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The color of death: race, observed skin tone, and all-cause mortality in the United States

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Abstract

Objective—This paper examines how mortality covaries with observed skin tone among blacks and in relation to whites. Additionally, the study analyzes the extent to which social factors such as socioeconomic status affect this relationship.

Design—This study uses data from the 1982 General Social Survey ($N = 1,689$) data linked to the National Death Index until 2008. We use this data to examine the links between race, observed skin tone among blacks, and all-cause mortality. Piecewise exponential hazard modeling was used to estimate disparities in skin tone mortality among blacks, and relative to whites. The multivariate models control for age, education, gender, region, metropolitan statistical area, marital status, labor force status, and household income.

Results—Observed skin tone is a significant determinant of mortality among blacks and in relation to whites. Light skinned blacks had the lowest mortality hazards among blacks, while respondents with medium and dark brown skin experienced significantly higher mortality. The observed skin tone mortality disparities covaried with education; there are significant mortality disparities across observed skin tone groups among black respondents with high school or more education, and nonsignificant disparities among those with less education.

Conclusion—It is crucial to identify the social processes driving racial disparities in health and mortality. The findings reveal that the nuanced social experiences of blacks with different observed skin tones markedly change the experience of racial inequality. Research on the nuanced social processes and biological mechanisms that connect differences in observed skin tone to mortality outcomes promises to better illuminate the experience of racial inequality and policy mechanisms we can use to undermine it.

Keywords

Race; mortality; health disparities; skin tone

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Research on mortality consistently shows that blacks in the United States (U.S.) live less healthy and much shorter lives than their similarly situated white counterparts (Hayward and Heron 1999; Rogers, Hummer, and Nam 2000; Williams 1997). In 2011, for example, mortality data show that a black newborn is 2.3 times more likely to die in the first year of life and 1.5 times more likely to die before the age of 65 than their white counterpart (Arias 2015). Although socioeconomic status (SES) covaries with these disparities in vital functions, the responsible social and biological mechanisms remain poorly understood (Zuberi, Patterson, and Stewart 2015).

Recent research in social science suggests that a key underlying mechanism of racial health disparities occurs in social interaction. More specifically, race ‘happens’ in the context of social interactions wherein observed phenotypic characteristics shape differential treatment, and privilege access to resources and opportunities (Emirbayer 1997; Stewart 2008a). This *interactive* theoretical perspective has been further confirmed by empirical research on perceived discrimination (Barnes et al. 2004; Kessler, Mickelson, and Williams 1999; Williams, Yu, and Jackson 1997), labor market discrimination (Pager 2003; Pager, Western, and Bonikowski 2009), and racial bias in medical settings (MacIntosh et al. 2013; Pletcher et al. 2008; Todd et al. 2000; Van Ryn and Burke 2000); blacks and other racial minorities experience significantly worse treatment, have less access to resources and opportunities, and have worse health encounters than similarly situated whites. Importantly, this research demonstrates that the unique experiences of racial minorities in social interactions vary *within* groups such that certain members receive distinct treatment (i.e. exposure to adverse social experiences) and have worse/better outcomes than other group members.

One characteristic that partly captures within-race variation in social interactions and health outcomes among blacks is skin tone (Brown et al. 1999). Blacks with lighter skin have less exposure to racial bias, better health outcomes, as well as higher levels of education, occupational prestige, employment rates and wages (Keith and Herring 1991; Klonoff and Landrine 2000; Krieger and Sidney 1996; Monk 2014; Uzogara and Jackson 2016). Furthermore, relative to whites, light skinned black men have modestly lower wages whereas medium and dark skinned black males earn substantially less (Kreisman and Rangel 2015). These findings affirm Goldsmith, Hamilton, and Darity’s (2007) assertion that skin tone is a fundamental aspect of marginalization whereby darker skinned blacks are exposed to higher levels of racial discrimination and poverty than their light skinned counterparts. Although socially assigned skin tone covaries with racialized treatment, SES and health outcomes within the black population (Jones et al. 2008), we do not know if/how skin tone covaries with mortality. *Do the benefits of having light skin in the black population also shape mortality outcomes?*

The aim of this study is to examine how skin tone covaries with mortality outcomes among blacks, and the extent that observed black/white mortality disparities are shaped by the experiences of specific skin tone groupings.¹ Specifically, we examine the validity of the

¹Although skin tone and, more specifically, the use of skin tone in social interaction precedes respondent death, we cannot definitively establish the direction of covariance. Thus, we cautiously use the term covariance to highlight that our observations are the measured aspects of a complex recursive system, which we are unable to fully express mathematically.

hypothesis that light skinned blacks have lower mortality rates than dark skinned blacks using data from the 1982 General Social Survey (GSS) linked to the National Death Index (NDI). These nationally representative data contain information on racial classification, observed skin tone of black respondents, a host of demographic, socioeconomic and geographic characteristics, as well as the vital status of respondents during a 26-year mortality follow up period. We use these data to estimate the mortality risks associated with varying skin tone among blacks, and, indirectly, assess if previously established skin tone differences in racialization translate into mortality.²

Our paper uniquely adds to the literature on racial mortality disparities in two ways. First, we greatly improve on the two modern studies on skin tone and mortality among blacks. These studies, Keil et al. (1992) and Knapp et al. (1995), examined mortality experiences of blacks between 1960 and 1990 using the Charleston Heart Study. Although they both found very modest evidence of skin tone mortality disparities among blacks, the data is out of date and not nationally representative; the data are based on a sample residing in Charleston County, South Carolina in 1960.³ We build on these studies by using a relatively recent, nationally representative dataset with categorical information on blacks' observed skin tone to assess how skin tone covaries with mortality outcomes. Our second contribution to the literature is the integration of mortality into recent discussions on the role of skin tone and health. This literature largely pertains to examining disparities in treatment, SES, and health. We add to this body of work by examining if the adverse experiences associated with darker skin accumulate and shape mortality outcomes among blacks. By using nationally representative data that contain multiple measures of blacks' racial identification (i.e. racial classification and externally observed skin tone), we improve our understanding of the less proximate, social mechanisms contributing to disparities in mortality and the experience of racial inequality more broadly.

We begin the paper with a review of the literature on race, skin tone, and mortality outcomes in the U.S. Then, we describe our data in detail, and review the methods we use to examine both racial and skin tone disparities in mortality. We then present our analytic results showing that skin tone is a significant determinant of mortality disparities, and is particularly relevant among those with higher levels of education. We conclude the paper with a discussion of the two broad mechanisms behind skin tone mortality disparities – categorical selection and categorical exposure – and the implications of our findings for future research on modern health disparities.

Background

There is a longstanding body of research on mortality disparities between blacks and whites. Early research showed dramatic racial differences in life expectancy between the groups (Davenport 1911; Hoffman 1896). For example, Du Bois (1899) showed that blacks

²Although we do not assess the extent that skin tone is a proxy for differential treatment, socioeconomic status and health outcomes in this paper, previous research discussed in the Introduction and Background highlights that skin tone is a significant correlate of these social and biological factors/characteristics.

³These authors also measured skin tone using a reflectometer to produce a continuous measure of reflectance—and arbitrarily grouped respondents into skin tone tertiles using this scale. This methodological decision ignored the possibility of non-linearities in the relationship between skin tone and mortality, and may not reflect socially meaningful skin tone variation within the black population.

experienced substantially worse death rates than whites. He suggested that the heightened black death rates were indicative of ‘... how far this race [blacks] is behind the great vigorous, cultivated race [whites] about it’ (163). Although Du Bois effectively argued that these historical disparities were a function of social conditions (e.g. nutrition, housing, etc), most of his contemporaries and the larger public viewed the disparities as a sign of blacks’ physical inferiority (Graves 2001; Morris 2015).

Like Du Bois, more recent research on racial mortality disparities underscores group differences in social conditions and characteristics (e.g. SES) as key mechanisms of inequities in vitality. These socioeconomic characteristics broadly represent an actor’s access to a set of health producing resources (Krieger, Williams, and Moss 1997; Link and Phelan 1995). As such, racial differences in access to these resources partly attenuate observed disparities in health and mortality; we still observe significant mortality disparities between blacks and similarly situated whites after controlling for socioeconomic resources using advanced statistical models (Rogers, Hummer, and Nam 2000; Stewart 2008c).

Though controlling for socioeconomic resources partly accounts for racial mortality disparities, the traditional black/white mortality models overlook two key aspects of race: social interaction and within-group variation. In the case of social interaction, traditional models of mortality disparities depict them as a function of several objective social characteristics such as SES (Bonilla-Silva 1997; Emirbayer 1997). Race and racial inequality, however, embody more than the possession of resources; they are the result of ongoing racialized (i.e. biased) social interactions between individuals and groups (Stewart 2008a, 2008b). Race embodies a complex system of social interaction where blacks experience worse treatment, less access to resources and opportunity, and, consequently, worse health outcomes than similarly situated whites (Zuberi, Patterson, and Stewart 2015). The traditional mortality disparity models give primacy to objective characteristics and ignore underlying social processes – the spaces where Stewart (2008a, 287) argues ‘... racial inequalities are created and maintained.’ We endeavor to shed light on these social processes by examining skin-tone variation in mortality.

A second oversight in research on racial disparities in health and mortality is within-group variation (Whitfield et al. 2008; Whitfield and Baker-Thomas 1999). Disparities research often treats racial groups as large, homogenous categories. Indeed, this body of work draws on statistical models that capture the variation within and across the respective groups. However, the central focus is on the average disparity among persons of different racial groups. This perspective overlooks within group variation in mortality experiences and, implicitly, the social processes that lie behind this variation (Bonilla-Silva 2003; Zuberi 2001; Zuberi, Patterson, and Stewart 2015). Firebaugh et al. (2014) recently examined within race variation in lifespans. They found greater within-group variance in the lifespans of blacks than whites. Their finding highlights that there are considerable overlaps in the mortality experiences of blacks and whites. But, we are left to speculate about the underlying social processes that drive this increased variability in vital status among blacks.

Skin tone is an ethno-racial marker that varies among blacks (i.e. within-group) and represents a critical aspect of the social processes (i.e. interactions) that constitute race. In

colonial America, racial mixing between blacks, whites and/or indigenous groups produced a wide range of skin tone variation among blacks (Frazier 1939, 1957; Myrdal 1944). Indeed, the children of racial admixture were racially classified as black. However, this pattern of racial admixture – along with other factors – laid the foundation for a ‘color caste system’ within the larger U.S. racial hierarchy (Drake and Cayton 1945 (1993)). The characteristic feature of this system was that blacks with light skin (i.e. the product of black and white progenitors) were more likely to be assigned to prestigious and socially desirable occupations, and have more wealth than those with darker skin (Bodenhorn and Ruebeck 2007).⁴ In other words, variation in skin tone was tied to differential treatment, and unequal access to resources and opportunities in early America.

Skin tone continues to shape both the interactions and outcomes of blacks in the modern era. Research shows that there remains a high level of skin tone variation among blacks (Hill 2000). And, as in the past, blacks with light skin continue to experience greater access to resources and opportunities than those with dark skin (Branigan et al. 2013; Hunter 2007; Klonoff and Landrine 2000; Krieger and Sidney 1996; Monk 2014, 2015). While the persistent privilege of light skin may transcend generations into the modern era because of selective inheritance (i.e. children inheriting both light skin and privilege), research suggests that inheritance plays a minor role. Hill (2000), for example, examined the differences in adult SES between blacks and mulattos, a black sub-group with light skin. He controlled for the advantaged social origins of mulattos using historical census data and confirmed ‘... the importance of color bias as an explanation of color-based stratification among African Americans’ (1454).⁵ Goldsmith, Hamilton, and Darity (2007), building on the work of Hill (2000), subsequently examined the extent to which skin tone was tied to intra-racial and inter-racial wage stratification using two data sets. They found that light skin was tied to higher labor market rewards, and that the ‘... bivariate characterization of race ignores the heterogeneity of labor market experiences of black subgroups’ (Goldsmith, Hamilton, and Darity 2007, 729). This work further highlights that skin tone shapes the outcomes/experiences both within the black population and in relation to whites. Blacks with light skin are more likely obtain higher levels of education, report higher earnings, get married, reside in more racially integrated areas, and are less likely to be suspended than their counterparts with dark skin (Allen, Telles, and Hunter 2000; Hamilton, Goldsmith, and Darity 2009; Hannon, DeFina, and Bruch 2013; Hersch 2006, 2008; Hughes and Hertel 1990; Keith and Herring 1991; Massey and Denton 1991). Thus, skin tone is a critical piece of the experience of race in the U.S.

Research shows that variation in blacks’ skin tone is also tied to health outcomes in the modern era (Cobb et al. 2016; Thompson and Keith 2001). A considerable amount of work

⁴Importantly, all else equal, the skin tone of enslaved blacks working in agricultural settings would be darker than enslaved blacks working in privileged spaces. Status construction theory suggests that this relationship may have contributed to the status belief that light skin was indicative of higher status among blacks in early America (Ridgeway 1991). Thus, environmental factors may have partly contributed to the relationship between skin tone and status.

⁵Gullickson (2005) subsequently examined cohort differences in the privileged social outcomes tied to skin tone using the National Survey of Black Americans. Although his results counter the conclusions of Hill (2000), his study/data has limited capacity to test the merits of time trends in the significance of skin tone. Specifically, Goldsmith, Hamilton, and Darity (2007) note that sample attrition, particularly that of light skinned blacks, was substantial—there were fewer than 15 blacks with light skin in the final wave of his sample.

on this has been done in the area of hypertension (Dressler 1991; Gleiberman et al. 1995; Harburg et al. 1973, 1978; Klag et al. 1991; Murray 1991; Veenstra 2011). Using data from the Charleston Heart study, Keil et al. (1977) investigated the relationship between skin tone, social class and the incidence of hypertension among blacks. They found that lighter skin was correlated with a significantly lower incidence of hypertension, but that this relationship was only discernible among those with high SES. More recently, Sweet et al. (2007) examined skin tone and hypertension among blacks using the Coronary Artery Risk Development in Young Adults (CARDIA) Study. They also found that blacks with dark skin had higher blood pressures than their counterparts with light skin. Furthermore, they revealed a distinct relationship between SES, skin tone and blood pressure; the relationship between income and hypertension was negative for light skinned blacks (i.e. more income related with lower blood pressure) and non-existent for dark skinned blacks. Taken together, these and other studies suggest that skin tone is related to health outcomes, and that the relationship between skin tone and health varies by SES (Monk 2015).

We do not know if there is a valid relationship between skin tone and mortality in the modern U.S. Three studies have examined the relationship between skin tone and mortality, each with distinct limitations. One article, Green and Hamilton (2013), examined the relationship between skin tone and mortality in the immediate post-Reconstruction era. They divided the black population of North Carolina from the 1880 U.S. census into two groups – mulattoes and colored (i.e. non-mixed race blacks) – and estimated racial mortality disparities. They found that mulatto and black men had similar, significantly higher mortality rates than white males. Among women, on the other hand, they showed that mulattos experienced a mortality advantage (i.e. lower mortality) in comparison to non-mulatto blacks. Like Green and Hamilton, the other two studies on skin tone and mortality use a historical, regional sample – the Charleston Heart Study. These studies (Keil et al. 1992; Knapp et al. 1995) both use baseline data on blacks residing in Charleston County, South Carolina in 1960, and examine skin tone mortality disparities based on the respondents experiences between 1960 and 1990. The analysis by Keil et al. (1992) revealed a modest relationship between light skin tone and lower all-cause mortality, and found no relationship between skin tone and cardiovascular disease mortality. Knapp et al. (1995) examined the relationship between skin tone and cancer mortality in the Charleston Heart Study. They found a nonsignificant relationship between skin tone and cancer mortality. But, Knapp et al. *did* show that among high SES blacks lighter skin was significantly associated with lower cancer mortality. This latter finding further suggests that skin tone may have a unique relationship with SES in shaping health outcomes as seen in the research discussed above.

The current paper adds to the aforementioned literature on skin tone and mortality by using a relatively recent, nationally representative dataset with information on observed skin tone. Our data allows us to estimate the degree to which mortality covaries with skin tone in the modern U.S. Research on skin tone and health among blacks suggests that lighter skin covaries with good health, and that this relationship is stronger among those with high SES. Given this, we expect skin tone to covary with mortality rates, especially among those with higher SES. Let us now discuss the data we use in our analysis.

Data

We use data from the 1982 General Social Survey (GSS), an ongoing social survey collected by the National Opinion Research Center in Chicago (NORC) which began in 1972. The GSS collects data on non-institutionalized adults aged 18 and above in the United States (U.S.) using a multi-stage probability sampling technique. Although the GSS was designed to study public opinion, there are three features that make the GSS very well suited to studying skin tone and mortality. First, the 1978–2002 GSS data have been linked to the National Death Index through 2008. This linkage provides GSS users with information on vital status and other mortality related variables (e.g. year of death) for virtually all the respondents during those years (Muennig et al. 2011). Second, the data contain information on the observed skin tone of black respondents. In 1982, the GSS interviewers coded observed skin tone of self-identified black respondents.⁶ Finally, the GSS data contain an array of demographic and socioeconomic characteristics of respondents. Given our focus, we restrict our analytic sample to blacks and whites in the 1982 GSS.

All-cause mortality

Our key outcome variable is all-cause mortality. Information on mortality was collected in the mortality follow-up which lasted from 1982 to 2008. The measurement of mortality in the GSS includes both duration and event components. Thus, our models incorporate both the number of years that a respondent lived between 1982 and 2008, as well as a variable detailing if an event (i.e. death) occurred during this follow up. We calculate exposure (i.e. person years) for deceased respondents as the difference between their year of death and survey year (i.e. 1982). Whereas for surviving respondents, we calculate exposure as the difference between the final year of observation (i.e. 2008) and the survey year; all survivors live for 26 person years. For our sample of 1,626 respondents, we observed more than 34 thousand person years of exposure during the mortality follow-up period (i.e. 1982–2008). Furthermore, approximately 43% of the sample respondents ($D = 702$) died during this period.

Race

The 1982 GSS used three categories to classify racial groups: black, white and other. Each GSS interviewer placed respondents into one of these three groups. If the interviewer was unsure of the respondent's race, they asked the respondent: 'What race do you consider yourself? White, Black, or Other.' Thus, the interviewers coded perceived race when 'there was no doubt' and asked respondents otherwise. We created a dummy variable, *black*, for race in our analysis which is coded 1 when respondents identified as black in the GSS interview and whites are coded as 0.

⁶In the GSS, interviewers only socially assigned the skin tone of black respondents. Specifically, interviewers assigned respondents into one of three racial groups: black, white and other. If the interviewer was unsure of respondent race, the interviewer asked the respondent to self-identify their racial group as black, white or other. After identifying respondent race, the interviewers assessed skin tone for all of the black survey respondents.

Observed skin tone

GSS interviewers rated respondents' skin color on a scale from one (very light) to five (very dark brown).^{7,8} Altogether, the interviewers classified approximately three percent of blacks as very light, 14% as light, 47% as medium brown, 26% as dark brown, and 10% as very dark brown. Due to sample size, we collapsed the two lightest skin tone groups and the two darkest skin tone groups so that we have three groups: (1) light brown, (2) medium brown and (3) dark brown. For our analyses, we use three dummy variables to represent each of these skin tone groups and whites are the reference group (unless otherwise specified).

Control variables

Our analyses includes control variables for age, gender, SES, marital status, region, and size of MSA. Age is a continuous variable measured at time of interview.⁹ The baseline age at interview variable ranged from 18 to 97—97 represents an open-ended interval. For each year that a person lived beyond the year of interview, we add one year to their respective age to control for the relationship between aging and mortality. We also include an age-squared term in our models to control for curvilinearity in the relationship between age and mortality. In addition to age, we use a gender dummy variable, where females are coded as 1, as a second demographic control variable.

We include three socioeconomic control variables. The first, educational attainment, is based on the respondent's completed education. We measure attainment as the number of years of education that a respondent completed, and include squared term in our models with education to account for curvilinearity. In addition to the years of education variable, we stratify our final models into two educational groups: 'less than high school' and 'high school or more.' We use this version of the education variable to examine whether skin tone mortality disparities are stronger among those with higher levels of education, as seen in previous research (Keil et al. 1977; Knapp et al. 1995; Sweet et al. 2007). Our second socioeconomic variable, household income, is based on interviewees' responses to queries about household income in the preceding year. The responses on household income are grouped into several categories, and we use the midpoint of these categories as an estimate of household income below the median. We fitted a Pareto curve to the distribution above the median to estimate average household income within the respective categories (Parker and Fenwick 1983). In our models, we transform the household income variable using a natural logarithm to account for the skewed distribution of incomes. The final socioeconomic variable, labor force status, draws on interview responses to questions about employment. We used these responses to create two labor force status dummy variables, part-time employment and unemployed; full time employment is the reference group.

⁷The GSS codes for skin tone rate '1' as the darkest complexion group and '5' as the lightest skin tone group. We reverse coded this variable such that '1' was the lightest and '5' was the darkest. We do this ease interpretation in our models which classify whites as having skin tone equal to 0. Thus, our descriptive and multivariate statistical tables present the categories: 0) white, 1) light brown, 2) medium brown, and 3) dark brown. (As mentioned in the text, we collapsed the two light brown and two dark brown categories due to sample size.)

⁸The 1982 GSS does not contain adequate data on interviewer characteristics to include in our models. Existing research shows that interviewer characteristics can mask skin tone effects. Hill (2000), for example, shows that controlling for race of interviewer magnifies skin tone disparities in income using the Multi-City Study of Urban Inequality. This result suggests our skin tone effect may be an underestimate of the effect of socially assigned skin tone on mortality.

⁹Six individuals did not provide information on age and were dropped from the analysis.

We also use information on marital status and geographic location in our analysis. Our marital status variables consist of 4 categories: currently married (reference group), divorced/separated, widowed, and never married. The geographic variables, on the other hand, consist of two variables. We coded region of residence using four categories: South, Midwest, West, and Northeast (reference group). Furthermore, we code Metropolitan Statistical Area (MSA) size using three categories: large MSA's (reference group), medium MSA's, and not residing in MSA.

We use dummy variables for missing data on our categorical variables, and multiple imputation to deal with missing information on our continuous variables. For multiple imputation, we use a Markov Chain Monte Carlo (MCMC) method to impute values for cases with missing information (Schafer 1999). The imputed values we use are the average of 25 imputations of the missing value for a respondent. Furthermore, we incorporate dummy variables indicating whether the respondent is missing information to account for possible imputation bias.

Analytic strategy

We use piecewise exponential hazard models to analyze racial and skin tone disparities in mortality.¹⁰ These models allow us/readers to estimate mortality hazards for the respective race/skin tone groups over the 26 year follow up period. The main assumption of these models is that the age-specific mortality hazards during each of the follow-up years (i.e. person-year intervals) are constant.¹¹ Demographers regularly use this assumption when constructing period life tables (Preston, Heuveline, and Guillot 2001). In this analysis, the assumption allows us to estimate how the probability of dying varies with age, race, skin tone and other characteristics of theoretical import.

Our analysis proceeds in three stages. First, we perform a baseline hazard analysis of black/white mortality disparities among GSS respondents. Our goal in this phase of the analysis is to shed light on the nature and magnitude of racial mortality disparities among GSS respondents, as well as their relationship with a set of demographic, socioeconomic, marital status and geographic characteristics. Second, we perform an analysis of within-race skin tone mortality disparities. This stage of the analysis highlights how mortality covaries with skin tone among black GSS respondents, and the extent that these within-group disparities are related to other covariates. Lastly, we analyze skin tone mortality disparities among both black and white respondents. Instead of using a single dummy variable for race (as in the 1st stage), we use three dummy variables signifying different shades of skin tone of black respondents with white respondents being the reference category. Additionally, we run separate models where we stratify respondents by education. Thus, this final stage of the analysis provides insight on how much skin-tone contributes to the broader model of racial mortality disparities, the degree to which the mortality hazards of certain skin tone groups deviate from others, and the extent that skin tone mortality disparities vary by SES.

¹⁰See Allison (1995) for a more complete discussion of piecewise exponential hazard models.

¹¹Importantly, mortality hazards vary across the life course and social groupings. The assumption of constant age-specific mortality hazards is a mechanism demographers employ to estimate mortality hazards in these groupings from discrete data.

Altogether, our analysis reveals how racial classification and skin tone covary with mortality. Previous research suggests that black/white mortality disparities among respondents with similar characteristics will be significant (Rogers, Hummer, and Nam 2000; Stewart 2008c). However, we do not know if there is substantial within race variation in mortality that covaries with skin tone. The current body of skin tone research indicates that skin tone is a significant predictor of educational achievement, SES and health outcomes (Keith and Herring 1991; Monk 2014). This and other work suggests that skin tone may be related to mortality disparities via SES and health, as well as represent a proxy for deeper within race disparities in treatment and/or resources. We now turn to our analysis.

Results

Table 1 shows several descriptive statistics for our GSS sample by race and skin tone (for blacks). There are several notable – and contrasting – differences/variations across the racial and skin tone groups. For example, black respondents have a higher baseline mortality hazard than whites in the follow up period (1.4 times greater $\approx (0.0027)/(0.0019)$). However, the large mortality disparity is not observed among all the skin tone groups. The lightest skin tone group has mortality hazards that are not considerably higher than their white counterparts, and the darkest skin tone group has lower mortality hazards than the medium group – admittedly, this hazard doesn't control for any covariates. In addition to racial and skin tone disparities in mortality, we also observe some contrasting variation across socioeconomic categories. For example, black respondents are less likely to be employed full time and more likely to be unemployed than white respondents. When we focus on the skin tone groups among blacks, the disparity in full time employment is only observed between whites and blacks in skin tone groups 2 and 3, medium and dark brown skinned blacks – light skinned blacks have full time employment rates similar to whites. The unemployment statistics complicate this picture as light skinned blacks in this sample are the group most likely to be unemployed.¹²

The racial and skin tone differences in education and income also show considerable variation, but are in line with existing research (Keith and Herring 1991; Monk 2014). Blacks have much lower levels of education than whites; nearly 20% of whites have attended college in comparison to only 13% of blacks. The disparities between blacks and white in educational achievement, however, are larger among dark skinned blacks (i.e. skin tone group 3). In line with this observation, dark skinned blacks earn significantly less than their white and lighter skinned black counterparts – all the black skin tone groups earn significantly less than whites.

The descriptive statistics highlight that there are sizeable racial and skin tone mortality disparities. The baseline skin tone mortality disparities follow a curvilinear pattern such that the lightest and darkest blacks have mortality experiences similar to their white counterparts. This pattern contrasts the racial/skin tone variation in education and income where the

¹²Indeed, the unemployment statistics in this dataset do not follow the expected pattern between skin tone and SES. This finding may be a nuance of the sample or a deeper social form. Although this nuance is interesting, we are concerned with the relationships between this and many other factors with mortality. As a result, we control for unemployment and other factors in our model and refrain from discussing potential mechanisms driving this statistic.

lightest skinned groups have more resources/education than their dark skinned counterparts. These contrasting patterns call for a deeper examination of racial and skin tone disparities in mortality.

Table 2 contains the results for our piecewise exponential hazard model of racial (i.e. black/white) disparities in mortality. The results in this table represent survival rates; we use a negative sign on the race coefficient when we exponentiate to estimate the ratio of black-to-white mortality hazards (e.g. $\exp(-\beta)$). These hazard models will establish a reference point for the unique mortality experiences of black and white GSS respondents. The baseline model (i.e. Model 1) shows that black GSS respondents experienced significantly higher mortality than their white counterparts. Blacks were 1.4 times more likely to die in the mortality follow up period than their white counterparts (i.e. $\exp^{-(-0.336)} = 1.399$). Models 2 and 3 show that after controlling for racial differences in education, income, employment and marital status, the mortality disparity is still significant; black and white GSS respondents with similar socioeconomic characteristics and marital status had significantly different mortality experiences. The addition of controls for MSA and region of residence does lead to a reduction in the race coefficient such that blacks experience mortality hazards roughly 1.3 times higher than whites in living in similar areas/parts of the country (i.e. $\exp^{-(-0.256)} = 1.29$). Notably, these findings are in line with existing research showing that similarly situated blacks and whites have significantly different mortality experiences, but they conceal considerable variation within the black population (Model 4).

The results for our analysis of intra-racial variation in mortality hazards appear in Table 3. The hazard models in these tables pertain only to black respondents so that we can focus on the form and magnitude of intra-racial, skin tone variation in the mortality experiences of blacks. Model 1 shows that the lightest skin color group has significantly lower mortality than the two darker groups. Whereas the mortality hazard for skin tone group 3 is 1.2 times higher than that of group 1 (i.e. light brown blacks), the hazard for group 2 is 1.47 times higher. Thus, blacks in the middle of the skin tone distribution, medium brown, experience significantly worse mortality hazards than their lighter and darker counterparts.¹³ Furthermore, this significant skin tone disparity in mortality among blacks is observed among those with similar socioeconomic, marital and geographic characteristics.

Table 3 reveals that there is considerable intra-racial variation in mortality hazards among blacks and it maps onto skin tone. We do not know, however, if larger black/white mortality disparities are largely shaped by a few of the skin tone groups or all of them. *Are the published statistics on black/white mortality disparities driven by all of the skin tone groups or just a few?* We address this question by incorporating whites into our hazard model of skin tone mortality disparities as a reference group.

Table 4 contains the results of our piecewise exponential hazard model of skin tone mortality disparities where white GSS respondents are the reference group. The coefficients on skin tone highlight how much higher/lower the mortality hazard is for the respective group.

¹³We performed a separate test examining the significance of the difference in mortality hazards of skin tone groups 2 and 3. We found that the mortality experiences of medium brown blacks (group 2) were significantly worse than those of dark brown blacks (group 3) across all of the models in Table 3.

Model 1, which controls for age and gender, shows that all the black skin tone groups have higher mortality than their white counterparts to varying degrees. The lightest skin tone group experiences nonsignificant disparities in mortality. The 2nd and 3rd skin tone groups (i.e. medium brown and dark brown) experienced mortality hazards that were 1.68 and 1.27 times higher, respectively, than their white counterparts. Although controlling for geography modestly reduced these disparities, blacks with medium and dark brown skin still experience significantly higher mortality hazards than whites living in similar locales (Model 4).

Comparing Tables 2 and 4, we see how much skin tone contributes to our understanding of racial mortality disparities. We use the BIC (i.e. Bayesian Information Criterion) to compare the models in these tables and ascertain if skin tone data produced a significantly better fit than the bivariate characterization of race. Looking at our baseline models in each table, the BIC statistic is considerably lower in the model with 3 skin tone groupings (BIC = 45,618) than with the race dummy variable (BIC = 45,693). This difference suggests that skin tone greatly contributes to our understanding of variation in mortality – more than race alone. And, we see the added contribution of skin tone to models of racial mortality disparities even after controlling for socioeconomic, marital and geographic characteristics (see Model 4 in Tables 2 and 4). Although skin tone clearly contributes to our understanding of mortality disparities, we do not know the extent to which skin tone disparities vary by social contexts and categories (i.e. SES). *Do skin tone mortality disparities covary with SES as in the case of skin tone and other factors (e.g. hypertension)?*

Table 5 contains selected results of our piecewise exponential hazard models of skin tone mortality disparities which are stratified by educational achievement. The top panel shows the results for GSS respondents with ‘less than high school’ education, whereas the bottom panel contains the results for respondents that have at least a ‘high school’ education – Figure 1 graphs the results of the full model. Our results show that skin tone mortality disparities are larger among those with higher education. Among those with less than a high school education, only one skin tone grouping has a higher mortality hazard than their white counterparts (i.e. Color 2: medium brown). Interestingly, this finding disappears after controlling for various characteristics (Model 4), but the two other skin tone groups exhibit significantly *lower* mortality than their white counterparts with less than high school education after controls. Among those with at least a high school education, there remains a curvilinear pattern of skin tone mortality disparities. Light blacks (Color 1) experience higher mortality hazards, and medium and dark blacks have considerably higher mortality hazards than whites and light skinned blacks – dark blacks do experience modestly lower mortality disparities than medium brown blacks with a high school education (Model 1). In contrast to the less than high school models, this pattern of skin tone mortality disparities among those with more than high school education holds after controlling for socioeconomic, marital and geographic characteristics. Taken together, these findings suggest that while skin tone is an important factor in racial mortality disparities, it is particularly relevant among those with higher levels of education (i.e. SES).

Discussion & conclusion

Our goal is to shed light on the extent that a ‘racial’ characteristic which plays a key role in social interaction, skin tone, is associated with mortality disparities. Research shows that blacks with lighter skin, on average, experience an array of social benefits not shared with their darker skinned counterparts (Cobb et al. 2016; Monk 2014). These benefits include higher levels of education, occupational prestige, employment and wages. Thus, skin tone covaries with the racialized treatment and outcomes that constitute the modern system of racial inequality (i.e. social processes).

We found that observed skin tone among blacks – a measure of socially assigned race that is linked to social benefits – is tied to significant variation in mortality hazards. Light skinned blacks have mortality hazards that are in line with their white counterparts, medium and dark brown skinned blacks have significantly higher mortality rates, and, curiously, blacks with the dark skin had mortality hazards that were significantly lower than those with medium brown skin (i.e. a curvilinear pattern). While the former results on blacks with light and medium brown skin is in line with work showing skin tone disparities in racial treatment, SES and hypertension, the latter curvilinear result on blacks with dark skin is atypical.¹⁴

The atypical mortality results – dark skinned blacks having lower mortality than medium brown blacks – is partly attributable to variation in the returns to skin tone across contexts. This effect is seen in the education stratified models of skin tone mortality disparities. Among blacks with less than high school education, we find inconsistent and largely nonsignificant mortality disparities across skin tone groups. In contrast, black respondents with a high school education or more revealed significant disparities among all skin tone groups. Blacks with the lightest skin in this category experience significantly higher mortality than whites, and medium and dark brown skinned blacks faced hazards that were significantly higher than both whites and light skinned blacks. Although the curvilinear pattern of mortality disparities is still modestly prevalent among those with high school or more education, there is a dramatic change in the mortality profile by skin tone. Namely, the difference in the mortality experiences of medium and dark brown blacks are no longer significantly different.

Altogether, our results shed light on two broad mechanisms that drive the complex, observed skin tone mortality disparities – categorical selection and categorical exposure. The categorical selection mechanism refers to the role of skin tone as a determinant of important social outcomes such as educational achievement. Research shows that blacks with light skin achieve significantly higher levels of education than those with darker skin (Keith and Herring 1991; Monk 2014). Thus, blacks with lighter skin are more likely to be ‘selected’ into higher educational categories through their unique experiences, and, as a result, have

¹⁴Due to sample size, we are unable to determine whether the baseline curvilinear mortality pattern is a function of immigrants among the dark skin tone group. There are only 4 respondents in the darkest skin tone category who are immigrants or children of immigrants—a number similar to those in our other skin tone groups. The uniform distribution of immigrants across skin tone groups suggests that dark skinned immigrants are not driving the lower mortality rates among the group, unless there is a distinct relationship between dark skin tone and *better* health among immigrants.

lower overall mortality (Elo and Preston 1996). We account for this and other forms of categorical selection with independent variables.

The second broad mechanism driving skin tone mortality disparities, categorical exposure, refers to the experiences of individuals within social categories (e.g. education). Whereas categorical selection focuses on the role of skin tone in determining outcomes like educational achievement, categorical exposure is concerned with the unique skin tone experiences among blacks within categories, such as those among blacks with similar educational achievement. Our stratified results suggest that the social experiences (i.e. categorical exposure) of blacks with different skin tones varies across educational groupings. Specifically, the mortality experience of those with more than a high school education is characterized by larger disparities across skin tone groups than those with less education. This result is in line with Sweet et al. (2007) and Keil et al. (1977) that showed larger skin tone disparities in hypertension among high SES respondents, as well as Knapp et al. (1995) who found significant skin tone disparities in cancer mortality for high SES black respondents. The categorical exposure mechanism highlights that the impact of skin tone on health is uniquely brokered by the experiences of blacks *within* important social categories such as education.

Taken together, the categorical selection and categorical exposure mechanisms complicate the puzzle of racial inequality. The task for future research is to understand how these two mechanisms shape skin tone mortality disparities across the life cycle. A critical part of this puzzle is identifying the sociobiological pathways through which skin tone becomes disparities in death. Future research should closely examine the varying cause of death distribution among skin tone groups across a variety of social contexts (e.g. educational groups, segregation levels, etc) to highlight the broad health determinants of observed mortality disparities. Furthermore, scholars should closely examine the nuanced experiences (i.e. categorical exposure) of skin tone groups in the respective social contexts. Existing research on class background (e.g. education), social context, and discrimination indicates that blacks who live/work in predominantly white spaces – those who interact more often with whites – are more likely to experience discrimination (Hunt et al. 2007; Jackson and Stewart 2003; Jackson, Thoits, and Taylor 1995; Oliver and Wong 2003; Uzogara and Jackson 2016). This reality, combined with the results above on education, suggests that future research should examine the biological and coping responses to the varied experiences of skin tone groups across social contexts (e.g. educational groups) with varying racial compositions. This research will advance our understanding of observed skin tone mortality disparities, and the nuanced ways that social and biological factors create unique mortality experiences across social contexts.

Although our findings shed new light on the relationship between skin tone and mortality disparities, they do have limitations. The first limitation pertains to sample size. The GSS is a nationally representative dataset with which we can interrogate the relationship between skin tone and mortality. Unfortunately, the small sample and number of deaths among respondents limit our capacity to perform a battery of advanced statistical models. For this reason, we combined skin tone groupings and did not divide the sample into gender groups for our analyses. Future researchers can overcome this limitation by finding larger datasets

with information on skin tone and connecting them with the NDI to better reveal the distinct relationship between skin tone and mortality.

The second limitation pertains to the measurement of skin tone. We use an interviewer assessed, categorical measure of observed skin tone to ascertain if skin tone is related to respondent mortality. Our findings add to the literature showing that this interviewer assessed measure of socially assigned race is associated with health (Jones et al. 2008; MacIntosh et al. 2013). We prefer this ‘social’ measure as it broadly captures how others perceive a respondent within a social interaction. And, while Gravlee, Dressler, and Bernard (2005) show that the social measurement of skin tone is more relevant than objective measures in predicting hypertension, we understand it is based on a subjective interpretation by an interviewer with potential for bias. Research indicates that interviewer characteristics can bias skin tone assessments, and controlling for these characteristics magnifies income disparities across skin tone groups (Hannon and DeFina 2014; Hill 2000). Although we do not have adequate data on interviewer characteristics in our sample, the literature suggests that interviewer bias may attenuate our estimate of the impact of skin tone on mortality (i.e. our estimates are conservative).

Indeed, biometric measures which use a handheld narrow-band reflectance meter to measure skin pigment offer an unbiased alternative to subjective measures of skin tone, but they also have unique limitations. The biometric measure of skin tone was originally designed to measure biological distinctions in skin tone, not social distinctions (Villarreal 2010). Thus, we do not know: (1) the extent to which biometric measures accurately capture important distinctions in observed skin tone, (2) how other phenotypic features and social contexts may bias these objective measurements (e.g. the extent that gender and/or educational background differentiates the perception of a given skin tone), and (3) any non-linearities in the relationship between objective skin tone and the racialized form of social interactions. These issues deserve serious consideration and should be addressed in future work that employs the objective biometric measures of skin tone in examining health and mortality disparities.

Our analysis shows that skin tone, a phenotypic symbol of within group variation in social benefits, is a significant determinant of mortality among blacks in a national sample. The findings also show that blacks of divergent skin tones have significantly different mortality experiences in certain social contexts (i.e. categorical exposure). The task of future research in this area is to shed light on the array of social and biological mechanisms through which differences in observed skin tone among blacks shapes eventual health and mortality in particular, and the experience of racial inequality more broadly. Research on these and other mechanisms that embody the social processes behind race promise to shed new light on how the phenotypic features of population groups become disparities in health and well-being. Furthermore, research on the varying social processes driving skin tone mortality disparities will better illuminate policy mechanisms for alleviating health inequalities, particularly those that move beyond traditional calls for changes in the distribution of objective characteristics.

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Figure 1.

Selected piecewise exponential hazard results (B/W odds ratios) for skin tone mortality disparities stratified by education – 1982 GSS respondents. Notes: The odds ratios represent the increased odds of dying for each skin tone group based on the coefficients in Table 5, Model 4. For the High School or more group, the odds ratios show significantly higher mortality among light brown, medium brown and dark brown skinned blacks. In contrast, the odds ratios show that light brown and dark brown skinned blacks have mortality hazards significantly lower than their white counterparts. All other differences are nonsignificant.

Table 1

Selected descriptive statistics by race and skin tone among 1982 GSS respondents.

	White	Black	Skin tone for black respondents		
			1 (Light)	2 (Med)	3 (Dark)
N	1153	473	78	214	167
Deaths	467	235	36	107	88
Mort Hazard ^a	0.0019	0.0027	0.0020	0.0031	0.0024
LF Status (%)					
Full Time	46.6	42.1	46.2	38.8	43.7
Unemployed	6.2	8.0	9.0	7.9	7.8
Education (%)					
LTHS	27.9	40.2	39.7	33.6	50.3
HS Diploma	52.5	46.3	43.6	48.1	43.7
Some College	4.8	2.5	1.3	4.2	1.2
College+	14.4	10.6	15.4	13.6	4.2
Marital Status (%)					
Married	58.9	39.7	32.1	40.2	42.5
Never Married	16.6	25.6	26.9	29.9	19.2
Region (%)					
Northeast	20.7	15.0	10.3	17.8	12.6
Midwest	29.1	22.6	30.8	24.8	16.8
South	33.5	52.6	48.7	49.1	59.9
West	16.7	9.7	10.3	8.4	10.8
MSA Residence (%)					
Large	18.3	54.1	52.6	59.3	47.9
Medium	14.7	13.7	15.4	14.0	12.6
None	67.0	32.1	32.1	26.6	39.5
Family Inc.	19848.8	14479.9	15012.92	15850.37	12913.32

Notes: The 1982 General Social Survey ($N = 1,626$) was linked to the National Death Index through 2008 ($D = 702$). There are 14 respondents with missing information on skin tone that we exclude from our multivariate analyses.

^aThe mortality hazard refers to the piecewise exponential hazard model estimates that include controls for age, gender and years since survey.

Table 2

Piecewise exponential hazard results for racial mortality disparities among 1982 GSS respondents.

	Model 1	Model 2	Model 3	Model 4
Intercept	6.254 ***	6.685 ***	6.247 ***	6.695 ***
Black	-0.336 ***	-0.337 ***	-0.332 ***	-0.256 ***
Female	0.288 ***	0.329 ***	0.334 ***	0.338 ***
Age	-0.071 ***	-0.076 ***	-0.081 ***	-0.081 ***
Age-Squared	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Years of Educ.		-0.036 *	-0.035 *	-0.041 **
Years of Educ. Squared		0.001 *	0.001 *	0.002 **
Log HH Income		0.014	0.013	0.009
Labor Force Status (Ref = Full Time)				
Part Time		-0.163 ***	-0.155 ***	-0.141 ***
Unemployed		-0.341 ***	-0.335 ***	-0.346 ***
Marital Status (Ref = Married)				
Never Married			-0.092 **	-0.091 **
Div./Sep.			0.078 *	0.084 *
Widowed			-0.086 *	-0.082 *
MSA Residence (Ref = Large MSA)				
Medium				-0.083 **
None				0.154 ***
Region (Ref = Northeast)				
South				-0.143 ***
Midwest				-0.058
West				-0.014
Log-Lik.	-22815.3	-22764.3	-22754.6	-22704.4
BIC	45693.36	45664.32	45676.31	45628.09
df	6	13	16	21

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Notes: All hazard models include a continuous control variable for years since survey. The results in this table represent survival rates. We use a negative sign on the race coefficient when we exponentiate to estimate the ratio of black-to-white mortality hazards (e.g. $\exp^{-(b)}$).

Table 3

Piecewise exponential hazard results for skin tone mortality disparities among 1982 GSS respondents – blacks only.

	Model 1	Model 2	Model 3	Model 4
Intercept	5.317 ***	6.477 ***	6.291 ***	6.716 ***
Skin Tone (Ref: Color = 1 [Light])				
Color 2	−0.385 ***	−0.354 ***	−0.339 ***	−0.360 ***
Color 3	−0.186 ***	−0.196 ***	−0.183 **	−0.190 ***
Female	0.172 ***	0.285 ***	0.304 ***	0.302 ***
Age	−0.047 ***	−0.062 ***	−0.059 ***	−0.060 ***
Age-Squared	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Years of Educ.		−0.078 **	−0.075 *	−0.071 *
Years of Educ. Squared		0.002 ***	0.001 ***	0.001 ***
Log HH Income		0.008	0.011	−0.001
Labor Force Status (Ref = Full Time)				
Part Time		−0.380 ***	−0.400 ***	−0.371 ***
Unemployed		−0.596 ***	−0.599 ***	−0.603 ***
Marital Status (Ref = Married)				
Never Married			0.124 *	0.095
Div./Sep.			0.122	0.150 *
Widowed			−0.184 **	−0.158 **
MSA Residence (Ref = Large MSA)				
Medium				−0.333 ***
None				0.015
Region (Ref = Northeast)				
South				−0.305 ***
Midwest				−0.237 ***
West				−0.305 ***
Log-Lik.	− 7200.3	−7127.7	−7119.0	−7080.1
BIC	14464.65	14383.34	14393.50	14361.37
Df	7	14	17	22

*
p < 0.05.

**
p < 0.01.

p < 0.001.

Notes: All hazard models include a continuous control variable for years since survey. The results in this table represent survival rates. We use a negative sign on the skin tone coefficients when we exponentiate to estimate the ratio of the respective darker skin tone-to-'light' mortality hazards (e.g. $\exp(b)$).

Table 4

Piecewise exponential hazard results for skin tone mortality disparities among 1982 GSS respondents.

	Model 1	Model 2	Model 3	Model 4
Intercept	6.282 ***	6.583 ***	6.753 ***	6.806 ***
Skin Tone (Ref: Color = 0)				
Color 1 (Light)	-0.064	-0.075	-0.064	0.005
Color 2	-0.519 ***	-0.520 ***	-0.517 ***	-0.446 ***
Color 3 (Dark)	-0.236 ***	-0.232 ***	-0.226 ***	-0.149 ***
Female	0.280 ***	0.319 ***	0.323 ***	0.327 ***
Age	-0.072 ***	-0.076 ***	-0.082 ***	-0.082 ***
Age-Squared	0.000 ***	0.000 ***	0.000 ***	0.000 ***
Years of Educ.		-0.045 **	-0.044 **	-0.051 **
Years of Educ. Squared		0.002 ***	0.002 ***	0.002 ***
Log HH Income		0.015	0.014	0.010
Labor Force Status (Ref = Full Time)				
Part Time		-0.144 ***	-0.134 ***	-0.120 ***
Unemployed		-0.338 ***	-0.329 ***	-0.341 ***
Marital Status (Ref = Married)				
Never Married			-0.109 **	-0.108 **
Div./Sep.			0.068	0.075
Widowed			-0.090 *	-0.082 *
MSA Residence (Ref = Large MSA)				
Medium				-0.098 ***
None				0.138 ***
Region (Ref = Northeast)				
South				-0.158 ***
Midwest				-0.061 *
West				-0.158 ***
Log-Lik.	-22767.5	-22717.5	-22706.8	-22625.2
BIC	45618.57	45591.74	45601.62	45552.73
Df	8	15	18	23

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Notes: All hazard models include a continuous control variable for years since survey. The results in this table represent survival rates. We use a negative sign on the skin tone coefficients when we exponentiate to estimate the ratio of the respective skin tone grouping-to-'white' mortality hazards (e.g. $\exp(-b)$).

Table 5

Selected piecewise exponential hazard results for skin tone mortality disparities among 1982 GSS respondents stratified by education.

	Model 1	Model 2	Model 3	Model 4
<i>Panel A: Less Than High School</i>				
Intercept	6.957 ***	6.053 ***	5.901 ***	5.866 ***
Skin Tone (Ref: Color = 0)				
Color 1 (Light)	0.121	0.139	0.108	0.270 ***
Color 2	-0.182 ***	-0.196 ***	-0.196 ***	-0.076
Color 3 (Dark)	0.204 ***	0.225 ***	0.231 ***	0.382 ***
<i>Panel B: High School or More</i>				
Intercept	5.492 ***	3.704 ***	4.027 ***	4.068 ***
Skin Tone (Ref: Color = 0)				
Color 1 (Light)	-0.176 **	-0.206 **	-0.184 **	-0.193 **
Color 2	-0.675 ***	-0.687 ***	-0.681 ***	-0.679 ***
Color 3 (Dark)	-0.580 ***	-0.569 ***	-0.565 ***	-0.550 ***
<i>Controls</i>				
Age	Y	Y	Y	Y
Gender	Y	Y	Y	Y
Education	N	Y	Y	Y
Log HH Income	N	Y	Y	Y
Labor Force Status	N	Y	Y	Y
Marital Status	N	N	Y	Y
MSA Residence	N	N	N	Y
Region	N	N	N	Y

*
 $p < 0.05$.

**
 $p < 0.01$.

 $p < 0.001$.

Notes: All hazard models include a continuous control variable for years since survey. The results in this table represent survival rates. We use a negative sign on the skin tone coefficients when we exponentiate to estimate the ratio of the respective skin tone grouping-to-'white' mortality hazards (e.g. $\exp(-b)$).