THE ROLE OF SES IN THE RACIAL STRATIFICATION OF HEALTH
ACROSS THE LIFE COURSE

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A thesis submitted to the faculty at the University of North Carolina at Chapel Hill in partial
fulfillment of the requirements for the degree of Master of Arts in the Department of Sociology.

Chapel Hill
2013

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ABSTRACT

Courtney Elizabeth Boen: The Role of SES in the Racial Stratification of Health across the
Life Course
(Under the direction of Karolyn Tyson)

The racial patterning of socioeconomic status (SES) in the U.S. is a key determinant of racial health disparities, yet critical questions about the role of SES in producing racial health inequality remain. This study examines how various socioeconomic factors—including wealth, duration spent in economic advantage or deprivation, and differential returns to SES—contribute to racial health inequality across the life course. Findings show that, net of income and education, wealth and duration of exposure to economic advantage or deprivation are significant contributors to the Black-White health gap. I also find that Blacks receive fewer health returns to increases in education than Whites, which contributes to the divergence of the health gap with age. These findings suggest that failure to consider wealth, duration of exposure to economic conditions, and differential returns to SES in studies of racial health disparities can result in the residual confounding of race and SES.

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CHAPTER 1

INTRODUCTION

In *Philadelphia Negro: A Social Study* (1899), W.E.B. Du Bois wrote "The most difficult social problem in the matter of Negro health is the peculiar attitude of the nation toward the well-being of the race. There have . . . been few other cases in the history of civilized peoples where human suffering has been viewed with such peculiar indifference." More than 100 years after Du Bois's condemnation of the United States' failure to address racial inequality, stark disparities in health outcomes between Black and White Americans persist. Despite significant public health and medical advances and overall reductions in morbidity and mortality, Blacks in the United States are still more likely than Whites to experience diabetes, cardiovascular disease, disability, and cancer (Farmer and Ferraro 2005; Williams and Collins 1995; Williams 2010). Black Americans live, on average, five years less than Whites, and Black infants are more than two times as likely as White infants to die before their first birthday (Arias 2007).

In the late nineteenth century, Du Bois (1899) claimed that the root causes of Black-White health disparities were social, due chiefly to the "vastly different conditions" in which Blacks and Whites lived and worked. Scholars today continue to recognize the social roots of racial health disparities. In particular, research identifies socioeconomic status (SES) as a fundamental determinant of health, and efforts to understand the causes of racial health disparities have found that some of the observed Black-White gap in health can be explained by racial differences in SES (Hayward et al 2000; Link and Phelan 1995; Williams and Collins

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1995). Accounting for the racial patterning of SES using indicators such as income or education attenuates Black-White health disparities, but disparities persist even after "controlling" for SES. However, research documents that the most widely used indicators of SES—annual income and education—are limited in their ability to capture racial differences in economic advantage and deprivation across the life course (Shuey and Willson 2008; Williams et al. 2010). As a result of the inadequacy of standard SES measures, our understanding of the role of socioeconomic status in producing racial health disparities—as well as racial disparities across other outcomes—is restricted by the potential bias created by the residual confounding of race and socioeconomic status (Kaufman et al. 1997). When studies "control" for SES using limited measures such as annual income or education, researchers are often left with a large portion of the racial health gap unexplained. Scholarly attention then turns to other possible explanatory factors, such as health behaviors or genetics. As explained by Krieger et al. (1997):

> Clarity about links between socioeconomic position, race/ethnicity and gender are important because, absent socioeconomic data, racial/ethnic disparities in health have typically been construed as signs of genetic difference, even at times of cultural inferiority, rather than as powerful clues about how economic forms of racial discrimination, past and present, along with noneconomic aspects of racial discrimination, harm health (348).

This research extends the literature on race, SES, and health by examining the roles of multiple facets of socioeconomic well-being over time in the life course patterning of Black-White health inequality. Using data from the Panel Study of Income Dynamics (PSID), I employ hierarchical growth curve modeling to examine whether Black-White disparities in self-rated health diverge, converge, or remain stable with age and how disparate access to economic capital and differential exposure to economic conditions contribute to the life course patterning of health inequality. By integrating multiple dimensions of SES over time into analytic models of Black-

White disparities in self-rated health, this research improves sociological understanding of the determinants of racial health inequality.

BACKGROUND AND THEORETICAL FOUNDATION

Black-White Health Disparities over Time and across the Life Course

Black-White disparities in health were noted in some of the earliest health records in the United States (see Dubois 1899, Williams et al. 2010). Despite the significant health gains Black Americans experienced in the mid-twentieth century because of the expansion of civil rights, education, employment, housing, and access to medical care, health inequality between Black and White Americans persists. While absolute rates of Black morbidity and mortality have decreased over the past 100 years, the health gap between Blacks and Whites has remained relatively unchanged in recent decades. Satcher et al. (2005) estimates that approximately 83,570 excess deaths each year in the U.S. could be prevented if the Black-White mortality gap was eliminated. While health disparities are observed across other racial groups, the persistence of the Black-White health gap across time remains a puzzle, as well as a critical public health concern (Finch et al. 2008).

In addition to their persistence over time, Black-White disparities in morbidity and mortality can be found across the life course, from birth through late life. In 2006, the infant mortality rate for Black women was 2.4 times that of White women (MacDorman and Mathews 2011). Black children are less likely than their White peers to be in good health (Flores, Olson, and Tomany-Korman 2005), and Black-White disparities in child health span an array of diseases and conditions, including asthma (Akinbami et al. 2009), lead poisoning (Lanphear et al. 1996), and obesity (Hedley et al. 2004). Among adults, stark disparities exist across a range of ailments and illnesses, including cardiovascular disease and cancer, which together account for

two-thirds of deaths in the U.S. In 2006 the death rate from stroke for middle-aged Black women was 3 times higher than the rate for White women of the same age, and middle-aged Black men die of stroke at a rate 3.4 times higher than their White peers (Keenan and Shaw 2011). For all cancers, Black mortality rates are 25 percent higher than White mortality rates (National Cancer Institute 2006). Scholars have characterized Blacks' high rates of morbidity as "first and worst," whereby Blacks experience earlier onset of illness, greater severity of disease, and poorer survival rates (Williams et al. 2010).

While a wide body of research documents that Whites in the U.S. have lower rates of morbidity and mortality than Blacks, fewer studies have examined how racial health disparities vary across the life course. Additionally, because researchers employ a variety of techniques to examine racial inequality across a number of health outcomes, previous studies offer inconsistent findings on whether racial disparities in health diverge, converge, or remain stable as individuals age. Most studies of the life course patterning of health inequality find that Black-White disparities grow over time and diverge with age (Dupre 2007; Shuey and Willson 2008; Willson et al. 2007), providing evidence of the "cumulative advantage hypothesis." Dannefer (2003) defines cumulative advantage as the "systematic tendency for interindividual divergence in a given characteristic (e.g., money, health, or status) with the passage of time" (S327). In racial disparities research, cumulative advantage suggests that racial health inequality grows though middle and late age, as Whites accumulate greater health and economic capital over time relative to Blacks. Other studies find that the racial health gap converges later in the life course, supporting the "age-as-leveler hypothesis." According to this hypothesis, inter-individual health inequality increases through midlife but begins to diminish in early-old age, as both advantaged and disadvantaged groups are affected by biological frailty (House et al. 1994; House, Herd, and

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Lantz 2005). Finally, some studies support the "persistent inequality hypothesis," which holds that inter-individual disparities in health remain constant across the life course, with social, economic, and human capital factors having persistent effects on health from early through late life (Ferraro and Farmer 1996; Brown et al. 2012). Unlike the cumulative advantage and age-as-level hypotheses, the persistent inequality hypothesis suggests that magnitude of the racial disparities remains stable with age.

SES as a Fundamental Determinant of Racial Health Disparities

Because of the strong racial patterning of SES in the United States, efforts to understand racial health disparities must examine the role of SES. Across the life course, movement down the socioeconomic ladder is associated with increased morbidity and mortality. There is no single mechanism linking SES and health, but rather there are numerous interconnected pathways whereby individuals' standards of living, working conditions, neighborhood environments, exposures to stress, and access to health promoting resources either advance or worsen health (Krieger et al 1997; Link and Phelan 1995).

Because of the overrepresentation of Blacks in the lower rungs of the socioeconomic ladder in the US, a wide body of research links Black-White disparities in health to racial differences in SES. Though distinct, race and social class are interrelated and intersecting dimensions of stratification that contribute to disparities in risk exposure, access to resources, and health (LaVeist 2005; Brown et al. 2012). Compared to Whites, Blacks in the United States have lower levels of education (US Census 2012a) and higher rates of unemployment (Bureau of Labor Statistics 2012). Blacks are also more than twice as likely as Whites to live in poverty. In 2009, 12.3 percent of Whites lived below the federal poverty line, compared to 25.8 percent of Blacks (US Census 2012b). Research documents that, because of the racial stratification of

socioeconomic resources in the US, racial health disparities are partially explained by racial differences in SES (Hayward et al 2000; Link and Phelan 1995; Williams and Collins 1995; Williams et al. 2010).

Measuring SES: Income and Education

While socioeconomic factors are widely identified as determinants of racial health disparities, previous research on the association between race, SES, and health has been limited by the inadequacy of standard SES measures to reflect the racialization of the social class structure. Most studies of racial health disparities use annual income or education as proxies for SES, which is flawed in several key ways.

First, annual income is unstable over time and does not reflect long term economic stability or instability. Income levels throughout the life course are incredibly volatile, and most individuals experience several sharp losses and gains in income throughout their lives (Williams and Collins 1995). Research suggests that slightly more than half of the U.S. population will experience poverty at some point in their lives (Rank and Hirschl 1999), but most individuals experience poverty spells of less than four years (Stevens 1999). Of those who become poor, approximately 50 percent exit poverty within a year (Stevens 1999). Duncan (1988) found that while 20-35% of women experienced poverty at least once during a ten year period, just 5-11% of women experienced persistent poverty. In the context of health, the duration of time spent in economic deprivation or advantage shapes trajectories of health. Life course sociologists have documented that, because it affects accumulation of economic and health capital over time, cumulative exposure to economic conditions has a greater effect on health than do temporary or episodic economic states (Williams and Collins 1995; Ferraro and Kelley-Moore 2003). Because of their volatility and short-term focus, measures of annual income are limited in their ability to

reflect persistent economic advantage or disadvantage. In the context of racial stratification, this temporal limitation of annual income is particularly problematic, as Blacks are more likely than Whites to experience long-term economic deprivation (Grieger and Wyse 2008; Iceland 2003).

In addition to annual income, many studies use education as a proxy for SES, which is also problematic in the study of racial inequality. First, research documents that Blacks and Whites receive different levels of economic return for their education (Wilson 2007). Among those with a high school diploma, Blacks earn approximately 85% as much as Whites (US Census 2012c), and the racial gap in wages grows among those with higher levels of education. In 2009, the mean income for Blacks with a Master's degree was approximately 81% of the mean income for Whites with the same level of education (US Census 2012c). Because they mask racial variation in economic well-being, measures of education are limited in their ability to capture SES in racial stratification research. In addition to differential economic returns to education, recent evidence of the "diminishing returns hypothesis" suggests that Blacks may receive fewer health returns to education than Whites (Farmer and Ferraro 2005; Shuey and Willson 2008; Wenzlow, Mullahy, and Wolfe 2004). Scholars have suggested that the stress related to racial bias and discrimination and contextual disadvantages that result from residential segregation may restrict highly educated Blacks from reaching their health potential, relative to their White SES peers (Shuey and Willson 2008; Hayward et al. 2000). Finally, because there is a lack of volatility in education for most adults, using education as a proxy for SES limits researchers' ability to examine how SES affects well-being across the life course. Levels of education are relatively stable for most adults in mid- and late-life, so using education as a proxy for SES restricts our understanding of how changes in SES affect health as people age (Williams and Collins 1995).

What's Missing?: Measures of Wealth and Long-Term Economic Well-Being

While measures of income and education are insufficient in capturing the racialization of SES, previous research indicates that the incorporation of measures of wealth and long-term economic well-being may help us to better understand the role of socioeconomic status in the production of racial health disparities (Braveman et al. 2005; Shuey and Willson 2008). As a measure of SES, wealth better reflects the economic stability, consumption patterns, and ability to absorb economic shocks of individuals and households than do measures of income or education (Spilerman 2000). Wealth, defined here as assets minus debts, reflects ownership of economic assets such property, savings, stocks, bonds, and retirement accounts, but it also accounts for household debt. Several studies have found that, net of income and education, wealth has a positive relationship with health (Hajat et al. 2011, 2010; Robert and House 1996; Wenzlow et al. 2004; Willson et al. 2007). After systematically reviewing the literature on health and wealth, Pollack et al. (2007) concluded that failing to measure wealth in studies of health may result in underestimating the role of SES in health, particularly in the study of racial health disparities.

In terms of health, research suggests that wealth may be particularly important for low-income families, as even a modest amount of wealth can cushion families from economic crises brought on by unemployment or illness. Wealth can allow families to continuing paying rents or mortgages, car payments, and other bills even when wages are temporarily suspended (Spilerman 2000). Similarly, the relationship between wealth and health may be strongest at older ages, as individuals retire and turn increasingly to their accumulated assets to support themselves and their families (Robert and House 1996).

Incorporating measures of wealth into models of racial disparities is particularly important, because while racial gaps in income are extreme, racial disparities in wealth are even larger (Williams and Collins 1995; Oliver and Shapiro 1995). Blacks in the U.S. own 9 cents for every dollar of White wealth (Williams et al 2010), and racial disparities in wealth exist at every level of income and every level of education (Oliver and Shapiro 1995). Among Black households, approximately 61% have zero or negative net financial worth (e.g., their debts equal or exceed their assets), which is almost 2.5 times higher than the percentage for Whites (Oliver and Shapiro 1995). Contemporary racial disparities in wealth reflect both the persistent effects of racially exclusionary public policies in the United States as well as present day racial discrimination. The failure of the Homestead Act to provide land to freed slaves, the widespread use of racially exclusionary lending practices by the Federal Housing Authority through much of the twentieth century, and the exclusion of agricultural and domestic workers from Social Security are just a few examples of institutional policies that prohibited non-Whites in the U.S. from accumulating economic capital (Conley 1999; Oliver and Shapiro 1995). While excluding Blacks, these policies were tremendous wealth generators for White families, as they allowed White families to purchase homes and acquire capital that they could pass on to future generations. In addition to the legacy of racially exclusionary policies, there is also evidence of contemporary racial discrimination in the housing (Galster and Godfrey 2005; Yinger 1986), lending (Bocian, Ernst, and Li 2008; Ladd 1998), and labor (Pager 2003; Kirschenman and Neckerman 1991) markets, which further exacerbates racial wealth inequality.

Research also suggests that including measures of persistent income and wealth over time in analytic models may improve understanding of the role of SES in Black-White health disparities. In contrast to measures of annual income, measures of persistent income and wealth

reflect the duration of exposure to economic deprivation or advantage. Because cumulative exposure to economic conditions impacts the accumulation of health capital across the life course (Williams and Collins 1995; Ferraro and Kelly-Moore 2003), including measures of persistent income and wealth into models of health inequality is critical to understanding how long-term economic deprivation and affluence impact health. Willson et al. (2007) found that, net of the beneficial effects of high annual income, those with persistently high income and persistently high wealth experienced additional health benefits. Similarly, net of the detrimental health effects of low annual income, those with persistently low income and persistently low wealth experienced additional health penalties across the life course. Because Blacks are more likely than Whites to experience long-term economic deprivation (Grieger and 2008; Grodner, Bishop, and Kniesner 2006; Stevens 1999), Black-White differences in duration spent in economic deprivation or advantage may be determinants of racial health inequality.

Research Questions

As described, previous research indicates that SES is a fundamental determinant of racial health inequality, but our understanding of the role of SES in producing Black-White health disparities has been limited by measures of SES that do not fully capture the racialization of the class structure. In particular, studies of racial health disparities generally fail to assess the roles of wealth and duration of exposure to economic conditions in health inequality, and few studies consider whether Blacks and Whites receive different levels of health benefits for increases in SES (Farmer and Ferraro 2005). Additionally, previous research has generally conceptualized economic conditions and health status in static terms by examining mean levels of racial inequality in a cross-sectional manner, rather than examining health and socioeconomic status as dynamic processes that change over time (McDonough and Berglund 2003).

This study extends the literature on race, SES, and health by simultaneously considering multiple facets of SES over time in the production of racial health disparities across the life course. In particular, this study investigates the extent to which Black-White differences in socioeconomic factors—including income, education, wealth, and duration of exposure to economic deprivation and advantage—account for disparities in health levels and rates of change across the life course. In this paper, I address two major research questions: 1) What is the life-course pattern of Black-White disparities in self-rated health (e.g., convergence, divergence, or persistence with age)? and 2) Do Black-White differences in household wealth levels, duration of exposure to economic conditions, and returns to education contribute to the life course patterning of health inequality?

DATA AND METHODS

Data

To examine the role of socioeconomic dynamics over time in producing Black-White disparities in self-reported health, I use data from the Panel Study of Income Dynamics (PSID). PSID is an ongoing, nationally representative, longitudinal study of individuals and their families in the United States that was started in 1968 by the federal government as a way to evaluate the War on Poverty. Because of its focus on poverty, the original study included an over-sample of low-income and African American families. PSID now contains 40 years of prospective life history data for the original families and their decedents. The PSID sample was interviewed annually from 1968 until 1997, when the interview shifted to a biennial design. PSID is a particularly rich source of data for the study of racial health disparities because of its long-term collection of data on employment, income, wealth, education, and health status. The analysis for this project includes data from eight observation points: 1984, 1989, 1994, 1999, 2001, 2003,

2005, and 2007. I selected these waves because they include information on respondents' self-rated health and wealth.

Analytic Sample

My analysis is limited to respondents aged 25 years and older who were listed as household "heads" or "wives" at the time of interview. I limit my sample to Black and White respondents, as PSID did not begin consistently collecting data on representative samples of Latinos or Asians until 1997. In addition, I also restrict my sample to individuals who were interviewed at least three times to avoid problems with estimation (Singer and Willet 2003). To limit the possible effects of reverse causality between SES and health, I exclude individuals who were in poor health at the time of their first interview[1]. Finally, I limit my sample to respondents for whom there is complete data for the variables included in the analysis. My final analytic sample includes 11,329 respondents.

Measures

Self-rated health is the dependent variable in this analysis. PSID asks respondents, "Would you say your health in general is excellent, very good, good, fair, or poor?" I recode this variable so that 1 represents excellent health and 5 represents poor health. As a measure, self-rated health has been validated across racial/ethnic groups (Chandola and Jenkinson 2000) and has been shown to be highly correlated with morbidity and mortality (see Idler and Benyamini 1997 for a review). Using the PSID, McDonough and Amick (2001) found self-rated health to be highly correlated with functional limitations, minor health problems, and work disability. Additionally, self-rated health is useful in measuring health at all ages, whereas measures that reflect illness, disease, and disability are most useful for older ages (Deaton and Paxson 1998).

Because it reflects continuous and underlying changes in health status over time, self-rated health is particularly useful in estimating health trajectories (Shaw and Krause 2002).

In order to more fully understand the role of SES in the production of racial health disparities, I utilize several measures of SES in my analysis. *Education* is a measure of respondents' years of completed education. To improve interpretation, I center my education variable on the sample mean. Because research shows that Blacks and Whites receive different levels of health benefits for education (Shuey and Willson 2008), I also include a race-by-education interaction[2]. *Annual household income,* measured in thousands of dollars, is computed by PSID staff and includes the taxable income of all household members and total transfers to household members in the previous year. I adjust total household income for household size[3] and inflation. In addition, to ensure precedence between income and health, I include income as a lagged measure, so that health at time *t* is affected by income at time *t*-1. *Total household wealth*, which is also computed by PSID staff, indicates a household's net worth and is measured in thousands of dollars. It is the sum of the value of six types of financial assets (farm or other business, savings and checking accounts, real estate, stocks, vehicles, and other assets) net of debts, and includes equity in homes. Because it consists of both assets and debts, the measure of wealth includes both positive and negative values. Similar to income, I adjust wealth for household size and inflation. To account for non-linearities in the relationships between income and health and wealth and health, I include quadratic measures of income and quadratic and cubic measures of wealth[4]. Similar to income, I include wealth as a lagged measure, so that I model health as a function of wealth in the previous wave.

To capture patterns of income and wealth over time, I include measures of both persistent income and persistent wealth, which are also adjusted for household size and inflation. *Persistent*

high income is operationalized as a cumulative proportion of waves in which the respondent is in

the top quintile of the income distribution. *Persistent low income* is defined as the cumulative

proportion of waves in which a respondent is in the bottom quintile of the income distribution. I

operationalize persistent wealth in a similar manner to persistent income. *Persistent high wealth*

is defined as the cumulative proportion of waves in which a respondent is in the top quintile of

the wealth distribution, and p*ersistent low wealth* indicates the cumulative proportion of waves in

which a respondent is in the bottom of the wealth distribution[5].

To assess racial variation in health trajectories, *race* is included as a dummy variable

(1=Black). *Age* is measured in years at the time of each survey and is centered on the grand mean

of the sample. I also include a measure of *quadratic age*, as the effect of age of health trajectories

may be curvilinear. Because research suggests that there are cohort differences in health

trajectories (Willson et al. 2007), I control for *cohort* membership. I construct the cohort measure

by dividing the sample into 10-year cohorts according to year of birth. I also include a control for

sex (1=female). To control for regional variation, I include a dummy variable indicating

residence in the South[6]. Finally, in studies of health inequality, it is essential to consider the

impact of attrition on model estimates. In particular, the bias created by the disproportionate

death of low-SES respondents compared to higher-SES groups may underestimate disparities in

health and could result in findings that show convergence of health trajectories at older ages. For

this reason, I include dummy variables indicating *death* and *non-response* during the survey

period to control for this potential bias.

Analytic Strategy

I estimate changes in individual self-rated health across the life course using hierarchical

growth curve modeling. Growth curve models are hierarchical linear models used to model

changes in individual outcomes over time using longitudinal data (Raudenbush and Bryk 2002).

The data used in estimating growth curve models have two levels: multiple observations at level

1 are nested within individuals at level 2. The use of growth curve models allows me to estimate

models for data that are unbalanced in time (Raudenbush and Bryk 2002), as is the case with the

PSID data. The use of growth curve models allows me to determine whether the health status of

Blacks and Whites begins at different starting points (intercepts) and changes at different rates

(slopes).

At level 1, the health trajectory of respondent i at time t is modeled as a function of time-

varying covariates, including age and SES. The level 1 model is specified as follows:

(Equation 1)

$$health_{ti} = \beta_{oi} + \beta_{1i}\ age_{ti} + \beta_{2i}\ age_{ti}^2 + \beta_{3i}\ educ_{ti} + \beta_{4i}\ income_{ti} + \beta_{5i}\ income_{ti}^2 +$$
$$\beta_{6i}\ wealth_{ti} + \beta_{7i}\ wealth_{ti}^2 + \beta_{8i}\ wealth_{ti}^3 + \beta_{9i}\ persistent\ low\ income_{ti} +$$
$$\beta_{10i}\ persistent\ high\ income_{ti} + \beta_{11i}\ persistent\ low\ wealth_{ti} +$$
$$\beta_{12i}\ persistent\ high\ wealth_{ti} + \beta_{13i}\ education * age_{ti} + \beta_{14i}\ income * age_{ti} +$$
$$\beta_{15i}\ wealth * age_{ti} + e_{ti}$$

At level 1, the coefficient β_{oi} represents the intercept. β_{1i} indicates the linear growth rate of self-

rated health with age, and β_{2i} represents the quadratic growth rate of health with age. The

coefficients β_{3i} - β_{12i} represent the effects of the multiple dimensions of SES—education,

income, wealth, persistently low income and wealth and persistently high income and wealth—

on health. The inclusion of β_{13i} - β_{15i} into the models allows me to test whether the effects of

education, income, and wealth on health vary by age. Finally, e_{ti} represents the random within-

individual error term, which is assumed to be normally distributed with a mean of 0 and a

variance of σ^2.

The individual growth parameters depend on individual characteristics, including race. At level 2, I incorporate time-invariant covariates associated with individuals into the models. The level 2 model is specified as follows:

(Equation 2)

$$\beta_{0i} = \gamma_{00} + \gamma_{01}black_i + \sum_q \gamma_{0q}Z_{qi} + \mu_{0i}$$

(Equation 3)

$$\beta_{1i} = \gamma_{10} + \gamma_{11}black_i + \mu_{1i}$$

(Equation 4)

$$\beta_{2i} = \gamma_{20} + \gamma_{21}black_i$$

(Equation 5)

$$\beta_{3i} = \gamma_{30} + \gamma_{31}black_i$$

In Equation 2, I allow the intercept (β_{0i}) to vary by race ($\gamma_{01}black_i$). I also model the intercept as a function of other time-invariant control variables, including gender, residence in the South, cohort, death, and nonresponse. $\sum_q \gamma_{0q}Z_{qi}$ represents the combined effect of my control variables on the intercept. In Equations 3 and 4, I allow the linear growth rate of health (β_{1i}) and the quadratic growth rate of health (β_{2i}) to vary by race. Finally, in equations 5, I allow the effect of education on health (β_{3i}) to vary by race, which allows me to test whether Blacks and Whites receive differential health returns to education.

RESULTS

Descriptive Statistics

Table 1 displays the summary statistics of all the variables used in the analyses for all waves combined. As presented in Table 1, on average, Whites in the sample have better health and more socioeconomic resources than Blacks. White respondents have higher levels of

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educational attainment than Black respondents (13.44 years vs. 12.22 years, *p*<0.001), and

Whites in the sample earn approximately twice as much in annual income than Black

respondents ($52,375 vs. $26,907, *p*<0.001). Further, Whites own significantly more wealth than

Blacks ($228,772 vs. $41,697, *p*<0.001), with Blacks owning approximately 18 cents for every

dollar of White wealth.

In addition to having lower levels of income and wealth, Black respondents spend more

time in the bottom of the income and wealth distributions than White respondents. Conversely,

White respondents are more likely than Blacks to experience high income and high wealth across

multiple observations. Figure 1 displays the duration of membership in the bottom and top

quintiles of the wealth and income distributions by race. While over 70% of White respondents

remain out of the bottom wealth quintile during the entire survey period, more than one in five

Black respondents are in the bottom quintile of the wealth distribution at every observation. By

contrast, 15% of White respondents are in the top wealth quintile during every observation, while

less than 1% of Blacks experience high wealth in every wave. Few Blacks ever enter it to the top

of the wealth distribution, with nearly 90% of Blacks spending zero observations in high wealth.

A similar pattern emerges for long-term income. 23% of Blacks are in bottom income quintile

during all observations, compared to just 4% of Whites. While more than one in ten Whites have

high income during all observations, more than 80% of Blacks never enter the top of the income

distribution during the entire survey period.

Hierarchical Growth Curve Models

The results of the multilevel models are presented in Table 2. Model 1 is the baseline

model that models the intercept on race and the control variables and models the linear and

quadratic growth rate of health with age on race. In Models 2-6 I introduce SES covariates in a

stepwise fashion. In Model 2 I model the intercept as a function of income and education. Model 3 introduces measures of wealth, and Model 4 includes measures of persistent income and persistent wealth. In Model 5, I test whether Blacks and Whites receive different health returns to education by including a race*education interaction term. Finally, in Model 6 I model the growth rate of health with age as a function of education, income, and wealth. As indicated by the Akaike information criterion (AIC) statistics, the inclusion of additional SES measures in each successive model improves model fit. Likelihood ratio tests also reveal that each successive model provides improved fit over the previous model ($p<0.01$). Taken together, the AIC statistics and likelihood ratio tests reveal that Model 6 provides the best model fit.

As indicated by the positive coefficient for Black in each of the models, Blacks have worse health than Whites. Additionally, in each of the models the coefficient for Black*age is positive but the coefficient for Black*age^2 is negative, indicating that the racial health gap diverges slightly through middle age, but diminishes at older ages. The racial health gaps in the intercept and growth rate are largest in the baseline model (Black=0.449, $p<0.001$; Black*age=0.004, $p<0.001$), where there are no controls for SES. The addition of income and education in Model 2 reduces the racial gap in the intercept and the growth rate. The magnitude of the coefficients for race in the intercept and growth rate is further reduced with the inclusion of measures wealth, persistent income, and persistent wealth in Models 3-5, indicating that racial disparities in wealth and long-term economic well-being contribute to the life course patterning of racial health disparities.

Models 2-6 assess the effects of multiple indicators of SES on health and indicate the extent to which Black-White disparities in SES explain the Black-White health gap. The negative coefficients for education (-0.090, $p<0.001$) and income (-0.0007, $p<0.001$) in Model 2 indicate

that increases in income and education protect against poor health. Additionally, the positive coefficient for income^2 indicates that the relationship between income and health is quadratic, with individuals in the lower-end of the income distribution receiving more health returns to increases in income than individuals at the upper-end of the distribution. The inclusion of income and education in Model 2 reduces the magnitude of the coefficient for both Black and Black*age, revealing that Black-White disparities in income and education account for a portion of the Black-White health gap.

Model 3 introduces measures of wealth, and results show that there is a positive relationship between wealth and health. The negative coefficient for wealth (-0.0002, $p<0.001$) indicates that, net of the beneficial effects of education and income, increases in wealth provide additional protective health benefits. Further, the coefficients for wealth^2 and wealth^3 suggest that the relationship between wealth and health is not linear and that individuals at the bottom and top of the wealth distribution receive the greatest health returns to increases in wealth. The addition of wealth measures to Model 3 reduces the race gap in both the intercept and the growth rate of health with age, net of income and education.

In Model 4 I introduce measures of persistent income and persistent wealth, which capture length of exposure to economic conditions. The positive and statistically significant coefficients for the persistent low income (0.229, $p<0.01$) and persistent low wealth variables (0.240, $p<0.001$) in Model 4 reveal that long-term exposure to economic deprivation has detrimental effects on health, net of the negative health effects of short-term low income and low wealth. On the other hand, the negative and statistically significant coefficients for persistent high income (-0.137, $p<0.001$) and persistent high wealth (-0.189, $p<0.001$) show that the opposite is also true; persistently high income and persistently high wealth protect against poor

health, net of the protective effects of high annual income and wealth. After including the persistent income and wealth measures in Models 4-6, the coefficient for annual income is no longer statistically significant.

In Model 5 I include an interaction for Black*education, which allows me to test whether Blacks and Whites receive differential health returns to education. The positive and significant coefficient for Black*education (0.028, $p<0.001$) indicates that, compared to Whites, Blacks receive fewer health returns to education.

Finally, in Model 6, I model the growth rate of health with age as a function of education, income, and wealth by including education*age, income*age, and wealth*age interaction terms. While findings indicate that the protective effects of income and wealth on health are consistent across the life course, the coefficient for education*age (0.0006, $p<0.01$) reveals that the beneficial effect of education on health is strongest at earlier ages and diminishes with age. According to the AIC statistic, Model 6—which incorporates multiple dimensions of SES, accounts for differential returns to education by race, and allows the effect of SES on health to vary by age—provides the best model fit.

DISCUSSION AND CONCLUSION

Research widely documents that Black-White differences in socioeconomic status are key determinants of health inequality. However, our understanding of the role of SES in the production of Black-White health disparities has been restricted by limited measures of socioeconomic well-being that do not fully capture the racialization of social class. Few studies of health inequality incorporate measures of wealth, and only a handful of studies to date have examined how disparities in duration of exposure to economic conditions contribute to health inequality. Additionally, while a wide body of research documents racial disparities in static

levels of health, this study extends the literature by examining how SES contributes to Black-White disparities in health across the life course. By examining racial inequality in health trajectories using robust measures of economic well-being over time, this research builds upon existing literature to advance sociological understanding of the dynamics of racial stratification across the life course.

Descriptive analyses of the data are consistent with previous research and reveal stark Black-White disparities in both health and SES. Black respondents, on average, report worse health and have fewer years of education, lower incomes, and less wealth than Whites. Additionally, compared to White respondents, Black respondents are more likely to remain in the lower rungs of the income and wealth distributions across multiples waves. By contrast, White respondents are more likely than Black respondents to experience long-term economic advantage.

Results from hierarchical models indicate that, in addition to gaps early in the life course, Black-White disparities in self-rated health grow slightly with age, providing evidence of the cumulative disadvantage hypothesis. In each of the models presented in Table 2, Blacks have worse self-rated than health than Whites in early adulthood, and the gap between Blacks and Whites grows slightly with age. This finding suggests that earlier life advantages and disadvantages compound over time, leading to a divergence of the Black-White health gap with age. The growth rate of the Black-White health gap slows at older ages, however, perhaps due to the greater likelihood of the most disadvantaged respondents to drop out of the survey over time. Further, findings also show that the protective effects of education on health diminish with age, which could contribute to narrowing of the racial health gap at older ages. Nevertheless, results

indicate that, even in old age, significant health disparities between Blacks and White respondents remain.

This study also finds that racial inequality in SES contributes to the life course patterning of Black-White health disparities. Consistent with previous research, I find that accounting for racial disparities in income and education reduces the racial health gap. However, this study advances understanding of the role of SES in the racial stratification of health by revealing that racial disparities in wealth and duration of exposure to economic conditions also contribute to Black-White disparities in self-rated health, net of income and education. While controlling for income and education in Model 2 reduced the gap from the baseline model, the gap was closed even further by the addition of wealth and patterns of income and wealth over time in Models 3 and 4. From Model 2 to Model 4, the race gap in the intercept decreased by approximately 42%. From the baseline Model 1 to the fully adjusted Model 6, the race gap in the intercept decreased by approximately 57% and the race gap the linear growth rate decreased by 25%. These findings indicate that, net of income and education, wealth and duration of exposure to economic conditions contribute to the life course patterning of Black-White health disparities.

A wide body of research documents the beneficial on wealth on health (Pollack et al. 2007; Hajat et al. 2011, 2010; Robert and House 1996; Wenzlow et al. 2004), as wealth provides economic security to individuals and enhances the ability of households to absorb economic shocks (Spilerman 2000). Further, Black-White disparities in wealth are greater than disparities in income or education, with Blacks in the U.S. owning approximately 9 cents for every dollar of White wealth (Oliver and Shapiro 1995). This study demonstrates that wealth has protective health benefits above and beyond income and education and that the racial wealth inequality explains a portion of the Black-White gap in self-rated health.

In addition to wealth, life course sociologists have documented the importance of duration of exposure to economic conditions for health (Evans and Kim 2007; Power, Manner, and Matthews 1999), yet few studies have examined the role of long-term economic conditions in the life course patterning of Black-White health disparities. This study applies the life course concept of duration to the study of Black-White disparities in self-rated health, and results show that Black-White differences in duration of exposure to economic conditions contribute to Black-White health inequality. Blacks spend more time in economic deprivation and less time in economic advantage than Whites, which contributes to the Black health disadvantage. Taken together, these findings on wealth, long-term economic well-being, and health suggest that, in order to fully understand the role of SES in Black-White health inequality across the life course, research must consider the effects of wealth and persistent income and wealth over time on health. Studies of racial inequality that adjust for SES using measures of education and annual income risk underestimating the role of SES in racial health disparities and confounding race and SES.

Results also show that the effect of education on health varies by race, with Blacks benefiting less from increases in education than Whites. In fact, results indicate that Black-White health disparities are greater among more highly educated Blacks and Whites than among less educated individuals. One possible explanation for differential returns to education is that increases in education do not translate into increases in income and wealth in the same way for Blacks as for Whites (Shuey and Willson 2008). Lynch (2006) found that much of the effect of education on health is mediated through its impact on income, as income affords individuals the ability to afford material resources that are beneficial to health. Additionally, a wide body of research documents that, even among individuals with similar qualifications, Blacks job

candidates are less likely to be offered jobs (Pager 2003; Kirschenman and Neckerman 1991) and Black workers earn less in wages (Huffman 2004; Grodsky and Pager 2001) than their White counterparts. In this way, the structural barriers Blacks face in the labor market may result in differential health returns to education by restricting the ability of Blacks to translate higher levels of education into higher earnings in the same way as Whites. The findings presented here indicate, however, that Blacks receive fewer health returns to education, even after adjusting for income, wealth, and long-term economic well-being. Figure 2 shows the health trajectories of Blacks and Whites by level of education after adjusting for multiple facets of socioeconomic well-being. As seen, the health gap between Whites with a college degree and Whites without a college education is greater than the gap between college-educated Blacks and Blacks without college degrees, indicating that the health benefits received from education are greater for Whites than for Blacks, net of the economic benefits associated with higher education. In addition to income and wealth disparities between more highly educated Blacks and Whites, research suggests that higher SES Blacks may perceive higher levels of racial discrimination than lower SES Blacks (Forman 2003; Weitzer and Tuch 2002). Research finds that racial discrimination in interpersonal interactions and institutional settings may contribute to the Black health disadvantage (Williams, Neighbors, and Jackson 2003; Williams 1999), as experiences with discrimination can lead to heightened physiological stress response and, thus, poorer health. While the mechanisms producing differential returns to education are not explored in present study, the findings here suggest that using education alone as a proxy for SES may be problematic in the study of racial health inequality, as the health benefits of education are not consistent across racial groups.

This study is not without limitations. First, because of data limitations, respondents in this study are not observed until early adulthood, resulting in left censoring. As a result, findings presented here likely underestimate Black-White disparities in both SES and health, as Blacks are more likely to experience economic disadvantage and mortality in early life. For this reason, findings should be interpreted as conservative. Additionally, because they are included as cumulative proportions, the persistent income and wealth measures also do not fully capture the ways in which duration of exposure to economic conditions affects health. For example, in this study, respondents who were in the bottom quintile of the wealth distribution for six of eight waves are treated the same as individuals who are poor for three of four waves. Future research should integrate more sensitive measures of persistent income and wealth into models of health inequality, as this study finds these measures to be critical determinants of Black-White disparities in health. Finally, because of data restrictions, this study uses self-rated health as the dependent variable of interest. Although self-rated health has been shown to be highly correlated with physical health and mortality risk (Idler and Benyamini 1997; McDonough and Amick 2001), future research should consider examining trajectories of Black-White disparities in health using objective measures of physical well-being.

While results indicate that the racial patterning of SES accounts for a substantial portion of the Black-White gap in self-rated health, disparities between Blacks and Whites remain even after adjusting for SES. The Black-White health gap that persists in the fully adjusted model suggests that other unmeasured factors play a role in Black-White health disparities. Research suggests that the stress related to perceived racial discrimination may contribute to racial disparities in health (Bratter and Gorman 2011; Williams and Mohammed 2009). Additionally, research documents that, even after controlling for individual-level SES, individuals living in

predominately Black neighborhoods have greater exposure to environmental toxins and crime

and less access to health promoting resources such as healthy food, green space, and medical

care than those living in predominately White neighborhoods (Williams and Jackson 2005;

Williams and Collins 2001). While this study focused on the ways in which racial differences in

individual-level SES contribute to health inequality, there are undoubtedly other unmeasured

factors, such as racial discrimination and residential segregation, that contribute to the Black-

White gap in health.

Despite the significant economic and educational gains of Black Americans in the post-

Civil Rights era, the findings presented here highlight that the Black-White health gap continues

to be a critical social problem. In addition to supporting the idea of SES as a fundamental

determinant of Black-White health inequality, my findings also find that high SES does not

necessarily translate into equal health advantage for all racial groups. As indicated in Figure 2,

even after adjusting for income, wealth, and long-term economic well-being, college-educated

Blacks have similar levels of self-rated health as Whites without a college-degree. Regardless of

the SES indicator employed, I find that Blacks experience poorer health than their White social

class peers. This research supports the idea of race and class as intersecting but distinct systems

of oppression that shape the lived experiences of individuals throughout the life course. In order

to fully understand the role of economic inequality in Black-White health disparities, researchers

should continue to develop and employ robust measures of socioeconomic well-being that reflect

the racialization of the social class structure. In addition, research should also examine how non-

economic forms of racial discrimination in interpersonal and institutional settings contribute to

the Black health disadvantage.

ENDNOTES

[1] A total of 14,940 respondents were identified as Black or White household heads or wives over the age of 25. 1,611 respondents were excluded from the sample because they had fewer than three observations or because they were in poor health at the time of their first interview, resulting in a final analytic sample of 13,329.

[2] I also tested whether Blacks and Whites received different health returns for increases in income and wealth, by including interaction terms for Black*income and Black*wealth, respectively. Consistent with Shuey and Willson (2008), I find that these interaction terms are not significant and that Blacks and Whites receive similar returns to income and wealth. As a result, I exclude these measures from my models.

[3] I used the following formula to adjust for family size: adjusted income = income/family size^e, where e is the equivalence elasticity, which can be set at a value ranging from 0 to 1. I set e to 0.55, which is the average summary elasticity measure for scales used to determine social benefit eligibility (Buhmann et a. 1988). I use the same formula to adjust household wealth for family size (adjusted wealth = wealth/family size^e).

[4] I tested a number of polynomial forms of income and wealth. The models with linear and quadratic forms of income and linear, quadratic, and cubic forms of wealth provided the best fit to the data.

[5] I ran models operationalizing persistent income and persistent wealth a number of different ways (i.e., dummies for the cumulative number of waves in which the respondent was low/high income and low/high wealth). The different operationalizations of the variables provided substantively similar results, and I ultimately decided to include my persistent income and wealth measures as a cumulative proportion, as this was the most parsimonious.

[6] In earlier analyses I tested for regional variation in health. However, the South was the only US region to have a statistically significant, negative association with health, so I chose to only include a control dummy for living a majority of waves in the South.

Table 1. Sample Descriptive Statistics

	Full Sample (n=11,329)		Whites (n=7,844)		Blacks (n=3,485)		
	Mean/Proportion	SD	Mean/Proportion	SD	Mean/Proportion	SD	p-value[a]
Gender (female=1)	0.54	0.50	0.52	0.50	0.61	0.49	<0.001
Age (in years)	46.29	14.35	47.22	14.86	43.99	12.71	<0.001
Self-rated health (5=poor)	2.39	1.04	2.28	1.01	2.69	1.05	<0.001
Years of education	13.09	2.41	13.44	2.35	12.22	2.33	<0.001
Total household income	45,012	60,620	52,375	69,175	26,907	21,988	<0.001
Total household wealth	174,685	694,870	228,772	810,089	41,697	177,838	<0.001
Persistent low income[b]	0.20	0.31	0.12	0.23	0.39	0.38	<0.001
Persistent high income[b]	0.20	0.30	0.26	0.32	0.06	0.17	<0.001
Persistent low wealth[b]	0.20	0.31	0.12	0.25	0.38	0.37	<0.001
Persistent high wealth[b]	0.20	0.33	0.27	0.36	0.03	0.12	<0.001
Death (1=died)	0.06	0.23	0.06	0.23	0.06	0.23	0.251
Nonresponse (1=nonresponder)	0.05	0.23	0.05	0.22	0.07	0.25	<0.001
Residence in South (1=South)	0.42	0.49	0.31	0.46	0.70	0.46	<0.001

[a]: p-value provided for the difference between Blacks and Whites; two-tailed test

[b]: though included as a time-varying covariate in the multilevel models, proportion of waves in which respondent was high/low income/wealth was calculated at respondent's last observation for the descriptive statistics

Table 2.   Hierarchical Growth Curve Models

	Parameter	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effects Parameters							
For Intercept							
Intercept	γ_{00}	-5.085***	-5.021***	-4.989***	-2.495*	-2.318*	-2.337*
		(0.959)	(0.998)	(0.995)	(0.983)	(0.983)	(0.983)
Race (Black=1)	γ_{01}	0.449***	0.335***	0.324***	0.185***	0.194***	0.193***
		(0.018)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)
Education	γ_{30}		-0.090***	-0.089***	-0.067***	-0.076***	-0.076***
			(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Income	β_4		-0.0007***	-0.0006***	-0.0001	-0.0001	-0.0002
			(9.20e-05)	(9.50e-05)	(0.0001)	(0.0001)	(0.0001)
Income^2	β_5		1.51e-07***	1.38e-07***	3.44e-08	3.34e-08	4.03e-08
			(2.77e-08)	(2.79e-08)	(2.87e-08)	(2.87e-08)	(2.97e-08)
Wealth	β_6			-0.0002***	-7.77e-05***	-7.65e-05***	-8.83e-05***
				(1.90e-05)	(2.01e-05)	(2.01e-05)	(2.10e-05)
Wealth^2	β_7			1.86e-08***	9.69e-09***	9.57e-09***	1.00e-08***
				(2.59e-09)	(2.69e-09)	(2.69e-09)	(2.72e-09)
Wealth^3	β_8			-4.80e-13**	-2.58e-13**	-2.55e-13*	-2.70e-13**
				(7.77e-14)	(7.98e-14)	(7.98e-14)	(8.04e-14)
Persistent low income	β_9				0.229***	0.239***	0.237***
					(0.023)	(0.023)	(0.023)
Persistent high income	β_{10}				-0.137***	-0.128***	-0.123***
					(0.023)	(0.024)	(0.024)
Persistent low wealth	β_{11}				0.240***	0.244***	0.240***
					(0.022)	(0.022)	(0.022)
Persistent high wealth	β_{12}				-0.189***	-0.185***	-0.187***
					(0.026)	(0.026)	(0.026)

Black*education	γ_{31}					0.028***	0.027***
						(0.007)	(0.007)
For Growth Rate with Age							
Intercept	γ_{10}	0.023***	0.021***	0.022***	0.025***	0.025***	0.024***
		(0.0005)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Black	γ_{11}	0.004***	0.004**	0.003**	0.003*	0.004*	0.004***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Education	β_{13}						0.0006**
							(0.0002)
Income	β_{14}						4.08e-06
							(5.45e-06)
Wealth	β_{15}						6.17e-07
							(5.58e-07)
For Quadratic Growth Rate							
Intercept	γ_{20}	0.0002***	0.0002***	0.0002***	0.0001***	0.0001***	0.0001***
		(2.22e-05)	(2.76e-05)	(2.75e-05)	(2.77e-05)	(2.77e-05)	(2.83e-05)
Black	γ_{21}	-0.0002***	-0.0003***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
		(4.71e-05)	(5.83e-05)	(5.82e-05)	(5.81e-05)	(5.82e-05)	(5.84e-05)
Control Variables							
Gender (female=1)		0.141***	0.115***	0.116***	0.088***	0.086**	0.087***
		(0.014)	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)
Cohort		0.004***	0.004***	0.004***	0.002***	0.002***	0.002***
		(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)
South		0.089***	0.069***	0.068***	0.073***	0.073***	0.074***
		(0.0153)	(0.0156)	(0.0156)	(0.0153)	(0.0153)	(0.015)
Death		0.241***	0.205***	0.199***	0.239***	0.241***	0.248***
		(0.035)	(0.036)	(0.036)	(0.035)	(0.035)	(0.035)
Non-response		-0.038	0.028	0.027	-0.012	-0.008	-0.002
		(0.028)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)

Random Effects – Variance Components

Level 1: within-person	σ^2	0.652***	0.641***	0.641***	0.641***	0.641***	0.641***
Level 2: in intercept	$r_{\mu 0}$	0.673***	0.649***	0.647***	0.626***	0.625***	0.625***
Level 2: in growth rate	$r_{\mu 1}$	0.024***	0.023***	0.023***	0.023***	0.023***	0.023***

Goodness of Fit

|						
Log likelihood[a]	-74319.31***	-60633.21***	-60599.69***	-60342.88***	-60334.28***	-60328.58***
AIC (smaller indicates better model fit)	148669	121302	121239	120734	120719	120713

Note: N=11,329; 51,230 observations. Standard errors in parentheses.

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

[a]: p-values (*p<0.05, **p<0.01, ***p<0.001) indicate that, for each model, model fit is significantly improved compared to the unconditional model. Additionally, likelihood ratio tests indicate that each successive model provides improved fit over the previous model (p<0.01).

Figure 1. Duration of membership in the bottom and top wealth and income quintiles[a], by race
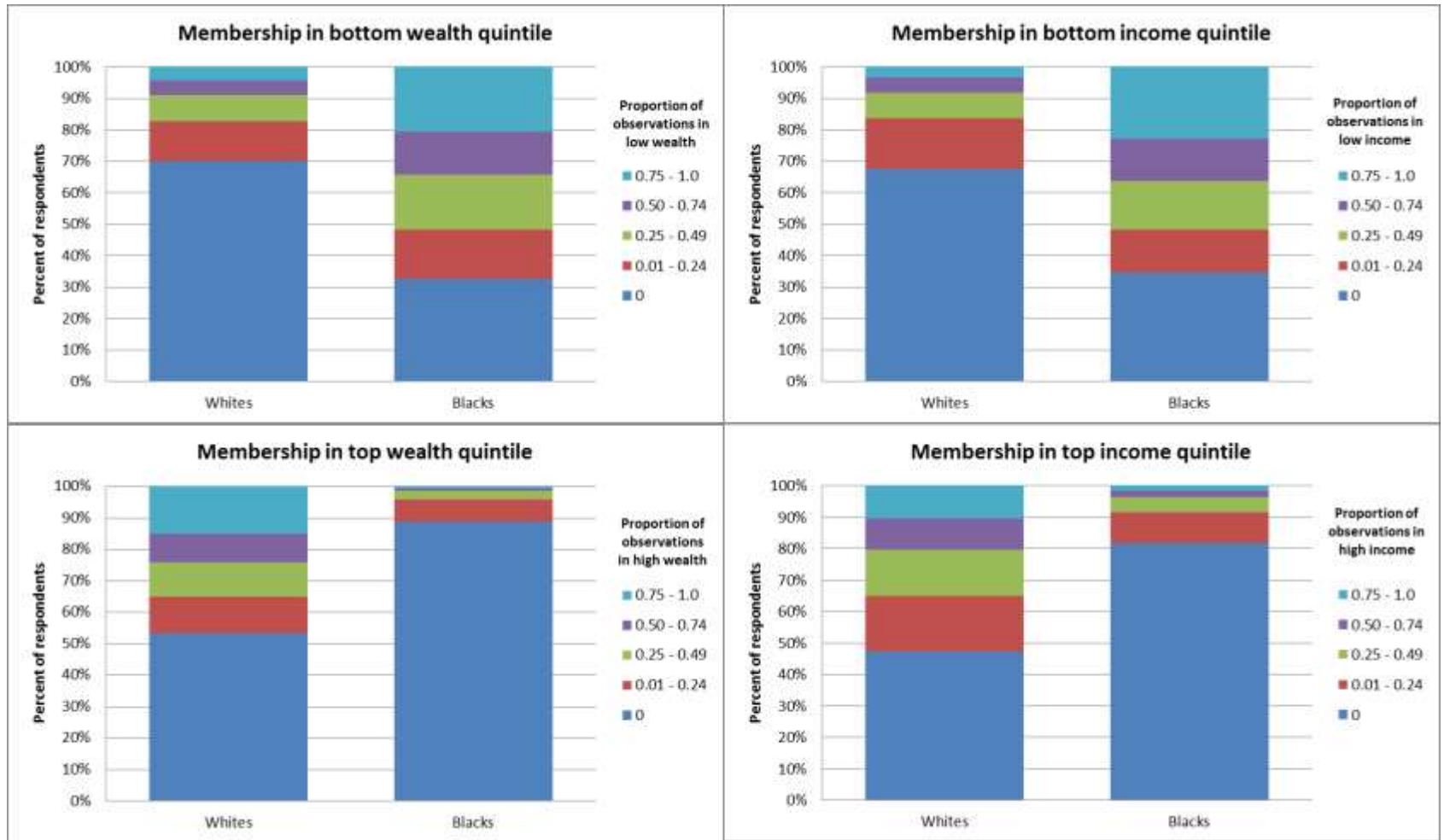
Note: N=11,329; Pearson chi-square statistics indicate the association between race and each of the persistent income/wealth measures is statistically significant ($p<0.001$).
[a]: though included as a time-varying covariate in the multilevel models, the proportion of waves in which respondent was high/low income/wealth was calculated at respondent's last observation for the descriptive statistics

Figure 2. Predicted trajcetories of self-rated health with full SES adjustment, by race and education
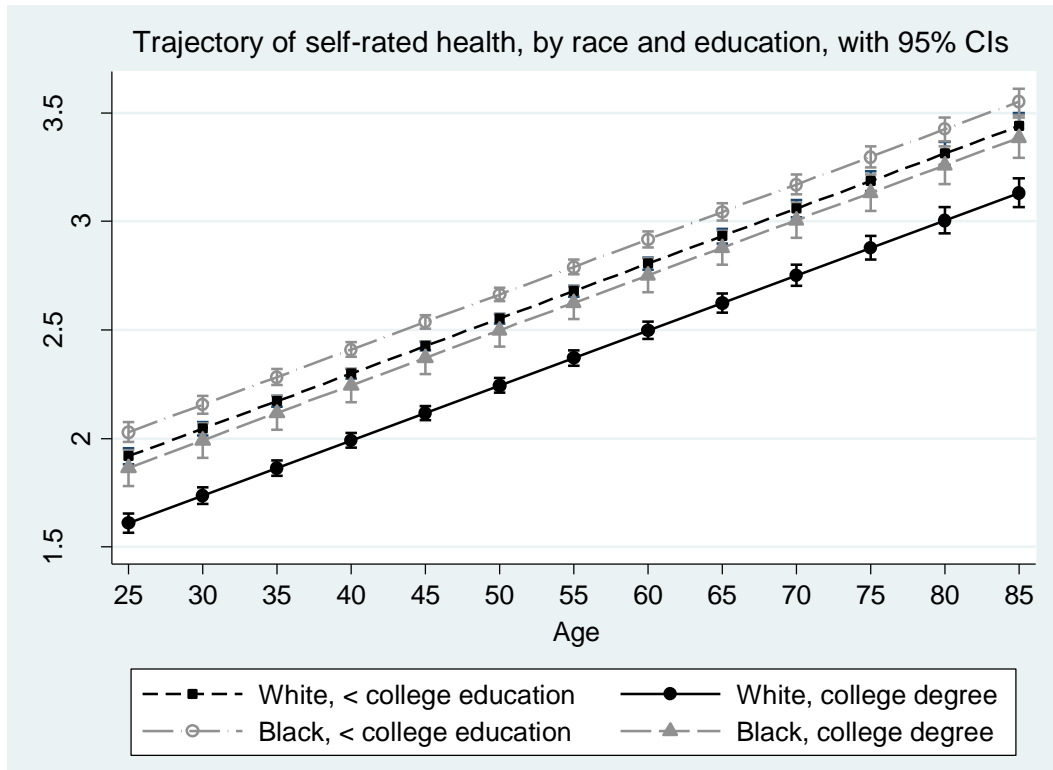
Note: N=11,329; predicted trajectories based on Model 6 of Table 2.

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