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Understanding Racial Disparities in Health: The Income-Wealth Paradox

Audra T. Wenzlow
Department of Economics
University of Wisconsin–Madison
E-mail: atwenzlow@wisc.edu

John Mullahy
Department of Population Health Sciences
University of Wisconsin–Madison

Barbara L. Wolfe
Department of Economics
Department of Population Health Sciences
University of Wisconsin–Madison

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Abstract

We examine the ways in which racial differences in health vary over the income-wealth distribution, comparing the self-reported health status of non-Hispanic whites with those of individuals of other races and ethnicities. Paradoxically, we find that although the largest unadjusted racial differences in health are between poor whites and poor nonwhites, after adjusting for income, wealth, and other demographic characteristics, health differences between nonwhites and whites are only significant among those in the upper half of the income-wealth distribution. The results suggest that unexplained racial differences in reported health status increase with socioeconomic status among individuals aged 25–54.

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INTRODUCTION

There are large and well-documented differences between the health of non-Hispanic whites and the health of other racial and ethnic groups. In the United States, African Americans have particularly poor health outcomes compared to whites. African Americans have shorter life expectancies and are more likely to live with a chronic condition than whites. Like African Americans, Hispanics and Native Americans have higher rates of diabetes and infectious diseases, such as tuberculosis and syphilis, than white individuals (Keppel, Pearcy, and Wagener 2002). A significant portion of these differences, however, may be due to differences in socioeconomic status (SES). On average, nonwhites have lower incomes, lower levels of education, and less wealth than non-Hispanic whites. A relatively large literature has explored the role of SES in explaining *average* racial differences in health. However, given the nonlinear relationship between income, wealth, and health, it is plausible that the role of SES in explaining the health gap differs over the income-wealth distribution. This possible distributional variation is explored below by assessing unadjusted and adjusted racial differences in self-reported health status at various levels of wealth and income. We also investigate what may account for apparent health differences.

Many researchers have found that income, wealth, and education can explain a large portion, if not all, of the mean racial disparities in health regardless of the measure of health, sample, or methodology employed. (See Hayward, Crimmins, Miles, and Yang 2000; Smith and Kington 1997; and Williams and Collins 1995, for reviews.) There is variation, however, regarding the degree to which SES accounts for all racial differences, and whether any significant differences remain. Kington and Smith (1997), for example, find that while racial disparities in functional limitations (among those with chronic illnesses) can be fully explained by income and wealth differences, unequal prevalence of chronic conditions remains to some extent.

The portion of the race gap that can be explained by SES also depends on how SES is defined. Relatively few studies examining the racial gap in health have incorporated wealth into their analysis. Those that have, such as Kington and Smith (1997), Bond Huie, Krueger, Rogers, and Hummer (2003), and Schoenbaum and Waidmann (1997) have found that wealth helps explain a significant portion of racial differences in both morbidity and mortality. Such results are expected, as the racial gap in wealth is much larger than the racial gap in income (Scholz and Levine 2004), and wealth has been shown to be a significant correlate of health over and above income and education, particularly among non-Hispanic whites (Robert and House 1996; Wenzlow, Mullahy, Robert, and Wolfe 2004).

Decompositions of racial differences in this literature typically analyze differences at the mean. That is, such research answers the question, What portion of the difference between black and white average health outcomes can be explained by SES? Although conceptually useful, this approach is limiting in that the relationship between health and SES greatly differs over the distribution of income and wealth, and decomposing averages may mask important variation. The concave character of the health gradient in income, reflecting a declining marginal product of income in producing health, is well known. Particularly large health disparities among those with little wealth have also been documented—among the working-aged population (Wenzlow et al. 2004) as well as among individuals nearing retirement (Kington and Smith 1997). This suggests that income and wealth may play a different role in explaining racial health disparities among the poor than among individuals who are better off. The value of understanding distributional differences is that such knowledge can assist in identifying populations that have particularly unequal health outcomes or are more susceptible to having poor health, and may give insight to why racial disparities exist and suggest policy interventions.

To our knowledge, the only research that addresses health and the distribution of SES has been on infant birth outcomes. For example, Kleinman and Kessel's (1987) research on low-weight births found the largest unexplained racial gap in low-weight births among highly educated women, and the smallest differences among those not completing high school. This unexpected pattern of racial disparities by

education has been replicated in a number of studies in the context of infant birth weight (Krieger, Rowley, Hermann, Avery, and Phillips 1993). Since education is highly correlated with income and wealth, this suggests that a similar pattern may be observed between health and economic variables.

Our objective is to evaluate whether the racial gap in health varies by SES among individuals aged 25–54. Are unexplained racial differences in health larger among the rich or the poor? Our findings suggest that in the United States, although the largest unadjusted health differences between races are among the poor, most of these differences can be explained by income, wealth, and education. Unexplained health differences between poor whites and poor nonwhites are relatively small. Instead, among richer Americans, racial differences persist even after holding income and wealth fixed. This pattern of results can be accounted for by a stronger estimated relationship between income, wealth, and health among whites compared to nonwhites, and by the important role played by wealth as a determinant of health differences among the poor.

DATA AND METHODS

Data

Four waves (1989, 1992, 1995, and 1998) of the Survey of Consumer Finances (SCF) are used in this analysis. The SCF is a triennial cross-sectional survey of households that oversamples wealthy individuals, arguably providing the most accurate information about the distribution of household wealth in the United States.[1] In addition to wealth and income, we use individual characteristics of the household head in our analysis. The household head is defined as the individual that is most familiar with the family finances. Our sample of 9,164 individuals is limited to working-aged household heads aged 25–54.

[1]Due to the sampling strategy and imputations implemented in the SCF, the analyses presented in this paper are weighted to reflect the noninstitutionalized U.S. population, and standard errors are bootstrapped to adjust for sampling and imputation variance.

In this study we define wealth as family net worth, which is equal to the sum of financial and nonfinancial assets, net of debt. Excluded are pension and social security wealth, which are not directly available in the SCF. Family income incorporates income from all sources, including disability and welfare income. We adjust both income and wealth using a household equivalence scale that implies that children consume less than adults and that there are economies of scale.[2] We also adjust the two economic measures using the CPI-U to reflect constant 1998 dollars. Weighted summary statistics for income and wealth, by race, are shown in Table 1. There are large differences in both income and wealth between the two racial/ethnic groups. As would be expected, wealth differences are larger than income differences, as they reflect in part accumulated income disparities of previous years.

Health is measured as a dichotomous variable reflecting whether the respondent reported having poor or fair health (compared to good or excellent health).[3] This is the only health outcome measure available in the SCF for the period of study. Race and ethnicity are also self-reported as Native American/Eskimo/Aleut, Asian or Pacific Islander, Hispanic, black or African American, white, or other. We group responses of Hispanic with races and ethnicities other than white to achieve an adequate sample size for nonwhites. With the exception of Asian individuals, there is evidence that both the health and economic status of nonwhites is lower than that of whites, validating this categorization. Unfortunately, Asian individuals were aggregated with Native Americans and other racial groups in certain waves of the SCF public use data, so we were unable to categorize them in a different manner. As part of our sensitivity analysis, we also compare non-Hispanic whites to African Americans only.

Variables used as covariates in our model include age, sex, education, marital status, smoking status, and time preferences for savings. Our education variable is based on reports of received degrees, or

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[2]The household equivalence scale is defined as $(A + .6*C)^{.65}$, where A is the number of adults in the family and C is the number of individuals under 18 in the family, plus the number of children under 18 that the household head has outside the household.

[3]The number of individuals who self-report health as "poor" is too small in this relatively young population to conduct a sensitivity analysis of our dichotomous health measure.

Table 1
Weighted Summary Statistics (Standard Errors), for Income and Wealth
Overall and by Race

	Overall		By Race			
			Non-Hispanic White		Other Races and Ethnicities	
Income						
Average income	$31,290	(766)	$35,384	(961)	$19,491	(575)
10th percentile	5,619	(180)	7,896	(180)	2,975	(129)
25th percentile	11,694	(240)	14,461	(292)	6,377	(240)
50th percentile (median)	21,808	(329)	24,635	(375)	13,233	(385)
75th percentile	35,395	(557)	38,974	(631)	24,944	(669)
90th percentile	56,337	(1,426)	60,931	(1,834)	39,794	(1,341)
Wealth						
Average net worth	$99,604	(5,817)	$119,177	(7,020)	$43,183	(4,833)
10th percentile	0	(0.4)	476	(142)	-477	(152)
25th percentile	3,790	(188)	8,401	(386)	132	(72)
50th percentile (median)	25,805	(726)	35,427	(1,340)	6,118	(531)
75th percentile	78,383	(3,791)	99,372	(4,932)	31,966	(1,493)
90th percentile	192,835	(12,319)	226,736	(17,063)	80,914	(5,163)
Sample Size	9,164		7,236		1,928	

Notes: Standard errors are adjusted for sampling and imputation variance. Both income and wealth are adjusted for household size and the CPI-U to reflect 1998 dollars.

years of schooling (<12, 12, 13–15, 16, 17+) when highest degree is unknown. Marital status distinguishes individuals who are married or cohabiting from others in our sample. Smoking status was only asked in the 1995 and 1998 surveys. We include year dummies in our analysis to take this into account. We also incorporate time preference for savings as a proxy for individual discount rates. The measure reflects a household head's saving and spending planning horizon as being a year or less (short horizon), between a year and 10 years (medium horizon), and longer than 10 years (long horizon). Summary statistics for these measures among household heads are shown in Table 2. The most striking differences are found in health and education: over 26 percent of nonwhites report poor or fair health, compared to only 13 percent of non-Hispanic whites, and nonwhites have much lower levels of education.

Empirical Model

The empirical model used in this study was developed in Wenzlow et al. (2004). The SCF data described above are used to estimate a probit model for the binary outcome "poor or fair health," controlling for individual characteristics, transformed measures of family income and wealth, and interaction terms. Income and wealth are transformed using the inverse hyperbolic sine (IHS) to accommodate the highly nonlinear relationship between the economic measures and health. The IHS transformation with scale parameter θ approximates linearity for values within $1/\theta$ of zero, and the log function otherwise. A particularly important benefit of using the IHS transformation is that negative values can be included in our analysis. The choice of θ was determined empirically based on model fit exercises and is equal to 1/5,000 for income and 1/2,000 for wealth for both racial groups.

The explanatory variables included in the model are age, age squared, gender, marital status, gender by marital status, education, smoking status, time preference variables, year dummies, and the transformed income and wealth measures described above. The model also includes transformed income by wealth, age by income, and age by wealth interaction terms, and allows the age, income, and wealth parameters to vary by race. Parameter estimates are shown in Table 3. Note that the interpretation of the

Table 2
Weighted Summary Statistics (Standard Errors) for Household Heads Aged 25–54, Overall and by Race

	Overall	By Race	
		Non-Hispanic White	Other Races and Ethnicities
Reports having poor/fair health (%)	16.5 (0.4)	13.0 (0.4)	26.6 (0.8)
Average age	38.8 (0.04)	39.1 (0.07)	38.1 (0.15)
Non-Hispanic white (%)	74.2 (0.7)	100.0 (0.0)	0.0 (0.0)
Male (%)	45.2 (0.5)	46.6 (0.6)	41.0 (1.0)
Married or cohabiting (%)	64.2 (0.5)	67.9 (0.6)	53.4 (1.0)
Education			
No high school diploma (%)	10.6 (0.4)	6.1 (0.3)	23.5 (1.0)
High school diploma (%)	31.4 (0.5)	31.4 (0.6)	31.6 (0.9)
Some college (%)	28.2 (0.5)	28.6 (0.5)	27.2 (0.9)
College degree (%)	19.1 (0.4)	21.9 (0.5)	10.9 (0.7)
More college (%)	10.7 (0.4)	12.0 (0.4)	6.7 (0.5)
Smokes (%)	15.5 (0.3)	16.2 (0.3)	13.4 (0.7)
Time preference for saving			
Short horizon (%)	35.7 (0.6)	31.7 (0.6)	47.2 (1.1)
Medium horizon (%)	47.3 (0.6)	49.2 (0.7)	42.0 (1.1)
Long horizon (%)	17.0 (0.4)	19.2 (0.5)	10.7 (0.6)
Sample Size	9,164	7,236	1,928

Note: Standard errors are adjusted for sampling and imputation variance.

Table 3
Probit Estimates of Poor or Fair Health of Household Heads Aged 25–54

	b (*SE*)
Intercept	-2.814*
	(0.757)
Non-Hispanic white	2.393*
	(0.864)
Male	0.307*
	(0.056)
Married or cohabiting	0.189*
	(0.042)
Male and married or cohabiting	-0.438*
	(0.068)
Education (no high school degree)	
High school diploma	-0.361*
	(0.048)
Some college	-0.552*
	(0.053)
College degree	-0.725*
	(0.058)
Graduate education	-0.752*
	(0.080)
Smokes	0.175*
	(0.040)
Time preference (short horizon)	
Medium horizon	-0.127*
	(0.037)
Long horizon	-0.158*
	(0.048)
1989 survey	-0.052
	(0.046)
1992 survey	-0.013
	(0.038)
1995 survey	0.018
	(0.042)

(table continues)

Table 3, continued

	b (*SE*)
Non-Hispanic whites	
Age	0.006*
	(0.025)
Age squared	0.000
	(0.000)
Transformed income	-0.491*
	(0.163)
Transformed wealth	-0.003
	(0.051)
Transformed income*	0.042*
Transformed wealth	(0.009)
Age * transformed income	0.002
	(0.004)
Age * transformed wealth	-0.004*
	(0.001)
Other races and ethnicities	
Age	0.117*
	(0.038)
Age squared	-0.001*
	(0.0005)
Transformed income	0.042
	(0.172)
Transformed wealth	-0.192*
	(0.093)
Transformed income*	0.064*
Transformed wealth	(0.021)
Age * transformed income	-0.013*
	(0.005)
Age * transformed wealth	0.001
	(0.002)

Note: Standard errors are adjusted for sampling and imputation variance.
*p<.05

key parameter estimates in Table 3 must be viewed in light of the nonlinearity of the probit, the nonlinearity of the income and wealth transformations, and the inclusion of interaction terms. As such, sample average marginal estimates for our key measures are shown in Table 4.

Our results indicate large differences in estimated marginal effects between racial/ethnic groups in this working-age population.[4] In particular, the age results are significantly different between races, and the marginal result for income is much larger for whites than nonwhites, although this latter difference is insignificant.[5] These results are consistent with differential access to health care by race by income/wealth (or compound disadvantage for nonwhites of low income/wealth.)

Decomposition Methods

Our main concern here is what proportion of the observed differences in health is due to income and wealth and what proportion to underlying differences in race over and beyond income and wealth at different points in the income/wealth distribution. To answer this question, the empirical model is used to compute both crude and adjusted racial differences in our health measure at various points of the income-wealth distribution. The typical approach to decomposing racial differences in wages, employment, and wealth is to use some variation of what is known as the Blinder-Oaxaca technique, first developed by Oaxaca (1973) and Blinder (1973). The technique takes advantage of the additive separability of ordinary least squares to decompose the difference in average outcomes between two groups. Given the nonlinearity of our model, the Blinder-Oaxaca method is not directly applicable to our analysis. A parallel

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[4]This result in not consistent with studies of older populations that use data from the Health and Retirement Study (HRS) or Asset and Health Dynamics Among the Oldest Old (AHEAD) surveys, such as Bond Huie et al. (2003), Hayward et al. (2000) or Schoenbaum and Waidmann (1997). It is not clear whether the different results in these studies are due to differences in the age of the populations, the health outcomes measured, explanatory variables used in the analyses, or the parameterization of the model. Another plausible reason for the discrepancy is the cross-sectional nature of the SCF compared to the longitudinal HRS and AHEAD surveys, although, for example, Schoenbaum and Waidmann (1997) run a similar analysis modeling the prevalence of poor or fair health.

[5]The income marginals are significantly different by race in a model with net worth replaced by financial wealth.

Table 4
Estimates of Average Marginal Effects for Household Heads Aged 25–54

	dF/dx (*SE*)
Non-Hispanic whites	
Age marginal	0.0044*
	(0.0005)
Income marginal	-0.0039*
	(0.0006)
Wealth marginal	-0.0019*
	(0.0004)
Wealth * income interaction	0.0001*
	(0.00004)
Age * income interaction	-0.00001
	(0.00006)
Age * wealth interaction	-0.0001*
	(0.00004)
Other races and ethnicities	
Age marginal	0.0027*
	(0.0008)
Income marginal	-0.0027*
	(0.0007)
Wealth marginal	-0.0014
	(0.0008)
Wealth * income interaction	0.00015*
	(0.00007)
Age * income interaction	-0.00013*
	(0.00006)
Age * wealth interaction	-0.00000
	(0.00006)

Notes: The following explanatory variables are also included in this probit model: age, age squared, race* age, race * age squared, sex, marital status, sex * marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*p<.05

approach for probit models was first described by Gomulka and Stern (1990) in the context of accounting for differences over time. The approach involves decomposing the difference between averages of predicted probabilities rather than averages of outcomes. Fairlie (2003) suggests a method for the slightly more complex case where differences between two groups are analyzed. The method involves simulating a population of nonwhites that have characteristics similar to whites (or vice versa) to see how much of the health gap can be explained by racial variation in the explanatory variables. In essence, this is an accounting exercise that identifies the source of predicted racial differences in a model as either differences in particular explanatory variables or differences in parameter estimates.

In our analysis, we decompose both individual predicted probabilities (predictions of averages), as well as average predictions. However, we implement these decompositions at various portions of the income-wealth distribution, rather than over the entire white and nonwhite populations. Since some of the arguments supporting this approach are relatively subtle, some detailed discussion is warranted.

We begin our analysis by employing a simple approach in which we compare individual predicted probabilities of typical white and nonwhite individuals. Given our interest in economic factors, our approach is to define a prototypical individual and allow only income and wealth to vary while holding other characteristics of the prototype fixed at sample mean or modal values.[6] We first compute the total difference in health between a white and nonwhite prototype, then determine what portion of this difference is explained once the nonwhite prototype is "given" white median income and wealth. Formally, let $\hat{H}_B$ be the predicted probability for a nonwhite prototype with nonwhite median income and wealth, and $\hat{H}_W$ be the predicted probability for the white prototype with white median income and wealth. The difference can then be written as

[6]The prototype is a nonsmoking married female with a high school diploma who has medium-term time preferences.

$$\hat{H}_B - \hat{H}_W = F\left(\mathbf{X}_B\hat{\boldsymbol{\beta}}_B\right) - F\left(\mathbf{X}_W\hat{\boldsymbol{\beta}}_W\right) = \left[F\left(\mathbf{X}_B\hat{\boldsymbol{\beta}}_B\right) - F\left(\mathbf{X}_W\hat{\boldsymbol{\beta}}_B\right)\right] + \left[F\left(\mathbf{X}_W\hat{\boldsymbol{\beta}}_B\right) - F\left(\mathbf{X}_W\hat{\boldsymbol{\beta}}_W\right)\right]$$

where the last equivalence is obtained by adding and subtracting $F\left(\mathbf{X}_W\hat{\boldsymbol{\beta}}_B\right)$, denoting the predicted health of a nonwhite prototype (reflected by $\hat{\boldsymbol{\beta}}_B$), with white income and wealth, $\mathbf{X}_W$.[7] This gives us an estimate of the portion of the total difference that is due to income and wealth differences (the change in $\mathbf{X}$) as compared to differences in parameter estimates. Note that we could alternatively have added and subtracted $F\left(\mathbf{X}_B\hat{\boldsymbol{\beta}}_W\right)$, the prediction for a white prototype with nonwhite income and wealth. The resulting decomposition, or the computed portion of the difference that is attributed to income and wealth, would not be precisely the same. This is known in the decomposition literature as the index problem.[8] Rather than arbitrarily choosing an index, we report both results. We also report the racial difference in health that remains once income, wealth, and the other explanatory variables are held constant. This "unexplained" portion of the health gap should be thought of as corresponding to the differences between the white and nonwhite parameter estimates.

We similarly decompose health differences at the 10th, 25th, and 75th percentiles of the white and nonwhite income and wealth distributions. We do not report outcomes for higher percentiles, as there are few nonwhites with 90th percentile white income and wealth. Income and wealth are shifted together simultaneously, as individuals with high wealth and little income, or vice versa, are relatively rare in our working-aged sample.

We implement a second approach, decomposing averages of predictions, to confirm the first results and to determine the degree to which variation in all the explanatory variables helps explain the

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[7]The function F is the cumulative normal distribution function for the probit.

[8]The "index" in our study is either white or nonwhite and reflects the reference $\boldsymbol{\beta}$ used to determine the portion explained by the vector $\mathbf{X}$ of explanatory variables. For example, in our first equation, where $F(\mathbf{X}_W\hat{\boldsymbol{\beta}}_B)$ is added and subtracted to the difference in predictions, the index would be considered to be nonwhite.

predicted racial differences in health. The computation is analogous, although more complex, than when predictions of averages are decomposed. If we let $\bar{\hat{H}}_W$ denote the average prediction among whites, and $\bar{\hat{H}}_B$ denote the average prediction among other races and ethnicities, then the difference between the two means can be written as

$$\begin{aligned}\bar{\hat{H}}_B - \bar{\hat{H}}_W &= \frac{1}{n_B}\sum_{i\in B} F\left(\mathbf{X}_{iB}\hat{\boldsymbol{\beta}}_B\right) - \frac{1}{n_W}\sum_{i\in W} F\left(\mathbf{X}_{iW}\hat{\boldsymbol{\beta}}_W\right) \\ &= \left[\frac{1}{n_B}\sum_{i\in B} F\left(\mathbf{X}_{iB}\hat{\boldsymbol{\beta}}_B\right) - \frac{1}{n_W}\sum_{i\in W} F\left(\mathbf{X}_{iW}\hat{\boldsymbol{\beta}}_B\right)\right] + \left[\frac{1}{n_W}\sum_{i\in W} F\left(\mathbf{X}_{iW}\hat{\boldsymbol{\beta}}_B\right) - \frac{1}{n_W}\sum_{i\in W} F\left(\mathbf{X}_{iW}\hat{\boldsymbol{\beta}}_W\right)\right]\end{aligned}$$

where, as before, the $\hat{\boldsymbol{\beta}}_B$ and the $\hat{\boldsymbol{\beta}}_W$ are vectors of parameter estimates associated with nonwhite and white individuals, respectively. $\mathbf{X}_{iB}$ and $\mathbf{X}_{iW}$ are vectors of individual characteristics for nonwhite and white individuals *i*. In this case, information regarding the entire distribution of explanatory variables is incorporated into the decomposition. We note here that unlike ordinary least squares and the logit model, $\bar{\hat{H}}_B - \bar{\hat{H}}_W$ does not equal $\bar{H}_B - \bar{H}_W$ in the probit model. Thus, these decompositions are of average predictions. We consider differences in prediction errors in our sensitivity analyses.

Given that our sample is weighted, in addition to the index problem described above, in this second approach it is also arbitrary that the added and subtracted term, $\frac{1}{n_W}\sum_{i\in W} F\left(\mathbf{X}_{iW}\hat{\boldsymbol{\beta}}_B\right)$, is averaged over the white population with their associated weights, rather than over a nonwhite population that is "given" white characteristics. Since our sample sizes are different for whites and nonwhites, we implement a procedure suggested by Fairlie (2003) in which whites are randomly sampled for the analysis. The nonwhites and sampled whites are then ranked, by race, and matched based on their predicted health outcomes. This sampling process is repeated multiple times, and calculated statistics that are computed with the alternative weights are averaged. We report our average prediction decompositions using both white and nonwhite weights, for each index, and compare the obtained results.

To evaluate how the decomposition of means varies over the income-wealth distribution, we group each race cohort into quintiles. The quintiles are based on factor-analytic scores that weight our transformed measures of income and wealth comparably. The score reflects financial well-being as determined by both income and wealth levels rather than one or the other. As before, we do not report decompositions for the highest quintile, given an insufficient number of nonwhites with such high levels of income and wealth. Our reported results consist only of overall decompositions. Further variable specific decompositions are described and presented in the Appendix.

RESULTS

Predicted probabilities for white and nonwhite prototypes at various income and wealth levels are shown in Table 5. For example, a non-Hispanic white individual with 10^{th} percentile income and 10^{th} percentile wealth is predicted to have a 0.306 probability of reporting poor or fair health. In comparison, holding other characteristics fixed, a nonwhite individual with nonwhite 10^{th} percentile income and wealth has a higher predicted probability of reporting poor or fair health: 0.497, or a difference of 0.191. If a nonwhite prototype is instead given the income and wealth of a white person at the10^{th} percentile, we obtain a prediction of 0.357, accounting for 73 percent of the difference in reporting poor or fair health between the two types. The remaining 27 percent is accounted for by the varying parameter estimates, such as the health gradients in income/wealth, in age, or other unexplained racial differences. The matched simulation using a white prototype with nonwhite 10^{th} percentile income and wealth suggests a 0.436 probability of reporting poor or fair health, which would account for 68 percent of the total difference.

Table 6 contains a summary of this information for the 10^{th}, 25^{th}, 50^{th}, and 75^{th} percentile of income and wealth pairs. The largest unadjusted health differences between races are among the poor. The difference in prediction between a white prototype and a nonwhite prototype declines significantly with income/wealth from 0.191 for the 10^{th} percentile to 0.106 for the 75^{th} percentile. Using a nonwhite index, 73 percent, 69 percent, 46 percent, and 20 percent of this difference is explained by racial income

Table 5
Predicted Probability of Reporting Poor or Fair Health for a Prototypical Individual Varying Race (Betas) and Income/Wealth Pairs (Xs)

	Race of Prototype	
Income/Wealth of Prototype	Non-Hispanic White	Other Races/Ethnicities
Non-Hispanic White		
10th percentile	0.306 (.024)	0.357 (.028)
25th percentile	0.184 (.016)	0.248 (.021)
50th percentile (median)	0.122 (.013)	0.197 (.019)
75th percentile	0.090 (.011)	0.175 (.020)
Other Races/Ethnicities		
10th percentile	0.436 (.032)	0.497 (.040)
25th percentile	0.339 (.026)	0.392 (.030)
50th percentile (median)	0.199 (.017)	0.261 (.021)
75th percentile	0.123 (.013)	0.196 (.019)

Note: Standard errors, in parentheses, are adjusted for sampling and imputation variance.

Table 6
Predicted Probability Racial Decompositions
at 10th, 25th 50th and 75th Income/Wealth Values

	Income/Wealth Percentile			
	10th	25th	50th	75th
Total Difference in Prediction	0.191	0.208	0.139	0.106
	(0.04)	(0.03)	(0.02)	(0.02)
% Attributed to Income/Wealth				
White index	68%	75%	56%	30%
	(20)	(13)	(9)	(5)
Nonwhite index	73%	69%	46%	20%
	(12)	(7)	(7)	(9)
Unexplained Difference				
White index	0.061	0.053	0.062	0.074
	(0.04)	(0.03)	(0.02)	(0.01)
Nonwhite Index	0.051	0.064	0.075	0.085
	(0.025)	(0.02)	(0.02)	(0.02)

Note: Standard errors, in parentheses, are adjusted for sampling and imputation variance.

and wealth differences at the four percentiles, respectively. Thus, we find that there is a large variation over the income-wealth distribution. Over 70 percent of the race gap between poor nonwhites and poor whites is explained by income and wealth differences, while only 20 percent is explained among wealthier individuals of each race. Similarly, using a white index or prototype, 68 percent, 75 percent, 56 percent, and 30 percent of the predicted race gap is explained by income and wealth. Levels of the remaining or unexplained racial differences actually increase with the SES percentiles, from 0.051 to 0.085 using the nonwhite index, and from 0.061 to 0.074 using the white index. Although these differences are not significant, we note that at the 10th percentile of income and wealth, we cannot reject the hypothesis that there are no racial health differences.

Differences in other variables such as education and age may also contribute to racial differences in health outcomes, and income and wealth may vary in ways not accounted for by the simple exercise above. In the second portion of our analysis, we decompose average predictions in four matched cohorts of whites and nonwhites. We categorize individuals from each racial/ethnic group into economic quintiles, where an individual's rank of economic status is determined by his or her factor score (a weighted sum of income and wealth). Average predictions for non-Hispanic whites are then compared to those of nonwhites in each of the first four quintiles. The results are summarized in Table 7.

As in our first decomposition analysis, the overall predicted racial difference declines over the income-wealth distribution, from 0.177 to 0.106. The portion attributable to variation in the entire set of explanatory variables is larger than the portion due to only income and wealth in our previous table, and again declines significantly over the four quintiles. This is true regardless of the index or the weight used, ranging from 86 percent to 95 percent at the 1st quintile to 44 percent to 53 percent in the 4th quintile. The remaining or unexplained portion of the gap increases over the four quintiles, significantly so when using the nonwhite index. As in our previous estimates, we find no significant racial differences in health among the poorest whites and nonwhites using either index or weight. Meanwhile, in the upper two quintiles, the remaining racial differences are significantly different from zero in each case.

Table 7
Decomposition of Average Predictions, by Income/Wealth Quintile

	Quintile			
	1st	2nd	3rd	4th
Total Difference in Prediction	0.177	0.165	0.143	0.106
	(0.03)	(0.02)	(0.01)	(0.01)
% Attributed to all Explanatory Variables				
White index – white weights	95%	90%	73%	53%
	(18)	(10)	(7)	(7)
White index – nonwhite weights	91%	87%	72%	51%
	(18)	(10)	(7)	(6)
Nonwhite index – nonwhite weights	86%	73%	62%	44%
	(9)	(7)	(6)	(7)
Nonwhite index – white weights	89%	73%	63%	45%
	(9)	(6)	(6)	(7)
Unexplained Difference				
White index – white weights	0.010	0.017	0.039	0.050
	(0.03)	(0.02)	(0.01)	(0.01)
White index – nonwhite weights	0.015	0.022	0.040	0.052
	(0.03)	(0.02)	(0.01)	(0.01)
Nonwhite index – nonwhite weights	0.026	0.044	0.054	0.060
	(0.02)	(0.01)	(0.01)	(0.01)
Nonwhite index – white weights	0.020	0.044	0.053	0.058
	(0.02)	(0.01)	(0.01)	(0.01)

Note: Standard errors, in parentheses, are adjusted for sampling and imputation variance.

In summary, the results thus far suggest that while raw predicted health differences are largest between poor whites and poor nonwhites, much of this gap is accounted for by socioeconomic status. Paradoxically, even though crude differences are smaller among individuals who are better off, they cannot be accounted for by racial differences in our explanatory variables. Thus the largest unexplained racial gap between whites and nonwhites is among individuals with relatively high incomes and wealth.

One possible concern regarding these results is the disparate income and wealth distributions of whites and nonwhites. Nonwhites may have considerably less wealth and income than whites, and thus 4^{th} quintile whites and 4^{th} quintile nonwhites may make a poor comparison. It is indeed true that income and wealth at a particular nonwhite quintile is more comparable to that of a lower white quintile. However, decompositions comparing the 4^{th} (3^{rd}, 2^{nd}) nonwhite quintile to the 3^{rd} (2^{nd}, 1^{st}) white quintile produce results that are consistent with larger racial differences among individuals at the upper portion of the income and wealth distribution.

Given that the decomposition results may be sensitive to our model parameterization, we further investigate the characteristics of our model and how our results might differ under alternative specifications. Poor predictions among a portion of those studied could affect our results, given that we analyze differences in predictions rather than outcomes per se. Average prediction errors appear to be relatively stable by race and over the four quintiles studied, although this was not formally tested.

To compare our results to those that may be obtained in research that does not use wealth as an explanatory variable, we run our model excluding wealth and its interaction terms. The results for this income-only model are shown in the top portion of Table 8 for both white and nonwhite indices. The decreasing trend in both the crude difference and the portion explained by the entire set of explanatory variables is still present. The unexplained difference, however, appears fairly constant and does not significantly differ between the quintiles. A notable difference between this model and the results shown in Table 7 is that in our original model with wealth, a particularly large portion of the race gap can be accounted for among the poor. Comparable results are shown in the following rows of Table 8 for a

Table 8
Sensitivity Tests: Decomposition of Average Predictions in Income Only, Financial Assets Only, and White vs. African American Models

	Percentile			
	1st	2nd	3rd	4th
Income Only (not Wealth) in Model				
Total difference in prediction	0.176	0.160	0.156	0.113
	(0.02)	(0.02)	(0.01)	(0.01)
% attributed to all explanatory variables				
White index	71%	63%	61%	47%
	(13)	(7)	(5)	(5)
Nonwhite index	71%	64%	66%	58%
	(6)	(5)	(5)	(6)
Unexplained difference				
White index	0.052	0.060	0.061	0.060
	(0.03)	(0.02)	(0.01)	(0.01)
Nonwhite index	0.051	0.057	0.053	0.047
	(0.01)	(0.01)	(0.01)	(0.01)
Financial Assets Only				
Total difference in prediction	0.182	0.202	0.142	0.085
	(0.02)	(0.02)	(0.01)	(0.01)
% attributed to all explanatory variables				
White index	79%	76%	68%	50%
	(15)	(8)	(8)	(8)
Nonwhite index	76%	79%	71%	47%
	(7)	(5)	(6)	(9)
Unexplained difference				
White index	0.039	0.048	0.046	0.043
	(0.03)	(0.02)	(0.01)	(0.01)
Nonwhite index	0.044	0.043	0.041	0.045
	(0.02)	(0.01)	(0.01)	(0.01)
White vs. African American				
Total difference in prediction	0.169	0.149	0.127	0.103
	(0.03)	(0.02)	(0.02)	(0.01)
% attributed to all explanatory variables				
White index	114%	104%	79%	54%
	(23)	(14)	(11)	(8)
African American index	101%	75%	59%	40%
	(11)	(9)	(10)	(11)
Unexplained difference				
White index	-0.024	-0.007	0.027	0.048
	(0.03)	(0.02)	(0.02)	(0.01)
African American index	-0.002	0.037	0.052	0.051
	(0.02)	(0.01)	(0.01)	(0.02)

Note: Standard errors, in parentheses, are adjusted for sampling and imputation variance.

model in which net worth is replaced by financial assets. These results suggest that there may be differences with respect to how nonfinancial assets are linked to health by race. An informal inspection of the prediction errors suggests that nonfinancial portions of net worth help distinguish health outcomes among whites, but not among nonwhites.

In a final sensitivity test, we include only African Americans in the nonwhite category. The decomposition for a model re-estimated with this subset sample is shown at the bottom of Table 8. Results for this subset are consistent with our original model, showing significant increase in unexplained predicted health disparities over the income-wealth distribution.

DISCUSSION

Our findings suggest that typical decompositions of racial differences in health may mask important variation over the SES distribution. We find that the "unexplained" portion of health differences between races is largest among individuals with higher incomes and wealth and smallest among the poor. How might we "explain" this seemingly paradoxical pattern? At low levels of income and wealth, individuals face a rather binding income constraint, which influences inputs into health production or investment such as nutrition, quality of housing, and environment, including pollution, crime, and other stressors. For some individuals, access to care is also limited, especially for preventive care. All of these factors could increase the probability of poor health among those with limited resources. At higher levels of income, individuals have more ability to choose factors that improve or maintain health so that racial differences may instead reflect ability to communicate to health care providers, differential access to health services perhaps due to the location of services, differential dietary preferences, and differences in investments in health while growing up. Testing such hypotheses would be best done with longitudinal (panel) data, and could prove to be an important step in accounting for the remaining racial health differences.

Another possible hypothesis that could "explain" our results is that we are observing racial differences in how individuals self-report health. Perhaps individuals of certain ethnic groups are less

likely to respond “excellent” or “very good” to such health questions, viewing them as extreme rather than average responses. Although our dichotomous variable of poor or fair health is less prone to such biases, differences still may exist. However, it is unclear how this could explain why remaining health differences are larger at higher income/wealth levels.

Although racial differences are larger, both in magnitude and in rate, among better-off individuals, the differences themselves are relatively small compared to health differences by economic status. Overall, our results suggest that nonwhites would be made much better off in terms of health if income and wealth disparities were addressed.

Our study is limited in that we employ only one measure of health. Self-reports may reflect a combination of prevalence of disease, lack of treatment, and possibly relative rather than objective health status. Recall, however, that these results are consistent with research on low-weight births, where larger racial health differences are observed among highly educated women rather than among those with lower levels of schooling. Nevertheless, additional research is needed to confirm our findings, and to determine the health outcomes for which racial differences increase with SES. Understanding the racial health disparities between higher SES whites and nonwhites may be particularly useful in uncovering more fully the factors that lie behind racial health differences.

APPENDIX

VARIABLE DECOMPOSITION

When decomposing average predictions, the racial disparity in health attributed to differences in the vector $\mathbf{X}$ of explanatory variables can be further decomposed into the portion attributable to each variable x_j. The variable decomposition as described by Fairlie (2003) is accomplished by changing the characteristics of each nonwhite individual, one variable at a time, to correspond to those of whites, and noting the portion of the total difference that is explained. This is accomplished using the sampling and matching procedure described for the overall decomposition. Unlike OLS, unchanged additive terms do not cancel out of the equation. Thus different variable orderings in the decomposition can produce different results. The inclusion of interaction terms in our model exacerbates this problem. We compute variable decompositions only for education and the set of interacted variables: age, income, and wealth.

The variable-specific decompositions are shown in Table A-1. Given that such estimates are not unique and are dependent on the order in which they are analyzed and the indices and weights used, we report representative results for only one white and nonwhite index. Age, income, and wealth account for a large share of the observed racial health gap. We estimate that variation in these measures alone accounts for about 70 percent of the gap at the 1st quintile and 29 percent (or 20 percent) of the gap in the 4th quintile. The percentage attributed to education is also large: nearly a third for the lowest quintile and less than a fourth for the highest. Meanwhile, other explanatory variables such as smoking status benefit nonwhites relative to whites in terms of health.

Table A-1
Variable Decomposition (Fairlie, 2003), by Income/Wealth Quintile

	Quintile			
	1st	2nd	3rd	4th
Total Difference in Prediction	0.177	0.165	0.143	0.106
	(0.03)	(0.016)	(0.012)	(0.010)
White Index				
% attributed to all explanatory variables	91%	87%	72%	51%
	(18)	(9.8)	(7.0)	(6.3)
% attributed to age, income, wealth	70%	59%	40%	29%
	(14)	(8)	(5)	(4)
% attributed to education	27%	21%	21%	12%
	(5)	(3)	(3)	(3)
Nonwhite Index				
% attributed to all explanatory variables	89%	73%	63%	45%
	(8.6)	(6.1)	(5.7)	(6.5)
% attributed to age, income, wealth	68%	50%	32%	20%
	(8)	(7)	(7)	(8)
% attributed to education	35%	31%	35%	25%
	(7)	(4)	(4)	(4)

Note: Standard errors, in parentheses, are adjusted for sampling and imputation variance.

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