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Cross race comparisons between SES health gradients among African-American and white women at mid-life

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Abstract

This study explored how multiple indicators of socioeconomic status (SES) inform understanding of race differences in the magnitude of health gains associated with higher SES. The study sample, 1268 African-American women and 2066 white women, was drawn from the National Longitudinal Surveys of Youth 1979. The outcome was the Physical Components Summary from the SF-12 assessed at age 40. Ordinary least squares regressions using education, income and net worth fully interacted with race were conducted. Single measure gradients tended to be steeper for whites than African-Americans, partly because “sheepskin” effects of high school and college graduation were higher for whites and low income and low net worth whites had worse health than comparable African-Americans. Conditioning on multiple measures of SES eliminated race disparities in health benefits of education and net worth, but not income. A discussion of current public policies that affect race disparities in levels of education, income and net wealth is provided.

Background

Health differences by socioeconomic status (SES) and race have been widely documented in the United States. Gradients in health are seen among African-Americans and non-Hispanic whites by income, education, occupation and wealth (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Daly, Duncan, McDonough, & Williams, 2002; Pollack et al., 2013). Link and Phelan have argued that SES is a fundamental cause of disease because it embodies access to important resources, affects multiple disease outcomes through multiple mechanisms, and maintains an association with disease even when intervening factors change (Link & Phelan, 1995). Despite the recognition of the importance of SES to health there are limitations in much of the SES health literature (Braveman et al., 2005). Choice of SES measure is often driven by data availability and rarely is consideration given to the

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mechanisms operating between the measures and the health outcome of interest (Braveman et al., 2005). There is evidence that different measures of SES are only partially correlated and that different measures captures different facets of how SES impacts health (Adler & Newman, 2002; Braveman et al., 2005). For example, research has shown that education predicts the onset of both functional limitations and chronic conditions better than income, but income is more strongly associated with their progression (Herd, Goesling & House, 2007). It is widely recognized that income is a major component of SES that influences health through access to material resources. Higher income affords access to higher quality food, better housing, and health care (Adler & Newman, 2002). Education is also used as a measure for SES because it is correlated with income through higher wages and employment. But the correlation between health and education is strengthened because unmeasured individual characteristics associated with better health lead a person to seek more education, including cognition, motivation and interpersonal or social skills. Higher cognitive skills, coupled with motivation, lead people to adopt health promoting behaviors, such as abstaining from tobacco, regular exercise, and good nutrition (Currie, 2009). Motivation and interpersonal skills are important for maintaining family stability and developing a sense of control over one's life which are health promoting (Daly et al., 2002). Wealth, measured by net worth (total assets minus debt), has been used less often as a measure of SES because data collection is complex and people are often reluctant to provide information on their net worth (Cubbin et al., 2011; Warner & Brown, 2011; Pollack et al., 2007). Positive net worth provides families with economic security that impacts health by reducing stress. It allows people to purchase homes in safe neighborhoods, purchase reliable means of transportation, and provides a financial buffer in the face of job loss, medical emergencies and other adverse contingencies. Positive net worth impacts the health of future generations by allowing families to move to neighborhoods with good schools and pay college tuition for children. Net worth may capture power and social position more accurately than income or education, particularly for older people who are on fixed incomes. The race gap in net worth is one of the primary reasons that racial inequality persists across generations (Shapiro, 2004). There is growing support for the use of multiple measures of SES in health research driven by recognition that different measures operate through different mechanisms driving and maintaining the relationship between SES and health.

Racial differences in health, especially differences between African-Americans and whites, are well known. There is great interest in understanding the effects of both race and SES on health (Braveman et al., 2010; Kawachi, Daniels, & Robinson, 2005; Olshansky et al., 2012). Multiple dimensions of SES are particularly important in studies considering race differences in health because race is easily confounded with race differences in distributions of SES measures. Studies that combine race and SES tend to categorize SES and examine race differences in health within a category. For example, comparisons across race showed that African-Americans had worse outcomes on multiple indicators of health than whites at each level of education (Braveman et al., 2010). This study compares differences across race in single measure SES gradients in health and explores whether these race differences are attenuated by including multiple measures of SES in the gradient. The specific aims of this research are:

1. To compare the magnitude of gains in health associated with higher SES (education, income and net worth) between African-American and non-Hispanic white women in middle age.
2. To test whether and how race differences in the effects on health of single measures of SES are attenuated when multiple measures of SES are included.

This paper builds on the relatively new literature, exemplified by Pollack et al. (2013), that examines how multiple measures of SES can be used to enhance understanding of socioeconomic gradients in health. Pollack et al. (2013) examined education, income and net worth gradients in self-reported health *within* race using race-specific cut points for percentiles of income and net worth categories. In contrast, this paper is primarily concerned with comparisons of SES gradients *across* race using race-invariant measures of SES. It examines physical health at midlife, measured by the physical component summary (PCS), derived from the 12 item Short Form survey (SF-12), among African-American and non-Hispanic white women at mid-life (approximately 40 years old). The mid-life period was selected because health differences between African-American and white women become more pronounced as they age (CDC, 2011). Geronimus et al. (2007, 2010) developed the “weathering hypothesis” to explain why health appears to deteriorate with age at a faster rate for African-American women than white women. While we do not test this theory directly, it supports the choice of study population used in this paper. We limit the analysis to women to avoid complications attributable to known physiological differences between males and females (Hosseinpoor, Williams, et al., 2012; Towfighi, Markovic, & Ovbiagele, 2011) and because there is growing recognition that the intersection of race, SES and gender identifies groups with unique experiences of disadvantage (Read & Gorman, 2006; Warner & Brown, 2011). The study used the National Longitudinal Surveys of Youth 1979 (NLSY79) because of its considerable strength in the collection of SES data over the life course.

Methods

Sample

Data were drawn from the 1979–2006 waves of the U.S. based NLSY79, a widely used, publicly available data set that includes a representative sample of individuals born between 1957 and 1964 as well as an oversample of African-Americans (Miller, 2004). The cross-sectional sample of white and African-American females and the oversample of African-American females were used in the study. Surveys were conducted annually between 1979 and 1994 and biennially thereafter. The Health at 40 module forms the basis for data on health at midlife, which was administered between 1998 and 2006 during the first interview after the respondents turned 40 years of age.

The NLSY79 included 1471 African-American women and 2488 non-Hispanic white women when it was first fielded. Thirty-nine African-Americans and 47 whites died before they turned 40, so the eligible sample was 1432 African-American women and 2401 white women. Of these, 126 African-Americans and 298 whites did not go through the Health at 40 Module. An additional 38 African-Americans and 37 whites did not have valid responses to the other variables used in the analysis (education, income, net worth). The study sample

of 1268 African-American women represented 89% of the eligible sample. The study sample of 2066 white women represented 86% of the eligible sample. The potential for sample selection bias due to attrition was considered by comparing the education, income and net worth between race-specific study samples and the excluded samples. Standard statistical tests did not detect significant differences for either African-Americans or whites. The Ohio State University Institutional Review Board approved the study.

Measurement

Dependent measure

Physical component summary (PCS): The PCS is a subscale of the SF-12, a generic health survey based on the SF-36 developed by Rand for the Medical Outcomes Study (Ware, Kosinski, & Keller, 1996). PCS is based on questions about physical functioning (e.g., ability to do moderate activities), limitations due to physical problems (e.g., accomplished less than you want), physical pain (e.g., interfering with work) and general health perception (poor, fair, good, very good or excellent). Scores are normed, with a mean of 50, range from 0 to 75, and standard deviation of 10 (Ware et al., 1996). Higher scores indicate better health. The PCS has been shown to replicate the SF-36 PCS in differentiating the health status of persons, including women, with varying symptoms and acute conditions (Ware et al., 1996). Changes in PCS were also predictive of mortality in middle aged women (Kroenke, Kubzansky, Adler, & Kawachi, 2008). We report results using the continuous PCS because R^2 s attached to the regressions allow assessment of the explanatory power of SES.

Dichotomous measure of health perception: For purposes of comparison we replicated results from the PCS using only the component based on health perception. An indicator variable was created that took a value of 1 if health was reported as excellent/very good/good and 0 if it was fair/poor.

Independent measures

Race: Race was recorded by the interviewer during the initial interview. This value was cross checked against a question asked in subsequent interviews allowing women to self-identify race/ethnicity. Of women who were classified as African-American (white) during the initial survey, 99% (97%) self-identified accordingly.

Education: The NLSY79 reports the highest grade ever completed for each respondent. They also report whether 12 years of completed schooling represents a Graduate Equivalency Degree (GED) or a high school diploma. Five educational categories were created: 1) High school dropout; 2) GED; 3) High school diploma; 4) Some college, but no college degree; and 5) College graduate.

Average family income age 30 to 39: During each interview the NLSY79 combined all sources of income, including transfer income, to create a variable for before-tax family income. The Consumer Price Index (CPI) was used to deflate income to constant 2010 dollars. Income was averaged across all years when the respondent was 30–39 years of age. Average income provided a better representation of long term purchasing power than a

single year of income because it smoothed yearly fluctuations that were transitory. The measure did not include income when the respondents were in their 20's because educational attainment confounds income during these ages. In the regressions the natural log of income was used to account for non-linearities in the income gradient in health.

In separate figures showing the distribution of income by education, income was grouped into 5 categories with cut points defined by approximations to percentiles of the 2002 family income distribution measured in constant 2010 dollars (US Census Bureau, 2013). The year 2002 was selected because that was the average year in which the Health at 40 Module was administered. The 5 categories were: 1) \$1–\$15,000 (below the 20th percentile for African-American families); 2) \$15,001–\$31,000 (above the 20th percentile for African-American families and below the 20th percentile for non-Hispanic white families); 3) \$31,001–\$62,000 (above the 20th percentile for white families and below median income for all families); 4) \$62,001–\$95,000 (between the 50th and 80th percentile for all families); 5) greater than \$95,000 (above the 80th percentile for all families).

Average net worth age 30 to 39: The NLSY79 created a variable for family net worth from detailed questions about the value of specific types of assets and debts during various waves of the survey. Net worth is the difference between the total value of assets and debt. This study used net worth data from the 1987–1990, 1992–1994, 1996, 1998, 2000, and 2004 interviews deflated to constant 2010 dollars and averaged over each interview that occurred during the woman's 30's. Preliminary analyses suggested that individuals with negative net worth were similar to those with zero net worth in terms of education, income and PCS. Since most forms of debt, with the exception of student loans, can be mitigated by bankruptcy, there is some inherent logic in collapsing all non-positive net worth as a single category. In regressions, the natural log of net worth was used with all non-positive values of net worth set to \$1.

Population net worth percentiles differ by data source due to differences in sample age and race/ethnic composition. The Survey of Consumer Finance (Federal Reserve, 2010) does not report for non-Hispanic whites and the Panel Study of Income Dynamics (Gittleman & Wolff, 2004) does not report on groups aged 30–39. Therefore, in figures for distribution of net worth by education, within-sample cut points were used to define six net worth categories- one for non-positive net worth and five based on percentiles of African-American and white distributions of positive net worth: 1) \$0; 2) \$0–2,000 (below African-American 20th percentile); 3) \$2,000–\$12,000 (20th–50th African-American percentiles); 4) \$12,000–72,000 (median African-American to median white net worth); 5) \$72,000–\$200,000 (50th–80th white percentiles); 6) net worth>\$200,000 (above 80th white percentile).

Additional measures: Additional measures of SES representing marital history prior to age 40 and teen child bearing. Indicators were created for whether the woman was: (1) never married; (2) married once and never divorced; (3) divorced at least once (reference category). An indicator variable was also created for whether the woman bore a child at age less than 20 years.

Analysis

The analysis began by examining summary statistics for the study sample. P-values for race differences were reported based on t-tests for continuous variables, median regression for medians, and χ^2 tests for categorical variables. The race-specific distributions of income and assets by education category were described in figures representing bar graphs using categories of income and assets. SES gradients in PCS were estimated using ordinary least squares (OLS). Gradients were estimated separately for education in categories, natural log of income and natural log of net worth. A fourth gradient was estimated using all three measures together. All regressions had full interactions with an indicator for African-Americans to provide an estimate of the African-American differential in PCS for each of the SES variables. The equation with African-American interactions was

$$y_i = \alpha + AA_i\delta + X_i\beta + AA_i * X_i\gamma + \epsilon_i,$$

where y_i was the PCS for the i^{th} individual, X_i was a vector of indicators for SES, AA_i was an indicator taking value one only if the i^{th} individual was African-American and ϵ_i was an i.i.d. error term. The parameter α represented the intercept term for whites and δ represented the difference in the intercepts between African-Americans and whites. The implied intercept for African-Americans was $\alpha + \delta$. The slope parameters β represented the SES gradient for whites and γ represented the difference between the African-American and white slopes, from which the African-American slope $\beta + \gamma$ was calculated. In the fully interacted linear model with continuous regressors, the race difference in the intercept terms does *not* represent an “unexplained race differences in PCS.” Each race-specific intercept adjusts so that the regression line runs through the means of all the variables. A steeper slope may imply a smaller intercept and vice versa. We report race differences in mean PCS for the lowest category of income and net worth to aid interpretation of race differences in intercepts. Education gradients were based on education categories. F-tests of the equality of coefficients on adjacent categories were used to determine statistical significance of the incremental gain from attaining a higher education level. All analyses were conducted in STATA 12.0. To facilitate understanding of the nature and statistical significance of the race differences, we reported the race-specific intercept and slope terms with confidence intervals, calculated using STATA’s *lincom* procedure for African-Americans, as well as the coefficients with confidence intervals on the race difference in intercepts and slopes. Finally the average marginal effect of being African-American was calculated for each of the models.

In order to assess robustness of the results, four additional regressions fully interacted with race were run: (1) PCS was regressed against indicators for marital history and an indicator for teen childbearing, controlling for education, income and net worth, to assess whether these additional markers explained more of the variance in PCS; (2) PCS was regressed against hypertension and diabetes as the only regressors to assess the explanatory power of these proximal conditions for purposes of comparison with the explanatory power of SES variables; (3) PCS was regressed against education, income, net worth, hypertension and diabetes to assess whether the explanatory power of SES variables was altered by inclusion of the proximal conditions; (4) A logistic regression with health perception of excellent/very

good/good as the dependent variable was run controlling for education, income and net worth for purposes of comparison with the PCS results

Results

Table 1 reports summary statistics. About 80% of African-American women in the sample had income below the 2002 population median of \$62,000. An even greater difference was seen in net worth. White women's mean net worth was approximately 5 times greater than African-Americans' and median net worth was 6 times greater. The race-specific correlations between education measured continuously and family income were 0.30 for both races. The correlations between education and family net worth were 0.23 for both races. However, the correlation between income and net worth was lower for African-Americans (0.36) than whites (0.47).

Figure 1 displays the race-specific income distributions by education category. As the correlations suggested, there were more women in the higher income categories and fewer in the lower income categories as education increased. At each level of education, African-Americans were overrepresented in the bottom three categories of income and underrepresented in the higher categories. Among African-Americans less than 1% of drop outs and 5% of GEDs had income above median family income (\$62,000), compared to 16% of white drop outs and 26% of white GEDs. Among college graduates 25% of African-Americans had income below median African-American family income (\$32,000), compared to 6% of whites.

Figure 2 displays the race-specific distributions of net worth by education. Among drop outs, 65% of African-Americans had net worth less than \$2,000 compared to 32% for whites. Among GED recipients, about twice as many African-Americans had net worth less than \$2,000 (50%) compared to whites (23%). Among college graduates only 5% of African-Americans had net worth above \$200,000 compared to 30% for whites, while 34% of African-American college graduates had net worth below \$12,000 compared to 9% for whites. At each level of education, African-Americans were more likely than whites to have net worth below \$12,000 and less likely to have net worth above \$72,000.

Table 2 reports estimates of the three SES gradients in PCS. Model 1 reports on education gradients. The first column shows coefficients for the African-American gradient, the second column shows the white gradient and the third shows the difference between the African-American and white coefficients. Drop outs were the omitted education category. There was no race difference in mean PCS for drop outs. Compared to drop outs, GED recipients had higher PCS, 2.78 points for African-Americans and 3.5 points for whites, but the race difference in the gains to acquiring a GED was not statistically significant. The PCS gains to a high school diploma were about twice as high for whites than African-Americans. Predicted PCS for white high school graduates was 6.2 points compared to white drop outs, and a statistically significant increase of about 2.7 points compared to GEDs. In contrast African-American high school graduates had predicted PCS about 3.2 points above drop outs, but the 0.4 increase relative to GEDs was both small and statistically insignificant. The gains to attending college relative to a high school diploma were higher for African-

Americans and whites (2 PCS points compared to 0.6 points). There was not a statistically significant gain from obtaining a college degree among African-Americans compared to having attended college, but whites on average gained 1.4 points. The primary race difference in the education gradients lay in the larger “sheepskin” effects for white high school and college graduates.

Results for the income gradients are reported in Model 2. Log income was used to reflect smaller PCS gains to a percentage increase in income at higher income levels. The PCS gains to a percentage increase in income were almost twice as large for whites as for African-Americans. The 14 point race difference in intercepts was partially a reflection of the difference in slope terms, but it also suggests that poor whites may have had lower PCS than poor African-Americans. A t-test on mean race difference in PCS for women with income less than \$15,000 revealed that poor whites had PCS 3 points below poor African-Americans and that this difference was statistically significant ($p=0.01$). Figure 3 plots the predicted values of these regression curves with income on the horizontal axis for incomes less than \$200,000. The curves cross at about \$41,000, with whites having predicted PCS that was significantly ($p=0.05$) lower than African-Americans for income below \$25,000, and African-Americans having significantly lower predicted PCS at income above \$75,000.

Model 3 reports the net worth gradients in PCS using log net worth to account for the declining marginal health gains to additional wealth. The race difference in intercept terms (1.69) suggested that low net worth whites might have lower PCS than comparable African-Americans. There was a statistically significant race difference in mean PCS for women with less than \$5,000 in net worth, with whites scoring about 1.5 points lower than African-Americans. As with income, the increases in PCS for a given percentage increase in net worth was higher for whites than African-Americans. Figure 4 plots predicted values of these regression curves with net worth on the horizontal axis for values of net worth below \$200,000. Predicted PCS for African-Americans were above predicted scores for whites at net worth less than \$45,000, but below whites for net worth above \$45,000. Race differences in predicted PCS were not statistically significant, despite statistically significant slope and intercept terms.

Table 3 reports the SES gradient using education, log income and log net worth together in the same regression. It reports on a model fully interacted with race and reports both race specific coefficients and race differences. The inclusion of multiple measures of SES attenuated the effects of each measure found in single measure SES gradients. Among whites PCS increased with all three measures, which implied that holding constant any two of the SES measures PCS increased with increases in the third. Among African-Americans only the effects of education and net worth were statistically significant, with no additional benefit to increases in income holding constant education and net worth. There were no statistically significant race differences in slope terms on education or net worth, but only whites benefited from additional income holding constant education and net worth.

Race alone explained less than 1% of the variation in PCS, while education and race, income and race, and net worth and race explained, respectively, 4.6%, 5.4% and 4.1% of the variance. The three SES measures and race together explained 7.6% of the variation. When

indicators for other markers of SES, in particular marital status and teenage childbearing, were included along with education, income and assets in models fully interacted with race the additional variables were not statistically significant. Since most SES gradients in health are estimated using discrete outcomes there was no literature on which to judge whether the explanatory power of SES was “large” or “small.” Therefore, we examined how much of the variation in PCS could be explained using proximal causes of overall health as explanatory variables. We selected doctor diagnosed hypertension and diabetes, the two most common diagnoses in the sample, as proximal health conditions. In a model fully interacted with race, these conditions alone explained about 6% of the variation in PCS. When we added the three SES measures to that model, SES explained an additional 6% of the variation. The results from a logistic regression with health perception (excellent/very good/good=1; fair/poor=0) as the dichotomous outcome were qualitatively similar to those reported for linear regressions of PCS.

Discussion

This study found better health (PCS) associated with higher SES measured using education, income and net worth among middle-aged African-American and white women. When PCS was regressed against each SES measure, the health gains associated with higher SES were larger for whites than African-Americans for reasons specific to each measure. There was no race difference in the PCS among drop outs and GEDs, but relative to drop outs the health gain from high school and college graduation were each about 3 PCS points (30% of a standard deviation) higher for whites than African-Americans. In contrast, there were no race differences in PCS among high income (high net worth) women, but at the bottom of the income (net worth) distribution whites had lower PCS than African-Americans. The race difference at the bottom drove the larger gains in PCS associated higher income (net worth) among whites. One hypothesis for race differences in single-measure SES gradients in PCS is that single measures are incomplete characterizations of SES. When PCS was regressed against all three measures of SES race differences in the coefficients on education and assets were eliminated but higher income was associated with larger PCS gains for whites than African-Americans. The health disadvantages of whites at the bottom of the income distribution compared to African-Americans does not seem to be artifact of the health outcome or sample used in this study because Olsansky et al. (2012) found similar results using different samples and different outcomes.

The R^2 associated with SES gradients suggested modest scope for reducing health disparities through redistribution policies. Education, income and net worth together explained less than 8% of the variation in PCS in models fully interacted with race. Since no previous study reported R^2 for SES gradients in health, we tried to provide some context by conducting a secondary analysis that examined the variation in PCS associated with selected chronic diseases. We choose hypertension and diabetes because they were the two most prevalent diagnoses in this population. A regression fully interacted with race using only hypertension and diabetes explained 5.8% of the variance in PCS. Thus the explanatory power of SES alone was similar to that attributed to diagnoses of hypertension and diabetes alone. When the set of regressors was expanded from diagnoses of hypertension and diabetes to include education, income and net worth, SES increased the explanatory power

of the regression by an additional 6.2% of the variation in PCS. Additional controls for marital status and teen childbearing were not significant. Therefore, the explanatory power of education, income and net worth was robust to different specifications of the health gradient.

To the extent that a causal pathway between SES and health exists, public policies to reduce race disparities across multiple dimensions of SES must be part of the public health agenda (Berkman, 2012). Income can to some extent be redistributed directly through taxes and transfers, while accumulation of net worth across generations can be limited by inheritance taxes. But education, savings, debt accumulation and earned income are largely the result of individual choice constrained by prices, interest rates, wages, and people's perception about opportunities. Some of the most effective policies for reducing SES disparities are only indirectly related to taxes and transfers. For example the earned income tax credit increases after-tax wages of low income workers which encourages them to seek employment thereby raising their income and reducing income inequality. The following discussion describes some of the underlying causes of race disparities in educational attainment, income and wealth formation focusing on how policies influence people's choices in ways that ameliorate and, sometimes inadvertently, entrench inequality.

Education statistics can be difficult to decipher because there are at least three paths to high school completion, which is reported as 12 years of completed schooling in most data sets. High school completion includes GEDs, certification through adult education classes as well as high school graduation. Health research tends to ignore the distinction between GEDs and high school diplomas. This paper is one of the few to treat GEDs as a separate education category. We found that GEDs in both races had higher PCS than drop outs, but, unlike whites, African-American high school graduates did not have higher PCS than GEDs. Future research on the health consequences of obtaining a GED instead of a high school diploma is likely to be important because graduation rates from public high schools have fallen to about 63.5% (range 60%–67%) for African-Americans and 81.5% (range 79–84%) for non-Hispanic whites (Heckman & LaFontaine, 2010; National Center for Educational Statistics, 2013). There has been a dramatic increase in the number of GEDs obtained by people aged 25–29 (National Center for Education Statistics, 2011a). Based on reports from NCES, author's calculations suggested that as many as 24% of African-Americans aged 25–29 and 13% of non-Hispanic whites aged 25–29 had a GED.

The paper also reported greater health benefits to college graduation for whites than African-Americans. In 2010, the fraction of the population aged 25–29 that had a college diploma was 19.4% among African-Americans and 38.6% among whites (National Center for Education Statistics, 2012). While college attendance rates for African-Americans and whites at 2 or 4 year institutions reflect their proportions in the population as a whole (National Center for Education Statistics, 2011b), graduations rates at 4-year institutions were, 61.5% for whites and 39.5% for African-Americans (National Center for Education Statistics, 2012). Race differences in income and net worth underscore the importance of federal college assistance to low- and moderate-income families in increasing African-American college graduation rates. The federal government assists these families with higher education expenses through subsidized loans as well as grants. However, the interest

rate on subsidized federal student loans is currently 6.8% and tax deductions for interest on student debt only benefit higher income families who itemize their deductions. Access to grants in addition to loans is critical to reducing race disparities in college graduation rates. Pell grants are the most important federal program to fund low- and moderate- income college undergraduates. The number of undergraduates receiving Pell Grants increased from 3.8 million to 9.4 million between the 1992 and 2012 and provided aid to 37% of all undergraduates in 2011–12 (Baum & Payea, 2012). Public health policies should include discussion regarding financial access to college for students from low and moderate income families for reasons of both SES and race equity.

In 2009 median African-American family income as a percent of median white family income was about 57% in the 1st quartile, 84% in 2nd, 60% in 3rd, 66% in 4th and 54% in the top 1% (Monnat, Raffalovich, & Tsao, 2012). Race differences in income have been impacted by recent changes in distribution of the three main categories of income: asset income from income-generating property, interest, dividends and realized capital gains; earned income from wages and salaries; and transfer income from private retirement accounts and government sources including Social Security, Railroad Retirement, public assistance (TANF), supplemental security income (SSI) and disability (SSDI). On balance these changes have led increases in race differences in income and widening differences between high and low income families.

Successive stock market crashes (2000–2002 and 2008–2009) reduced the overall importance of asset income which tended to reduce race disparities in income. By 2009 earned income represented over 85% of median family income for both African-Americans and whites in the top 3 income quartiles (Monnat et al., 2012). There have also been large increases in earned income among the top quartile, especially the top 1%, which have disproportionately increased income of whites. Compensation rose in certain private sector occupations, particularly in banking and financial services, where whites were over represented, but stagnated in the government sector, where African-Americans were over represented. Transfer income has fallen more for African-Americans than whites. Transfer income is critical to families with income in the bottom income quartile, where more than 50% of families had no earned income. Between 1988 and 2009 the median transfer income for African-Americans in the bottom quartile fell from \$6,000 to \$4,000 (in constant 2010 dollars) while remaining constant for whites at around \$8,000 (Monnat et al., 2012). The rising racial gap in transfer income in the bottom quartile is primarily due to the switch from AFDC to TANF where African-Americans were more likely than whites to time-out of benefits, be subjected to family caps, and lose benefits from violations of work requirements.

There are additional racial disparities in the distribution of after tax income that are influenced directly by generosity of federal, state and local tax policies that often benefit middle and upper income groups. These include tax deductions for mortgages interest, college saving accounts, retirement accounts, and reduced tax rates for self-employed persons. Consumption taxes, like sales taxes, fall disproportionately on lower income groups because they consume a larger fraction of their income. Among the few tax policies that explicitly benefit the working poor are the progressive income tax and the earned income tax

credit. While these policies are largely viewed as economic and not public health policies, they have implications for public health that should be a part of any health disparity policy debates.

By any measure, the black-white gap in net worth has been large. Kochhar, Fry, and Taylor (2011) reported that in 2009 median net worth for non-Hispanic whites (\$113,149) was 20 times greater than for African-Americans (\$5,677). These authors also reported that in 2009 35% of African-Americans had negative or zero net worth compared to 15% for whites. In addition, there were large race differences in the composition of assets. Gittleman and Wolf (2004) reported four salient facts: (1) inheritances raised the rate of wealth accumulation of whites relative to that of African-Americans; (2) African-Americans had proportionately more debt than whites and usually paid higher interest rates to service their debt; (3) African-Americans had a lower absolute savings rate than whites, but saved at the same rate after adjusting for income; and (4) African-Americans held a greater proportion of their net worth in housing than whites. The housing crisis was primarily responsible for race differences in the decline of median net worth between 2005 and 2009, when median net worth among African-Americans fell 53% compared with just 16% among white households (Kochhar et al., 2011).

Many public programs designed to assist lower income families such as TANF and Medicaid actually deter wealth accumulation by basing access to these programs on low net worth. The policies of the Clinton and Bush administrations to encourage home ownership among lower income families was an admirable goal but backfired and destroyed wealth, particularly among African-Americans, because there was little oversight or regulation of mortgage finance. Higher inheritance taxes could slow the growth in the net worth gap between the wealthiest and poorest Americans, but the more intractable problem is how to encourage asset accumulation among low and middle income families. This problem has been exacerbated by rapid growth in high cost, high fee, high interest rate, alternative non-bank financial institutions that locate primarily in low income neighborhoods. That industry includes providers of non-bank money orders, check cashing services and remittances, payday loans, rent-to-own services, pawn shops, and tax-refund anticipation loans. Burhouse and Osaki (2012) found that in 2011 8.2% of U.S. households (21.4% of African-American households) had no adult with a checking or savings account. An additional 21% of households (33.9% of African-American households) used alternative non-bank financial services despite having a checking or saving account. Since wealth formation often begins with a savings account, policies to encourage greater reliance on the formal banking system should be part of the public health agenda. These policies should also include greater regulation of fees and interest rates that alternative financial institutions can charge.

Race disparities cannot be reduced without addressing SES disparities and SES disparities cannot be reduced without addressing race disparities. African-Americans have made remarkable gains relative to non-Hispanic whites in educational attainment, income and net worth over the past 60 years. But disparities persist. The low rate of high school graduation for African-Americans is of paramount concern. As long as the race disparities in high school and college graduation rates persist, income disparities will remain because people with better education earn more. This is particularly true in a globalizing economy. Public

health research may benefit from additional studies examining the relation between health and net worth and from increased appreciation of the depth of race disparities in net worth. Net worth, which can pass from one generation to the next, perpetuates disparities across generations and contributes to the persistence of many race disparities. Policies to encourage wealth formation in low net worth and African-American communities should be part of the public health agenda. There are only a few studies examining the relation between net worth and health in part because the number of datasets that collect both types of data are limited. Initiatives to collect net worth and other financial data in health surveys should be encouraged. Finally, the literature on SES gradients in health should recognize that using a single indicator for SES masks large variation in health attributable to other indicators of SES.

There are limitations of the study. The NLSY79 is representative of the 1957–1964 birth cohorts living in the U.S. at the end of 1978, but it is not representative of the population as a whole. Due to the cross-sectional study design and absence of credible instrumental variables for SES, none of the associations between SES and PCS are causal. Finally the analysis does not include the role that race discrimination plays in African-American/white disparities in health and SES. The data do not allow us to measure perceived or actual discrimination which can influence command over resources as well as the health benefits associated with a given level of SES (Stuber, Meyer & Link, 2008). The study adds to the growing literature exemplified by Adler and Newman (2002), Braveman et al. (2005), Herd, Goesling, House (2007) and Olshansky et al. (2012) on the usefulness of multiple measures of SES to enhance understanding of health gradients in SES and race.

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Highlights

- Whites' health at midlife worse than blacks' among the low income/low net worth
- Steeper income/net worth gradients among white women due to poor health of most disadvantaged
- White education gradient steeper due to larger health advantages among high school and college graduates
- Controls for multiple SES measures reduces race difference in gradients
- Public policies contribute to persistence of race differences in SES

Figure 1.
Income by Education

Figure 2.
Net Worth by Education

Figure 3.
Predicted PCS score as a function of income

Figure 4.
Predicted PCS score as a function of net worth

Table 1

Sample Characteristics

	African-American	White	p-value for test of equality across race
Sample Size	1268	2066	
PCS ^a	50.41 (9.17)	51.85 (8.74)	<0.000
Highest Grade Completed	13.34 (2.31)	13.84 (2.51)	<0.000
HS drop out	9%	5%	<0.000
GED	9%	7%	-
High school diploma	31%	34%	-
Some college	32%	24%	-
College graduate	19%	30%	-
Mean income	43.30 (50.26)	77.98 (84.24)	<0.000
Median income	31.27	61.84	<0.000
Income<\$15,000	20%	4%	<0.000
\$15,000 income<\$31,000	30%	13%	-
\$31,000 income<\$62,000	30%	33%	-
\$62,000 income<\$95,000	13%	30%	-
Income \$95,000	7%	20%	-
Mean net worth ^b	30.79 (72.40)	159.11(261.66)	<0.000
Median net worth ^b	11.92	72.65	<0.000
Net worth 0	19%	7%	<0.000
0<net worth<\$2,000	16%	3%	-
\$2,000 net worth<\$12,000	25%	10%	-
\$12,000 net worth<\$72,000	29%	33%	-
\$72,000<net worth<\$200,000	9%	28%	-
Net worth \$200,000	2%	19%	-

^aPhysical component summary subscale from SF-12

^bFor families with positive net worth (n=1026 for African-Americans; n=1915 for whites)

Note: Bonferroni joint tests of the equality of income and net worth categories are reported.

Table 2

OLS estimates of SES gradients in PCS fully interacted with race

	Separate regressions for education, log income and log assets		
	African-American coefficients	White coefficients	Race difference in coefficients
	Model 1: Education		
Intercept	46.48 *** [44.88,48.06]	45.40 *** [43.77,47.03]	1.08 [-1.20,3.35]
Drop out	reference group	reference group	reference group
GED	2.78 ** [0.49,5.06]	3.52 ** [1.33,5.71]	-0.74 [-3.91,2.42]
HS diploma	3.19 *** [1.38,5.00]	6.20 *** [4.44,7.96]	-3.01 * [-5.53,-0.49]
Some college	5.17 *** [3.37,6.98]	6.80 *** [4.99,8.60]	-1.63 [-4.18,0.93]
College graduate	5.37 *** [3.45,7.32]	8.27 *** [6.49,10.04]	-2.88 * [-5.51,-0.26]
	Model 2: Income		
Intercept	34.29 *** [28.68,39.91]	20.19 *** [14.87,25.50]	14.10 *** [6.37,21.84]
Log income	1.56 *** [1.02,2.10]	2.89 *** [2.40,3.37]	-1.33 *** [-2.05,-0.60]
	Model 3: Net Worth		
Intercept	47.80 *** [46.78,48.82]	46.11 *** [44.86,47.35]	1.69 * [0.08,3.30]
Log net worth	0.34 *** [0.23,0.47]	0.56 *** [0.45,0.68]	-0.22 * [-0.38,-0.05]

*
p<0.05;**
p<0.01;***
p<0.001

Note: African-American coefficients and confidence intervals calculated with lincom option in Stata. The estimated average marginal effect of being African-American was less than 0.8 PCS points in all three models; none was statistically significant. R^2 's were: Model 1 (0.046); Model 2 (0.054); Model 3 (0.051).

Table 3

OLS estimates of SES gradients in PCS fully interacted with race

	Single regression including education, log income and log assets		
	African-American coefficients	White coefficients	Race difference in coefficients
Intercept	39.93 *** [33.72,46.13]	24.32 *** [18.44,30.20]	15.60 *** [7.05,24.15]
Drop out	reference group	reference group	reference group
GED	2.42 * [0.16,4.68]	3.10 ** [0.95,5.26]	-0.69 [-3.81,2.44]
HS diploma	2.38 * [0.56,4.20]	4.76 *** [3.00,6.51]	-2.38 [-4.91,0.15]
Some college	4.01 *** [2.13,5.88]	5.16 *** [3.35,6.97]	-1.15 [-3.76,1.45]
College graduate	3.72 *** [1.63,5.81]	5.49 *** [3.65,7.32]	-1.77 [-4.55,1.02]
Log income	0.57 [-0.08,1.23]	1.85 *** [1.26,2.44]	-1.28 *** [-2.16,-0.39]
Log net worth	0.21 ** [0.08,0.35]	0.24 *** [0.11,0.38]	-0.03 [-0.22,0.16]

*
p<0.05;**
p<0.01;***
p<0.001Note: African-American coefficients and confidence intervals calculated with lincom option in Stata. $R^2 = 0.076$.