods of coding wealth for women.

Table 2: Summary Descriptive Statistics

| Variable | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|
| *Males* | | | | |
| Dead | 0.93 | 0.26 | 0 | 1 |
| Age at death* | 74.03 | 10.22 | 49 | 90 |
| Age at base year | 51.88 | 4.39 | 40 | 65 |
| Black | 0.29 | 0.45 | 0 | 1 |
| Southern residence | 0.37 | 0.48 | 0 | 1 |
| Years of education | 9.30 | 3.95 | 0 | 18 |
| Average income | 11.74 | 0.14 | 10.32 | 12.44 |
| Average Wealth | 11.97 | 0.50 | 11.33 | 15.00 |
| *Females* | | | | |
| Dead | 0.40 | 0.49 | 0 | 1 |
| Age at death* | 68.33 | 9.95 | 41 | 85 |
| Age at base year | 37.62 | 4.45 | 23 | 54 |
| Black | 0.28 | 0.45 | 0 | 1 |
| Southern residence | 0.38 | 0.49 | 0 | 1 |
| Years of education | 10.96 | 2.84 | 0 | 18 |
| Average income | 11.73 | 0.14 | 11.18 | 12.60 |
| Average Wealth | 12.16 | 0.59 | 10.79 | 14.57 |

* Calculated only for respondents who have died

## Methods

I use Cox proportional hazards models to conduct an event history analysis of the association between race, socioeconomic status, and mortality. Event history models allow the examination of the occurrence and timing of events, such as death. Cox models are a type of event history model that expresses the hazards of an event as the sum of a baseline hazard function, a(t), and a series of predictors (Allison 1984):

$$\log h(t)=a(t) + b_1x_1+b_2x_2$$

The baseline hazard function is not estimated, but coefficients can be converted to hazard ratios to represent the increase or decrease in hazards associated with a unit change in a predictor.

Cox models can incorporate both time-constant and time-varying measures. One requirement for using time-varying covariates, however, is that values of the independent variables must be known for all individuals in the risk set for every time at which an event occurs (Allison 1984). Because many respondents in the NLS data died during periods for which no information is collected from respondents, it is not possible to measure variables such as income and wealth in a time-varying manner within the requirements of Cox models. They are therefore measured as time-constant covariates.

An additional requirement of Cox models relates to the issue of 'ties', or events that occur at the same time. Because in Cox models time is conceptualized as continuous, the partial likelihood method used to estimate the models requires that events be rank ordered such that no two events occur at the same time. The NLS data currently available measures age at death in integer years, meaning that there are a significant number of ties[3]. Several strategies for dealing with ties have been proposed, and I make use of the Efron method, which has been shown to be preferable to other methods (Hertz-Picciotto and Rockhill 1997).

[3] More detailed data on age at death, calculated to the day, month, and year of death, is available in restricted form. As I continue with this project, I will be able to access this more detailed variable and lower the number of ties substantially.

# Results

## Wealth-Mortality Gradient

I begin my analysis by examining the wealth gradient in mortality. The data indicate clear disparities in wealth by race: Table 3 reveals that white households have about five times the net wealth that black families have. This is further indication that wealth may play a key role in clarifying the relationship between race and mortality.

Table 3: Average Net Household Wealth

| Race | Male | Female |
|---|---|---|
| White | $100,570 | $102,622 |
| Black | $19,501 | $23,974 |

Table 4 displays the age of death for respondents in each wealth quartile. A clear gradient is seen, with a higher percentage of respondents in low wealth quartiles having died and at younger ages than those in high wealth quintiles. For example, only 20% of men in the lowest wealth quartile died at age 80 or older, compared to 44% of men in the highest wealth quintile. The percentage of people dying before age 60 is about 4 times as high for women in the first wealth quintile as for women in the fourth wealth quintile. Although a clear gradient cannot be seen for women in the oldest ages, this is likely due to the fact that the majority of the sample is still alive and has not yet aged into those categories. The gradient for women is clear, however, when looking at younger ages, as well as those who are still alive. Less than half of the women in the lowest wealth quintile were still alive in 2008, while over 70% of women in the highest quartile are still alive.

Table 4: Wealth-Mortality Gradient

| | Wealth Quartile | | | |
|---|---|---|---|---|
| Age at Death | 1st | 2nd | 3rd | 4th |
| *Males* | | | | |
| 59 and younger | 12.4% | 8.1% | 6.6% | 3.8% |
| 60-69 | 28.1% | 23.3% | 18.4% | 13.7% |
| 70-79 | 32.9% | 34.0% | 31.8% | 27.0% |
| 80 and older | 20.9% | 28.8% | 35.5% | 43.9% |
| Alive | 5.7% | 5.8% | 7.7% | 11.6% |
| *Total* | *100.0%* | *100.0%* | *100.0%* | *100.0%* |
| *Females* | | | | |
| 59 and younger | 8.8% | 2.8% | 3.6% | 2.2% |
| 60-69 | 18.6% | 15.1% | 11.7% | 7.7% |
| 70-79 | 20.6% | 20.8% | 19.2% | 14.8% |
| 80 and older | 4.4% | 5.8% | 5.5% | 4.1% |
| Alive | 47.6% | 55.6% | 60.0% | 71.2% |
| *Total* | *100.0%* | *100.0%* | *100.0%* | *100.0%* |

## Main Models

I turn next to my primary models examining the effect of race and socioeconomic status on mortality. Table 5 displays these results, calculated separately for men and women. Model I includes only a measure of race, showing that the hazards of death are significantly higher for blacks than for whites. Model II adds controls for age at the first survey and southern residence, reducing the effect of race only slightly. The hazards of death for blacks are 18% higher among men and 34% higher among women than the hazards of death for whites. Although many researchers would proceed to control for measures of socioeconomic status before reporting the 'true' effect of race, Hummer and Chinn (2011) argue that the best indicator of mortality differences across races is the estimate given by a basic model such as this, rather than a model that fully controls for socioeconomic inequalities and other factors that are structured by racial inequalities in society. They

argue that "differences in mortality among groups are not confounded by socioeconomic and other inequalities; the historical and continued significance of race and ethnicity are the reasons for such inequalities" (Hummer and Chinn 2011:9). Although controlling for socioeconomic indicators in later models reduces the effect of race, therefore, it is important to remember that these socioeconomic indicators are not eliminating the race effect, but clarifying the ways in which racial inequality affects mortality.

Model III adds a control for highest education completed. Although education significantly lowers the hazards of death for both men and women, the effect is not large: completing an additional year of education lowers hazards of death by about 2% for men and 6% for women. Race is still a significant predictor of mortality, although the magnitude of the coefficient has declined somewhat, indicating that part of the way in which race affects mortality is through education disparities.

Model IV controls for income, as well as an indicator of missing data for income. Income has a clear negative relationship with mortality, with each unit increase in logged family income resulting in a 69% decrease in hazards of mortality for men and a 74% decrease for women. The missing income indicator is significant for men, but not for women, indicating that men with missing income data have 16% lower hazards than those with valid values. This is not surprising, given that people with high incomes may be more likely to have missing income data. Controlling for income also renders race insignificant for men, although it remains significant for women. This indicates that the primary way in which race affects mortality is by determining inequalities in education and income.

Finally, Model V adds the control for wealth (and the missing data indicator for wealth). As hypothesized, wealth has a significant effect on mortality for both men and women, even

after controlling for income. An additional unit of logged wealth reduces hazards of death by about 24% for men and 27% for women, controlling for demographics and other indicators of socioeconomic status. Wealth also provides additional information about the way in which race affects mortality among women: although race remains significant for women in Model V, the magnitude of the coefficient is reduced by controlling for wealth. This indicates that race affects mortality among women in part through its effect on wealth distributions.

Table 5: Hazard Ratios for All-Cause Mortality

| | Model I | Model II | Model III | Model IV | Model V |
|---|---|---|---|---|---|
| *Men (N=4798)* | | | | | |
| Race | 1.192*** | 1.181*** | 1.115** | 1.075 | 1.011 |
| Age at First Survey | | 0.998 | 0.995 | 0.993* | 0.992* |
| Southern Residence | | 1.026 | 1.004 | 0.985 | 0.988 |
| Years of Education | | | 0.983*** | 0.998 | 1.002 |
| Average income | | | | 0.318*** | 0.430*** |
| Missing income indicator | | | | 0.848** | 0.879* |
| Average Wealth | | | | | 0.761*** |
| Missing wealth indicator | | | | | 0.92 |
| *Women (N=4952)* | | | | | |
| Race | 1.379*** | 1.341*** | 1.246*** | 1.172** | 1.112* |
| Age at First Survey | | 0.989 | 0.986* | 0.985** | 0.984** |
| Southern Residence | | 1.093 | 1.037 | 1.034 | 1.024 |
| Years of Education | | | 0.949*** | 0.961*** | 0.966*** |
| Average income | | | | 0.265*** | 0.446** |
| Missing income indicator | | | | 0.888 | 0.962 |
| Average Wealth | | | | | 0.739*** |
| Missing wealth indicator | | | | | 0.859 |

* p<0.05, ** p<0.01, *** p<0.001

## Interactions

I also considered interactions between race and measures of socioeconomic status. The literature suggests that, due to structural barriers and discrimination, blacks may be less able to translate improved socioeconomic status into improved outcomes such as neighborhood quality, residential integration with whites, and other factors (Iceland and Wilkes 2006; Charles 2003). The models in Table 6 test whether blacks benefit to the same extent as whites from improved socioeconomic status.

Table 6: Interactions between Race and Socioeconomic Status

| | Model I | Model II | Model III | Model IV |
|---|---|---|---|---|
| *Men* | | | | |
| Black | 1.011 | 1.108 | 1.007 | 0.959 |
| Age at First Survey | 0.992* | 0.993* | 0.992* | 0.992* |
| Southern Residence | 0.988 | 0.993 | 0.986 | 0.988 |
| Years of Education | 1.002 | 0.994 | 1.002 | 1.003 |
| Average income | 0.430*** | 0.449*** | 0.466*** | 0.431*** |
| Missing income indicator | 0.879* | 0.893 | 0.882 | 0.878* |
| Average Wealth | 0.761*** | 0.764*** | 0.756*** | 0.772*** |
| Missing wealth indicator | 0.92 | 0.922 | 0.917 | 0.918 |
| Race * Education | | 1.022* | | |
| Race * Income | | | 0.701 | |
| Race * Wealth | | | | 0.779 |
| *Women* | | | | |
| Black | 1.112* | 1.188** | 1.146* | 1.078 |
| Age at First Survey | 0.984** | 0.984** | 0.984** | 0.984** |
| Southern Residence | 1.024 | 1.027 | 1.023 | 1.027 |
| Years of Education | 0.966*** | 0.953*** | 0.965*** | 0.966*** |
| Average income | 0.446** | 0.455** | 0.424** | 0.443** |
| Missing income indicator | 0.962 | 0.961 | 0.966 | 0.96 |
| Average Wealth | 0.739*** | 0.743*** | 0.744*** | 0.748*** |
| Missing wealth indicator | 0.859 | 0.861 | 0.862 | 0.858 |
| Race * Education | | 1.034* | | |
| Race * Income | | | 1.427 | |
| Race * Wealth | | | | 0.875 |

*Estimates reported are hazard ratios*

* p<0.05, ** p<0.01, *** p<0.001

Model I of Table 6 controls for all non-interaction terms. An interaction between race and education is added in Model II, and the term is significant. The difference in effect of education by race is significant but quite small for men: each additional year of education increases hazards of death by about 1% for blacks, and decreases hazards by about 1% for whites. The difference is greater for women, however: each additional year of education decreases hazards of death by about 2% for blacks, but 5% for whites. This indicates that whites receive a greater benefit from education in terms of mortality reductions than blacks do.

Models III and IV add interaction terms with race and income and wealth, respectively. Neither of these terms are significant for either men or women. This indicates that the effect of income and wealth on mortality operates in the same way for blacks as for whites.

# Conclusions

The results clearly indicate that race has a significant effect on mortality. After including controls, the hazards of mortality among blacks relative to whites are 18% higher for men and 34% higher for women. Controlling for measures of socioeconomic status reduce the magnitude of the effect of race, and render it insignificant for men. This implies that much of the way in which race affects mortality is by structuring the education, income, and wealth of blacks and whites. A direct effect of race remains for women, however, even after controlling for these variables. It appears that either these measures of socioeconomic status do not capture all the class variation for women, or there are additional factors such as barriers to health care or discrimination that lead to higher mortality among black women.

Wealth is also shown to be an important variable in predicting adult mortality. For both men and women, those with higher levels of wealth have lower hazards of dying, even when education and income are held constant. Controlling for wealth also explains an additional portion of the racial gap in mortality for women, revealing another mechanism through which race affects mortality. Furthermore, controlling for wealth reduces the magnitude of the effect of income for both men and women. Failing to incorporate a measure of wealth would result in overestimating the direct effect of race and income on mortality.

Tests of interactions between race and socioeconomic status reveal that the effect of education differs by race. This was true for both genders, although the effect was more substantial for women. This indicates that black women are not receiving the same returns to higher education that white women do. However, interactions between race and income, as well as race and wealth, were not significant. This suggests that increases in income and wealth offer the same reductions in mortality for blacks as for whites.

These results suggest that race and socioeconomic status have important effects on mortality, and that conclusions about the relative importance of each factor depend on the measures of socioeconomic status employed. Wealth offers important additional information about mortality processes, and should be included independently of income. My future research will work to extend these findings about the effects of race and socioeconomic status to an analysis of cause-specific mortality. I will conduct competing risk models to determine whether the effects of race and socioeconomic status differ depending on cause of death. Previous literature suggests that, while the direction of effects is roughly constant across causes, the magnitude of the effect of race and

socioeconomic status, and the presence of interactions, varies substantially by cause (Adler and Rehkopf 2008). Diseases for which mortality is more affected by lifestyle factors or health care are likely to be more influenced by race and socioeconomic status (Howard et al. 2000). The National Longitudinal Studies, with the newly merged mortality data that includes cause of death, provides an excellent opportunity to expand the literature relating to the effects of social status to cause-specific mortality.

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