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Skin color, sex, and educational attainment in the post-civil rights era

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ABSTRACT

We assess the relationship between skin color and educational attainment for native-born non-Hispanic Black and White men and women, using data from the Coronary Artery Risk Development in Young Adults (CARDIA) Study. CARDIA is a medical cohort study with twenty years of social background data and a continuous measure of skin color, recorded as the percent of light reflected off skin. For Black men and women, we find a one-standard-deviation increase in skin lightness to be associated with a quarter-year increase in educational attainment. For White women, we find an association approximately equal in magnitude to that found for Black respondents, and the pattern of significance across educational transitions suggests that skin color for White women is not simply a proxy for family background. For White men, any relationship between skin color and attainment is not robust and, analyses suggest, might primarily reflect differences in family background. Findings suggest that discrimination on the basis of skin color may be less specific to race than previously thought.

1. Introduction

While narrative evidence that skin color matters for minorities in the United States is abundant, accurately measuring the extent to which skin color discrimination affects social outcomes, and for whom, has been a challenge for social scientists.[1] Using the case of educational attainment, in this paper we introduce two important elements into the study of how and to what extent skin color affects social outcomes. First, we use a continuous measure of skin color, assessed as a spectrophotometer reading at the volar upper arm. This method of color measurement is standard in the medical sciences (e.g., Jablonski, 2004; Jablonski and Chaplin, 2000), but in prior work on the relationship between skin color and social outcomes, interviewer-reported categorical skin color data have been used almost exclusively.[2] Our continuous, mechanical measure of skin color not only increases precision and reduces the possibility of interviewer-induced bias, but also can be replicated in future studies

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[1] For further discussion of the challenges in using interviewer-coded skin color data, see Villarreal (2010), Hersch (2006), and Gullickson (2005); for discussion of difficulties in comparing across studies of skin color and social outcomes, see Hughes and Hertel (1990).

[2] Scarr et al. (1977) is one exception, as we discuss in footnote 9.

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to assess change in the salience of skin color over time. Second, our spectrophotometer measure allows us to observe a degree of skin color variation in White respondents not seen when color is assessed using a categorical scale, affording us the unique opportunity to investigate the relationship between skin color and attainment within-race for native-born White Americans.

1.1. Background

While other physical characteristics have been used to judge racial ancestry, in the American context, skin color has long been the most prominent. At least as far back as slavery, skin color has been conceived not as a marker of dichotomous racial classification, but as a relatively continuous indicator of Caucasian ancestry (Myrdal, 1944). Lighter-skinned 'mulatto' slaves, often biologically related to their owners, were known to receive preferential treatment ranging from additional work-related training to an increased likelihood of earning freedom (Franklin, 2000). Decades after abolition, the effects of these early status differentials were still visible: Hill (2000) found significant differences in school attendance and occupational prestige between individuals identified in the 1920 census as 'mulatto' and individuals identified as 'Black,' controlling for household differences in literacy, parental occupation and family structure.

With legal discrimination by race now decades in the past, whether and how much socioeconomic outcomes still vary by skin color for American minorities is a subject of debate. Gullickson (2005) hypothesizes that skin color became less consequential over the Civil Rights period, as African Americans became more integrated into the formerly White education and labor markets, and the meaning of skin color within the Black community itself evolved. He found that skin color had "virtually no effect" on educational outcomes for cohorts born after 1953 (169). Studies by Udry et al. (1971) and Goering (1972) also support the argument that skin color was growing less significant at the time, showing a decrease in the significance of skin color for social outcomes including spouse selection and 'job-mobility orientation.' On the other hand, Hughes and Hertel (1990) found skin color differentials persisting fairly stably on a number of social dimensions from 1950 through 1980, using the same data as Gullickson (2005), and a number of recent studies have affirmed that differentials by color do still exist. Goldsmith et al. (2006, 2007) found skin color to be significantly related to wage differences among Black men. Hersch (2006) found an association between skin color and educational attainment in which the penalty for being dark-skinned amongst Black men was approximately double the equivalent penalty for Black women.[3] Keith and Herring (1991) found an association between skin color and education, family income, and occupation for Black women only, and an association between skin color and personal income for Black respondents of both sexes.[4]

In this abundance of studies, it becomes quickly apparent that White Americans are not perceived as a relevant population for those interested in within-race effects of skin color on socioeconomic outcomes. A small number of the studies cited use White respondents as a single-category comparison group for interpreting the relationship between skin color and socioeconomic outcomes for Black respondents (e.g. Goldsmith et al., 2006, 2007), while the majority of studies omit White respondents altogether. In both cases, the seeming assumption is that skin color variation within-race is not expected to influence social outcomes among Whites.[5] Hochschild and Weaver (2007) elaborate the rationale behind this assumption in their description of the psychology of colorism, wherein people "attribute higher status and grant more power and wealth to one group, typically those designated as white... [and then] attribute higher status and grant more power and wealth to people of one complexion, typically light skin, within the groups designated as non-white" (646). Goldsmith et al. (2007) term this phenomenon a societal "preference for whiteness," in which minorities gain advantage when they possess phenotypical attributes of the White in-group. In this framework, Whiteness is the homogeneous identity that is privileged in American society and within which relative color is irrelevant, while among minorities there is a benefit to appearing more similar to those who are White. That a preference for lightness may also operate between individuals identified as White is not explicitly considered.

Although the idea that skin variation will not be socially meaningful among Whites is understandable in the American historical context, social valuation of particular skin coloring is far from unique to the United States. Of the 51 societies in the Human Relations Area Files for which skin color is a documented criterion for attractiveness—societies ranging six continents, with great variation in cultural practices, level of development, and colonial history— lightness was preferred in over 90% of cases (Van den Berghe and Frost, 1986). Nor are such preferences a modern phenomenon: in Japan, for example, a bias towards lighter skin in women was evident as early as the eighth century AD, and may have persisted from significantly earlier (Wagatsuma, 1967). Indeed, even within the U.S., an aesthetic preference for lighter skin among White women has been documented (Feinman and Gill, 1978). Although aesthetic idealization of particular coloration does not necessarily imply a relationship between coloration and socioeconomic outcomes, the relative ubiquity with which color is culturally relevant within many and varying societies outside the U.S. makes notable the presumed homogeneity of White

[3] Hersch (2006) analyzed the relationship between skin color and educational attainment in both the Multi-City Study of Urban Inequality (MCSUI) and the National Survey of Black Americans (NSBA); the difference in magnitude by sex was observed in the MCSUI data only, though the association between skin color and education was robust across both samples. Hunter (2002) found a similar association between skin color and educational attainment for women in the NSBA sample, but did not include men in her analysis.

[4] While we focus on non-Hispanic Blacks and Whites in this analysis, past research has demonstrated an association between skin color and socioeconomic outcomes in other groups as well, both domestically (see Murguia and Telles (1996), Darity et al. (2002, 2005), Golash-Boza and Darity (2008), and Frank et al. (2010) on Hispanics in the U.S.) and elsewhere (see Telles (1992) on Brazil; Gravlee et al. (2005) on Puerto Rico; and Villarreal (2010) on Mexico).

[5] As one exception, Hersch (2008) found that for immigrant populations in the U.S., lighter skin color is correlated with higher wages across the full sample, even net of race, education, language proficiency, occupation before immigration, family background, ethnicity, and country of origin. It is unknown whether this finding reflects a phenomenon unique to immigrants, or should be expected to hold for native-born Americans, as well.

Americans in the sociological literature on skin color. The absence of studies investigating the relationship between skin color and socioeconomic outcomes within-race for White Americans may reflect a lack of any association, or it may simply reflect a lack of interrogation.

Following the question of whether there exists a relationship between skin color and social outcomes for White or Black Americans is the question of how such a relationship plausibly functions. As a phenotypic characteristic like any of many others found in past to be relevant for social outcomes, such as height (Rashad, 2008) or weight (Conley and Glauber, 2007), the relationship between social outcomes and skin color is generally hypothesized to operate through one of two distinct pathways.

First, skin color might be *directly* relevant for social outcomes if people with darker skin are treated differently than people with lighter skin as a function of their skin color, commonly referred to as "colorism" as per the discussion above (Pearce-Doughlin et al., 2013). In the case of educational attainment, if darker-skinned individuals are subjected to additional discrimination in ways that make schooling a different experience depending on one's skin, educational opportunity is constrained by a social response to skin color itself.[6] Direct relevance of skin color is hard to confirm or refute, as objectively measuring discrimination is notoriously difficult (Anderson et al., 2006). Even when perceived discrimination measures are available, it is impossible to determine whether perception of discrimination varies by skin color.[7]

Second, skin color might *proxy* for unobserved individual-level social characteristics that are more frequently present at particular points in the skin color spectrum. Since attainment differentials are known to perpetuate intergenerationally (Black et al., 2005), it follows that a corresponding association between skin color and education would do so as well. In other words, if skin color was an important source of discrimination in the past, then given that skin color and education are both correlated between parents and children, we might still expect an association between skin color and education even in the absence of continued discrimination today. A number of past studies have interpreted any remaining skin color association net of social background controls as attributable to colorism (Hill, 2002a,b; Keith and Herring, 1991; Hughes and Hertel, 1990), but this assumption should be made cautiously, particularly in cases where relatively few background measures are available.

The major technical difficulty in answering questions regarding whether and for whom skin color is significantly associated with social outcomes has followed from limitations in available data. Only a modest number of social surveys have collected information on respondent skin color. The most commonly utilized survey has been the National Survey of Black Americans (*NSBA*; Hersch, 2006; Gullickson, 2005; Hill, 2002a,b; Thompson and Keith, 2001; Keith and Herring, 1991; Hughes and Hertel, 1990), a random sample of Black Americans ages 18 and older as of 1979. Other data sources include the Multi-City Study of Urban Inequality (*MCSUI*; Hersch, 2006; Hill, 2002a,b), the 1982 General Social Survey (*GSS*; Gullickson, 2005), the Detroit Area Study (*DAS*; Hersch, 2006), and the New Immigrant Survey (*NIS*; Hersch, 2008).[8] In all these datasets, the skin color measure relies on an interviewer correctly coding the respondent into one of between three and eleven categories, ranging from light to dark.[9] In the New Immigrant Survey, for example, the scale ranged from zero for "albinism, or the total absence of color" through ten for the "darkest possible" skin (Massey and Martin, 2003).[10] As albinism is quite rare, values of zero should have been quite rare. Instead, by the statistics presented in Hersch (2008) there appear to have been twice as many respondents coded as "albino" than in the two darkest categories combined. While Hersch (2008) reports that the NIS survey managers noticed the overuse of the "zero" category and sent out a memo attempting to correct the problem, the episode overall illustrates the difficulties in attempting to calibrate a group of interviewers with respect to perceptions of respondent skin color.

Furthermore, research on perception of skin color suggests that subjective factors other than a respondent's skin are likely to be captured in an interviewer-coded color rating. For example, Hill (2002a,b) demonstrated that one's own race affects how one codes skin color in others, while Caruso et al. (2009) found that even such a seemingly unrelated characteristic as political affiliation can affect color perception, with a respondent's favored candidate being perceived as lighter-skinned. Interviewer coding might therefore be considered a useful tool for measuring 'lived experience' of color, since in practice skin is never encountered independent of the body; however, an interviewer-coded measure may also capture characteristics such as carriage, dress, or accent, which may themselves reflect educational attainment. There is no reason to suppose that self-ratings of skin color are any better, given the lack of standardization and the array of factors that might influence how one classifies oneself. In addition, variation in the instruments used for interviewer coding across datasets makes it

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[6] Borrell et al. (2006) found that the self-reported discrimination was significantly associated with skin color only for light-skinned Black males, suggesting that discrimination could theoretically vary in the reverse direction such that light-skinned individuals experience more discrimination than dark-skinned individuals.

[7] The first questions regarding self-reported discrimination in CARDIA were asked at Wave 4, by which point respondents were past the prime years of educational attainment (ages 25–37). We thus could not include self-reported discrimination as a control variable in this analysis.

[8] The New Immigrant Survey is a nationally representative sample of new legal immigrants and their children; the remaining data sources listed survey primarily native-born Americans.

[9] One exception is Scarr et al. (1977), where skin color was captured as a continuous measure of skin reflectance for 160 school-aged twin pairs, both Black and White. While their sample was too young to assess many of outcomes typically studied in the literature on skin color (e.g. educational attainment, occupation, wages), they did find some relationship between skin color and test scores, which they argue to be the result of differences in social treatment. No relationship was found between test scores and blood group markers intended to proxy the "degree of African ancestry."

[10] NIS interviewers were asked to memorize the color scale and to code respondents without having to display the coding chart during the interview (Massey and Martin, 2003; Hersch, 2008).

exceedingly difficult to assess how and whether the significance of skin color has changed over time. Finally, interviewer-coded color data has thus far precluded within-race analyses of White respondents, as the relatively small variance in skin color among Whites combined with the small number of categories in the coding scales results in little color variation being actually captured. The vast majority of Whites consistently fall into the lightest one or two color categories.

As Hill (2002a,b) and Hersch (2006) note, the most promising alternative to interviewer coding is the objective measurement of light reflectivity provided by a spectrophotometer. Our study assesses the relationship between educational attainment and a spectrophotometer-based measure of skin color, collected as part of a larger dataset focused on cardiovascular health risks among non-Hispanic Blacks and Whites in the United States. For studying the relationship between skin color and socioeconomic outcomes among Black Americans, the tradeoff between spectrophotometer measurement and interviewer coding is one of accuracy versus breadth: while interviewer coding may arguably better capture socially-perceived cumulative phenotype, only through mechanical measurement can one ensure that socioeconomic outcomes of interest are not themselves captured in the measurement of the independent variable. Study of the relationship between skin color and socioeconomic outcomes among White Americans, on the other hand, might only be possible in light of the increased precision of our spectrophotometer data relative to interviewer-coded color measures.

2. Data and methods

The National Heart, Lung and Blood Institute's Coronary Artery Risk Development in Young Adults (CARDIA) Study is a widely-used health-related cohort study. The study began in 1985 with 5115 community-dwelling non-Hispanic Blacks and Whites between the ages of 18 and 30, randomly selected after stratification by race, sex, age, and education in four US cities: Birmingham, AL, Chicago, IL, Minneapolis, MN, and Oakland, CA.[11] This respondent pool is thus both younger and more age-homogenous than the NSBA, where the limited number of respondents in younger age groups has made analysis of the relationship between skin color and social outcomes difficult for more recent cohorts (Gullickson, 2005; Goldsmith et al., 2006). Of the seven waves of CARDIA data available, the first was fielded in 1985–1986, and the most recent was fielded twenty years later (2005–2006). A basic sociodemographic questionnaire, including educational attainment, has been administered in each wave of data collection.

In CARDIA, skin color is measured as the percent of light reflected off the skin (see Sweet et al. (2007) on skin color and blood pressure; Borrell et al. (2006) and Krieger et al. (1998) on skin color and self-reports of discrimination). Skin color was measured for 96% (3808) of respondents interviewed in the fourth wave of data collection (1992–1993) as a Photovolt 577 spectrophotometer reading at the volar upper arm (i.e., the same side of the arm as one's palm). Respondents for whom a measure of skin color was not recorded were excluded from the analysis. Spectrophotometer readings were taken with each an amber, a green, and a blue filter, but the correlations among the three sets of readings ranged from .96 to .98. Consistent with past literature, we used only the reading taken with the amber filter (e.g. Sweet et al., 2007).

Since lighter colors reflect more light, higher reflectance scores denote lighter skin. As can be seen in the summary statistics (Table 1), mean skin color is slightly lighter for women than men within both races, consistent with Jablonski and Chaplin's (2000) findings that skin color readings are lighter for women across every population sampled in an international database of skin reflectance data. The distribution of spectrophotometer readings for Black and White respondents overlaps minimally, and the variance is greater in the Black sample than in the White sample (Fig. 1). Although racial categories are not absolute and may be perceived differently in different contexts, there is perhaps surprisingly little overlap between the skin reflectance scores for respondents who self-identify as Black relative to respondents who self-identify as White. Rather, only 3% of Black respondents in our sample have a spectrophotometer reading greater than 38%, while only 3% of White respondents have a reading at or below that cutoff.

The volar upper arm is used because spectrophotometer readings in this area have been found in past research to be fairly constant for the same person over time relative to other locations on the body (Pershing et al., 2008). The mean difference between CARDIA reflectance scores measured in the summer versus winter is small and non-significant for Black respondents (0.17 percentage points of reflectance, $p = 0.960$), and for White respondents the mean difference is significant ($p = 0.002$) but still substantively small, about one-fifth of a standard deviation (0.847 percentage points of reflectance).[12] Skin color readings by season of measurement for White respondents are presented in Fig. 2. Of especial concern to us is the possibility that any association between skin color and educational attainment for White respondents might partly result from sociodemographic differences in outdoor labor or cosmetic tanning. Since individuals engaging in outdoor labor are likely to be both less educated and more tanned, we risk biasing our estimates upwards; however, this concern is limited by the fact that only 13 White women and 48 White men reported working in outdoor occupations at the survey wave in which skin reflectance was measured.[13] While we have no information regarding frequency of cosmetic tanning in our sample, researchers have

[11] For a detailed description of selection procedures at each site, see Hughes et al. (1987). Sex was stratified to balance men and women; race was stratified to balance non-Hispanic Blacks and Whites; age was stratified to balance respondents ages 18-24 with respondents ages 25–30; education was stratified to balance those with a high school degree or less and those with more than a high school degree.

[12] We also ran our models with the season in which the spectrophotometer reading was taken included as a set of dummies. Indicators of seasons were not significant in any model, nor did the inclusion of season have any substantive effect on the outcome of interest.

[13] When these respondents were excluded from the sample population, results of all models were substantively similar and the statistical significance of coefficients was the same.

Table 1
Summary statistics for selected variables by race and sex: the CARDIA study.

Variable	Full sample	White men	White women	Black men	Black women
Years of education[a]	14.58	15.39	15.28	13.57	13.88
	(2.46)	(2.62)	(2.40)	(2.18)	(2.03)
% Reflectance[b]	34.77	45.42	46.82	20.70	23.20
	(13.30)	(3.99)	(3.89)	(6.98)	(7.25)
Socioeconomic index (SEI)[c]	48.20	51.24	50.12	41.11	43.87
	(14.64)	(15.38)	(13.98)	(13.81)	(12.72)
Father's education	13.20	14.48	14.27	11.66	11.51
	(3.63)	(3.37)	(3.43)	(3.15)	(3.39)
Mother's education	13.08	13.89	13.56	12.42	12.24
	(2.76)	(2.62)	(2.79)	(2.55)	(2.69)
Father's SEI	45.65	50.38	50.63	39.83	39.03
	(14.51)	(14.23)	(14.23)	(12.07)	(12.24)
Mother's SEI	44.65	48.69	47.58	42.01	40.76
	(12.96)	(13.31)	(13.09)	(14.02)	(13.69)
Number of siblings	3.14	2.70	2.67	3.62	3.68
	(2.47)	(1.92)	(2.01)	(2.84)	(2.84)
Non-same-race parent	0.03	0.03	0.02	0.05	0.04
	(0.18)	(0.17)	(0.14)	(0.22)	(0.19)
Birth year	0.16	0.07	0.08	0.23	0.27
	(0.37)	(0.25)	(0.27)	(0.42)	(0.45)
Missing father's ed data	0.07	0.05	0.03	0.09	0.11
	(0.25)	(0.22)	(0.16)	(0.28)	(0.31)
Missing mother's ed data	0.11	0.04	0.05	0.16	0.18
	(0.31)	(0.21)	(0.22)	(0.36)	(0.39)
Missing father's SEI	0.29	0.35	0.32	0.25	0.23
	(0.45)	(0.48)	(0.47)	(0.43)	(0.42)
Missing mother's SEI	14.58	15.39	15.28	13.57	13.88
	(2.46)	(2.62)	(2.40)	(2.18)	(2.03)
N	3380	866	909	668	926

[a] Education is measured at the wave after a respondent turns 30.
[b] Skin reflectance is measured at year 7 (wave 4). Higher skin reflectance denotes lighter skin.
[c] Socioeconomic index (SEI) score is measured at the wave after a respondent turns 35. Analytical sample sizes for models utilizing respondent SEI data are as displayed in Table 7.

repeatedly found higher frequency of indoor tanning to be associated with higher education and income amongst adults (Heckman et al., 2008; Stryker et al., 2007), and thus any effect of indoor tanning would be expected to bias our results downwards.[14,15]

Our outcome variable of interest is years of education, measured on a scale ranging from zero to 20 at the wave after a respondent turns 30, with 20 or more years coded as 20. Respondents who were no longer in the sample by the wave after they turned 30 were excluded from the analysis. Indicators of high school and Bachelor's degree completion are derived from degree status, and respondents are coded as having attended college if they report 13 or more years of education. Race was self-reported as non-Hispanic White or Black, and 14 self-reported Hispanic respondents were dropped from the analytic sample due to the lack of sufficient cases to analyze them separately.[16] While respondents were not given the option to self-report as mixed-race, they did report the race of their mother and father, and we include a variable indicating whether either parent was identified as belonging to a racial group other than the respondent's own.[17] Place of birth was recorded in the fifth wave of data collection, and we dropped the 93 respondents who reported having been born outside of the U.S. We included a full set of dummy variables for birth year, as well as for the four sites from which the respondent pool was drawn.[18] Since sibship size is known to correlate with educational attainment (Jaeger, 2008), number of biological siblings as reported in the first wave of data collection is also included.

[14] While women in CARDIA were adults (ages 25–37) when their skin color was assessed, the sociodemographic correlates of indoor tanning for adolescents are less clear. Demko et al. (2003) and Hoerster et al. (2007) found that adolescents of less educated parents tan at a higher rate than adolescents of parents with more education; Cokkinides et al. (2002) observed a non-significant relationship in the same direction; and Lazovich et al. (2004) found no difference in tanning frequency by parental education.

[15] The use of make-up might also be of concern were women regularly altering their skin color via cosmetics, although the emphasis in makeup campaigns on "color matching" make-up to skin tone makes it unclear how often this would be the case. Indeed, Caisey et al. (2006) found that, as typically applied, make-up very slightly *darkens* the facial skin of self-identified Black women regardless of their base skin shade, as a byproduct of efforts to balance unevenness in facial skin tone. Furthermore, the differences in lightness due to make-up application for both Black and White respondents in this study were substantively very small.

[16] We considered respondents to be Hispanic if they reported as such in the initial telephone interview.

[17] Only 115 respondents in our sample reported having a parent of a different race: 34 Black men, 36 Black women, 27 White men, and 18 White women.

[18] All models were also estimated with a continuous measure of birth year. Results were substantively similar and the statistical significance of coefficients was the same.

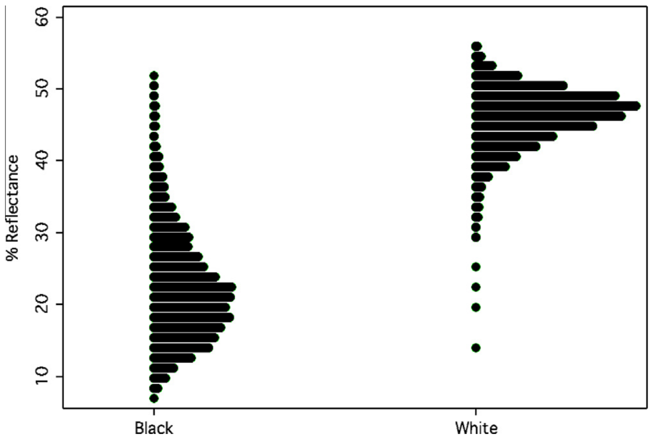

Fig. 1. Spectrophotometer readings for Black and White respondents. *Note*: Higher reflectance indicates lighter skin color.

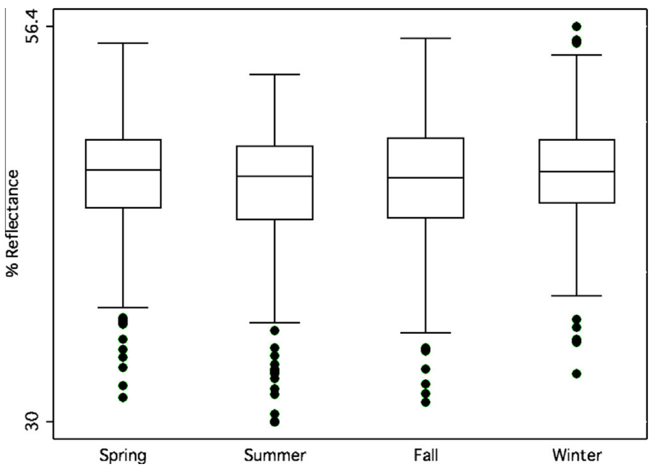

Fig. 2. White respondents' spectrophotometer readings by season of measurement. *Note*: Spring is defined as March through May; summer as June through August; fall as September through November; winter as December through February.

Mother's and father's education were reported by the respondent, and were measured as the number of years completed from zero to 20. Additional categories were provided for respondents who reported that they did not know their parent's education, and we coded these responses to zero and included a dummy variable indicating replacement.[19,20] The twenty-three respondents who provided no codable information on parental education were excluded from the analysis.[21] Mother's and father's occupation were coded as socioeconomic index (SEI) scores based on the three-digit 1980 Census occupational code.[22] For the very few respondents who reported the occupation of a "responsible adult" in lieu of a parent, we coded the information provided. Parents reported as not employed or as holding occupational positions without a corresponding prestige score (e.g., homemaker) were coded to zero, with a dummy variable included in models to denote this replacement.

[19] Respondents were not directly asked about parental absenteeism, and were coded as "not knowing" their parent's education unless they independently volunteered that a parent was absent from the home, in which case education for that parent was coded as "not applicable." The vast majority of missing data fell into the "I don't know" category, and secondarily into the "not applicable" category. Because these two categories were distinguished only by whether a respondent mentioned having an absentee parent without this information being solicited by the interviewer, we combined these categories in our analysis.

[20] Among White respondents in our sample, 45 men and 23 women did not report mother's education, while 60 men and 71 women did not report father's education. Among Black respondents in our sample, 59 men and 103 women did not report mother's education, while 151 men and 253 women did not report father's education.

[21] 19 respondents did not respond at all when asked about father's education, and four did not respond for mother's education. All models were also estimated excluding respondents with any category of missing parental education data; while the coefficients were substantively similar in all groups, the decreased sample size, particularly amongst Black men, led to some difference in statistical significance.

[22] SEI scores for occupations were obtained from those used by the General Social Survey (Davis et al., 2009). The scale runs from zero through 100.

Respondents providing no codable information on parental occupation were also coded to zero.[23] 3990 respondents were native-born, non-Hispanic, and had educational attainment data recorded in the wave after he or she turned 30; our analytical sample of 3380 respondents were also assessed for skin color at wave 4 and had codable parental education data.

While an alternative approach to missing data here would have been multiple imputation (Rubin, 1987), the technical merits of multiple imputation are debatable in this case given the plausible violation of the assumption that values are missing at random (see Allison, 2000).[24] Even so, all models presented below were also estimated using multiple imputation for missing data instead of the procedure described above.[25] Results were substantively similar and the statistical significance of coefficients was the same.

2.1. Analytic strategy

Our analysis proceeds in three parts. First, we estimate the conditional association between skin color and educational outcomes using the OLS regression equation

$$y_i = \alpha + \beta_r r_i + \beta_p P_i + \beta_C C_i + \beta_B B_i + \varepsilon_i, \tag{1}$$

wherein i denotes an individual respondent and y is the number of years of education attained by respondent i by the survey wave after he or she turned 30. The spectrophotometer reflectance score for each individual i is denoted by r, with higher reflectance scores signifying lighter skin. P is a vector of family background measures; C is a full set of indicator variables for each of the four sites; and B is a full set of indicator variables for each birth year of respondents in the sample. This model represents the standard approach to evaluating whether skin color is associated with educational attainment (e.g. Hughes and Hertel, 1990; Keith and Herring, 1991), and serves as an important point for comparison with past and future studies. We run the regression separately for each race by sex, in keeping with past literature (e.g. Hersch, 2006; Keith and Herring, 1991).[26] To test the appropriateness of a linear model in this case, we began by running a non-parametric regression of years of educational attainment at age 30 on skin reflectance using a kernel estimation method, and found the difference between that result and the linear result to be negligible. We also introduced quadratic terms on skin color into our full OLS regression model, but none were significant.

Second, we attempt to evaluate whether any significant association between education and skin color appears to be attributable primarily to unmeasured social background characteristics. In light of a long tradition of research assessing how social background affects ultimate educational attainment, Mare (1980) introduced a model based on successive analyses of educational transitions, under the assumption that different transitions may require different levels of familial resources and support. Logistic response models were estimated for each transition, conditional on having completed the previous transition. Both in the United States (Mare, 1980) and internationally (Shavit and Blossfeld, 1993), studies using this method of analysis have demonstrated that the later the educational transition, the lower the association with a range of social background measures. We replicate a similar set of logistic response models across educational transitions, using skin reflectance as our independent variable of interest, to evaluate whether the pattern of results for skin color are consistent with the pattern of results that has emerged for indicators of SES in numerous prior studies using this methodology across a wide array of samples (e.g. Mare, 1980; Shavit and Blossfeld, 1993).

For this analysis, we use the logistic response model written

$$\ln_e\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_0 + \beta_{jr} r_i + \beta_{jp} P_i + \beta_{jc} C_i + \beta_{jB} B_i + \varepsilon_{ij}, \tag{2}$$

in which p_{ij} is the probability that individual i will make school transition j, and the remaining variables are defined as in the OLS model above. Each β_{jk} indicates a parameter to be estimated for independent variable k in transition j. We run only the full model, again separately for each race by sex. For each regression, the sample includes only those who have completed the previous educational transition, and the outcome is a binary variable indicating whether an individual completed the subsequent educational transition.

Third, we evaluate the extent to which the association between skin color and education can explain any observed association between skin color and occupational prestige.[27] A bivariate relationship has been found between occupational prestige

[23] Supplemental analyses both omitted cases with no codable information, and used separate dummies to distinguish types of employment without a corresponding prestige score (i.e., homemakers, military, disabled, unemployed, etc.). Results were substantively similar and the statistical significance of coefficients was the same.

[24] In particular, missingness on parental occupation or education data seems plausibly dependent on the true values of that data itself. This would be the case if the pathways through which a respondent is unable to report basic SES information about a parent—for example, parental absenteeism—are associated with lower true values of parental education and SEI scores. Furthermore, if parental education or occupation data is missing because that parent was absent, it becomes unclear whether that parent's education or occupation is relevant to a respondent's educational outcomes, other than through an association between the missing values and likelihood of absenteeism.

[25] Multiple imputation analyses were conducted in Stata 11.2 using an iterative chained equations technique (Royston, 2005).

[26] To further justify our stratification by sex, we tested the null that all coefficients are equal across sex within race. We were able to reject the null ($p < 0.001$) for both Black and White respondents.

[27] While a similar analysis with respect to respondents' income would certainly be of interest, in the CARDIA data, income is collected only at the household level.

and skin color in the NSBA (Keith and Herring, 1991); we first look for a similar relationship in our data, and then test whether that relationship can be explained by differences in educational attainment. We estimate the conditional association between skin color and occupational attainment using our initial OLS regression equation,

$$y_i = \alpha + \beta_r r_i + \beta_e e_i + \beta_P P_i + \beta_C C_i + \beta_B B_i + \varepsilon_i, \quad (3)$$

in which our outcome is now respondent's SEI score at the wave after the respondent turned 35, coded based on the respondent's three-digit 1980 Census occupational code.[28] Educational attainment at the wave after a respondent turned 30 is denoted by e, and all remaining variables are as previously defined.

Weights are not provided nor typically used with CARDIA data, and the results we report are unweighted. In light of the stratified sampling and geographic limitations of CARDIA, we also ran our models weighting individuals in each race-sex group by age and educational attainment (the CARDIA stratum) in order to replicate the distribution of these categories in the U.S. census.[29] Patterns of significance were robust to changes in the weighting scheme, and the magnitude of effects was substantively similar.

3. Results

The results of the first OLS regression models are reported in tables two through four. In each case, we first assess the bivariate relationship between skin color and educational attainment at age 30. We then include the full set of controls for both birth year and survey center, and finally we add the set of family background measures, including parents' education, parents' occupation, number of siblings, and whether either parent was reported as being of a different race than the respondent.

In keeping with prior work, the bivariate relationship between skin reflectance and educational attainment is significant for Black respondents (Table 2), and remains as such through the addition of site and birth year dummies in the second model and family background measures in the third. Notably, the addition of family background only slightly reduces the association between skin color and education, suggesting that our skin color measure is not serving as a simple proxy for family-level SES as measured by our control variables. The coefficient on skin color in the final model for Black men is nearly identical to that estimated for Black women ($p > 0.8$). In sum, there does appear to be a significant association between education and skin reflectance amongst Black respondents in our sample, and that association does not significantly differ by sex.

As discussed above, the dearth of prior work on the association between skin color and social outcomes for White native-born Americans leaves us with little basis for generating hypotheses, beyond that the lack of published research might suggest skin color variation is not socially meaningful for this group. Indeed, as presented in Table 3, this hypothesis is supported in the non-significant bivariate association between skin color and education for White male respondents in our sample. Although the magnitude of the White male bivariate coefficient is actually quite similar to that for Black men and women, interpretation of these coefficients should take into account that Black respondents have nearly twice as large a standard deviation in our skin color measure as do White respondents, a matter we discuss further below. Moreover, the coefficient for White men is reduced by nearly half with the addition of family background controls, such that by the third model it is not only non-significant but substantively quite small.

For White women, on the other hand, the bivariate association is not only significant ($p < 0.001$), but more than two and a half times the size of the bivariate coefficient for White men. With the addition of family background controls in the third model, the association remains significant at the same level and decreases in size by a third, leaving it now nearly three and a half times the size of the coefficient for men.[30] While the standard errors are large enough that we cannot reject the null of no difference by sex in the population ($p = 0.17$), the difference in magnitudes of the coefficients is nonetheless striking.

For each group, Table 4 presents the increase in predicted years of education associated with the predicted difference between the 10th and 90th percentile of skin reflectance, as well as the difference between the 25th and 75th percentile, and a one-standard-deviation difference. For Black men and women, a one-standard deviation increase in reflectance is associated with nearly a one-quarter year increase in educational attainment. For White women, the increase is almost identical to that for Black respondents. To put the magnitude of this effect in context, a one-standard deviation increase in skin lightness is associated with nearly the same difference in years of ultimate attainment as is a one-standard deviation increase in father's SEI.[31] For White men, the non-significant coefficient implies that a one-standard deviation increase in skin lightness is

[28] Like for parental SEI scores, respondent SEI scores were obtained from those used by the General Social Survey (Davis et al., 2009).

[29] Individuals in CARDIA strata were weighted to replicate the distribution in the 1% general population subsample of the year 2000 U.S. Census, the first census year by which all CARDIA respondents would have turned 30. To test robustness of results across varying weighting schemes, we also ran our models weighting CARDIA respondents to the general population distributions in the 1980 Census and 2010 Census, and to the year 2000 urban subsample. Census data were accessed via the Integrated Public Use Microdata Series (IPUMS) website, www.ipums.org/usa/.

[30] To confirm that this result is not driven largely by self-reported White women at the extremes of the skin color distribution, we also ran our models for White women excluding those respondents below the bottom 5th, 10th, and 25th percentiles and above the top 5th, 10th, and 25th percentiles in skin reflectance. Differences in the coefficient on skin color between models were substantively small and non-significant.

[31] A one-standard deviation increase in father's SEI is associated with a 0.28-year increase in ultimate educational attainment for Black men, a 0.33-year increase for Black women, and a 0.27-year increase for White women. For White men, a one-standard deviation increase in father's SEI is associated with a 0.40-year increase in ultimate educational attainment.

Table 2
Ordinary least squares regression models: Black respondents' years of education at ∼age 30 on percent skin reflectance.

	Men			Women		
	Model 1 Bivariate	Model 2 Center and birthyear fixed effects	Model 3 Family background	Model 1 Bivariate	Model 2 Center and birthyear fixed effects	Model 3 Family background
% Reflectance	0.049***	0.052***	0.037**	0.044***	0.048***	0.032***
	(0.013)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)
Father's education			0.090**			0.023
			(0.033)			(0.027)
Mother's education			0.097*			0.126***
			(0.038)			(0.027)
Father's SEI			0.023**			0.027***
			(0.008)			(0.006)
Mother's SEI			0.003			0.011
			(0.007)			(0.006)
Number of siblings			−0.051			−0.065**
			(0.031)			(0.023)
Non-same-race parent			−0.655			−0.534
			(0.337)			(0.352)
Missing father's ed data			0.220			−0.498
			(0.425)			(0.333)
Missing mother's ed data			0.831			0.978**
			(0.569)			(0.366)
Missing father's SEI			1.109**			0.794**
			(0.392)			(0.275)
Missing mother's SEI			0.027			0.562*
			(0.322)			(0.255)
Constant	12.544***	7.217***	4.952***	12.855***	14.377***	11.780***
	(0.284)	(0.282)	(0.721)	(0.222)	(0.225)	(0.393)
R^2	0.025	0.116	0.229	0.025	0.081	0.240
N	668	668	668	926	926	926

Note: Standard errors are in parentheses. Education is measured at the wave after a respondent turns 30, with 20 or more years of education coded as 20.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

associated with .08 additional years of education, amounting to less than a third of the analogous change for White women or for Black respondents of either sex.

With respect to our initial question of whether skin color matters for educational attainment, the conclusions we can draw from this analysis are fairly straightforward: for Black men and women, there does appear to be a significant association between skin color and educational attainment, and the magnitude of the coefficient does not appear to differ by sex. For White men, there appears to be no significant association between skin color and educational attainment, whereas for White women, the association is both significant and over three times the magnitude of the coefficient for White men, net of family-level background controls and fixed effects for birth year and center.

3.1. Educational transitions analysis

Having observed the relationships between skin color and social outcomes reported above, we are still left with the question of how these associations are produced. We remain with two competing hypotheses: first, that skin color affects educational attainment through a direct mechanism such as discrimination, and second, that skin color does not directly affect attainment but serves as a proxy for unmeasured family background characteristics.

Similar to other multivariable analyses of skin color and educational attainment for Black respondents, we see only a slight attenuation in the coefficient on our skin color measure when we introduce controls for family background. Family background accounts for a larger percentage of the skin color association for White women than for Black respondents of either sex, but the remaining skin color association is still significant and large. For White men, the small and insignificant bivariate skin color association shows the largest percent reduction of any group with the addition of family background measures. As in past studies (Hill, 2002a,b; Keith and Herring, 1991; Hughes and Hertel, 1990), we tentatively interpret our nontrivial skin color association net of family background as suggestive that for White women and for Black respondents of both sexes, skin color directly influences educational attainment.

Particularly given our finding of a skin color-education association for White women, though, we revisit our concern regarding insufficient measurement of family background factors, and estimate a set of logistic response models across educational transitions as a robustness check to evaluate whether skin color appears to operate similarly to known measures of

Table 3
Ordinary least squares regression models: White respondents' years of education at ~age 30 on percent skin reflectance.

	Men			Women		
	Model 1 Bivariate	Model 2 Center and birthyear fixed effects	Model 3 Family background	Model 1 Bivariate	Model 2 Center and birthyear fixed effects	Model 3 Family background
% Reflectance	0.033	0.041	0.020	0.082***	0.083***	0.055**
	(0.022)	(0.023)	(0.019)	(0.020)	(0.019)	(0.018)
Father's education			0.120***			0.111***
			(0.035)			(0.031)
Mother's education			0.120**			0.120***
			(0.043)			(0.034)
Father's SEI			0.028***			0.019**
			(0.007)			(0.007)
Mother's SEI			−0.018*			0.013
			(0.009)			(0.007)
Number of siblings			−0.130**			−0.066
			(0.041)			(0.039)
Non-same-race parent			−1.328**			−0.213
			(0.510)			(0.499)
Missing father's ed data			0.624			−0.242
			(0.564)			(0.507)
Missing mother's ed data			−0.116			0.627
			(0.638)			(0.683)
Missing father's SEI			0.135			1.134*
			(0.502)			(0.516)
Missing mother's SEI			−0.551			0.665
			(0.441)			(0.376)
Constant	13.901***	10.619***	8.994***	11.440***	11.528***	8.615***
	(1.030)	(0.948)	(0.889)	(0.918)	(0.931)	(0.926)
R^2	0.002	0.064	0.270	0.018	0.063	0.251
N	866	866	866	908	908	908

Note: Standard errors are in parentheses. Education is measured at the wave after a respondent turns 30, with 20 or more years of education coded as 20.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 4
Increase in years of education as percent skin reflectance increases.

	Change from 10th to 90th percentile		Change from 25th to 75th percentile		One standard deviation change	
	Difference in reflectance	Difference in years	Difference in reflectance	Difference in years	Difference in reflectance	Difference in years
White men	9.4	0.188	4.8	0.096	4.0	0.080
White women	9.1	0.500	4.5	0.248	3.9	0.215
Black men	17.6	0.651	8.7	0.322	7.0	0.259
Black women	18.0	0.576	9.3	0.298	7.3	0.234

Note: Differences in years were calculated using coefficients on skin reflectance from the final models (Model 3) presented in Tables 2 and 3.

social background. As detailed in Section 2.1, we present these models as a comparison to prior research, observing whether our results for skin color are consistent with the pattern of results that has emerged for indicators of SES in numerous studies using this methodology across a wide array of samples (e.g. Mare, 1980; Shavit and Blossfeld, 1993). We expect that the coefficients on measures of family background characteristics will decrease across transitions, consistent with Mare (1980) and Shavit and Blossfeld (1993), and if skin color is serving as a proxy for unobserved background characteristics, we expect that the coefficient on our measure of skin color will decrease across transitions as well.[32]

[32] Although we present our models as a simple robustness check, a more extensive examination of the role of skin color in educational transitions would be a useful extension of this research. See Hauser and Andrew (2006) and Mare (2006) for a recent exchange on more advanced methods for estimating the role of socioeconomic background across educational transitions, including discussion of the methodological points raised in Cameron and Heckman (1998).

Table 5
Logistic response models: educational transitions on family background controls.

	White respondents		Black respondents	
	College attendance	Bachelor's degree	College attendance	Bachelor's degree
Father's education	0.166***	0.067*	0.031	0.074**
	(0.028)	(0.027)	(0.023)	(0.027)
Mother's education	0.135***	0.088**	0.097***	0.075*
	(0.035)	(0.033)	(0.027)	(0.035)
Father's SEI	0.021**	0.015**	0.025***	0.021**
	(0.007)	(0.006)	(0.006)	(0.006)
Mother's SEI	0.002	−0.011	0.004	0.004
	(0.007)	(0.007)	(0.005)	(0.006)
Number of siblings	−0.073*	−0.022	−0.077***	−0.071*
	(0.033)	(0.031)	(0.020)	(0.028)
Non-same-race parent	−0.519	−0.863*	−0.139	−0.412
	(0.353)	(0.385)	(0.284)	(0.362)
Missing father's ed data	1.041*	−0.429	−0.354	0.351
	(0.434)	(0.500)	(0.297)	(0.386)
Missing mother's ed data	0.961	0.350	1.051**	0.172
	(0.536)	(0.623)	(0.373)	(0.563)
Missing father's SEI	0.968*	0.085	0.862**	0.666*
	(0.415)	(0.424)	(0.268)	(0.337)
Missing mother's SEI	0.389	−0.513	0.104	0.412
	(0.348)	(0.339)	(0.237)	(0.309)
Constant	−4.056***	−1.907	−2.178*	−2.530***
	(1.018)	(1.205)	(1.028)	(0.603)
N	1885	1541	1662	1079

Note: Center and birth year fixed effects included. Standard errors are in parentheses.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Given our data, we are constrained to two transitions: first, the likelihood of starting a post-high school program conditioned on having received a high school degree, and second, the likelihood of completing a bachelor's degree conditioned on having started a post-high school program. While we do have data on high school completion, the high school completion rate in our sample is around 90% for each group, which is consistent with Census estimates for this cohort (Stoops, 2004). This leads to sparse data given our sample sizes. Low sample size likewise precludes analysis of transition to postgraduate programs, not to mention that postgraduate degrees serve a significantly different function than a bachelor's degree and have quite different and diminished returns (Pascarella and Terenzini, 2005).

For each race, we first run our two transition models without including the measure of skin reflectance in order to confirm that we do find the expected pattern of decreasing importance of social background variables across subsequent transitions (Table 5). For White respondents, the pattern is consistent with past findings: coefficients of both paternal and maternal education decline, as does that of sibship size, often interpreted as an indicator of family resource dilution (Downey, 1995). We do not see a similar decreasing pattern across transitions for Black respondents on any variable except for maternal education, and in that case the difference in effect size across models is smaller than the standard error in either model. That the impact of family socioeconomic characteristics does not appear to decrease across transitions for Black respondents is not strictly contradictory to prior literature, given the sparse research on educational transitions for Black respondents[33]; as this finding may suggest a differential impact of family background on educational progression for Blacks than has been found for Whites, further research on this point seems certainly merited. However, it precludes our continuing with the transitions analysis for Black respondents in our sample.[34]

For White men and women, we then introduce the skin reflectance measure into our model in order to evaluate whether the association with reflectance appears to be functioning similarly to other social background measures (Table 6). Results differ drastically between the sexes. For men, the skin reflectance variable follows the same pattern as the known social background variables, showing a decrease in magnitude and a shift from significance to non-significance between the models. For women, we see the opposite pattern: the skin reflectance measure is not significant in the college transition model, but is both significant and markedly larger in the college completion model. The sex difference in skin color coefficients is not

[33] Mare (1980) was based on an entirely White male sample. Later research (Lucas, 2001; Stolzenberg, 1994) included minority status as a control, but did not test for differential SES patterns across transitions by race.
[34] For comparison, we also ran our transition models on Black and White respondents in the National Longitudinal Survey of Youth (NLSY79), a nationally-representative dataset in which respondents are comparable in age to the CARDIA cohort (birth years 1957 through 1965). We observed the same pattern across groups in the NLSY79 that we see in the CARDIA data: for White respondents, the coefficients on family background decrease across transitions, whereas for Black respondents they do not. The replication of this difference by race emphasizes the need for future study of how family background affects educational attainment in minority populations.

Table 6
Logistic response models: White respondents' educational transitions on percent skin reflectance.

	Men		Women	
	College attendance	Bachelor's degree	College attendance	Bachelor's degree
% Reflectance	0.063**	−0.005	0.022	0.074**
	(0.024)	(0.023)	(0.025)	(0.025)
Father's education	0.193***	0.045	0.167***	0.070
	(0.045)	(0.041)	(0.042)	(0.042)
Mother's education	0.060	0.091	0.147**	0.090
	(0.059)	(0.051)	(0.050)	(0.049)
Father's SEI	0.022*	0.016	0.022*	0.024**
	(0.010)	(0.008)	(0.010)	(0.009)
Mother's SEI	−0.011	−0.020	0.011	0.004
	(0.012)	(0.010)	(0.011)	(0.011)
Number of siblings	−0.141**	−0.013	−0.042	−0.046
	(0.052)	(0.051)	(0.050)	(0.047)
Non-same-race parent	−1.497**	−0.067	1.810	−1.075
	(0.514)	(0.647)	(1.149)	(0.583)
Missing father's ed data	1.155	0.153	1.241	−1.113
	(0.708)	(0.825)	(0.642)	(0.789)
Missing mother's ed data	−0.188	−0.115	1.822*	0.512
	(0.874)	(0.934)	(0.854)	(1.105)
Missing father's SEI	0.844	−1.199	0.721	1.442*
	(0.668)	(0.713)	(0.638)	(0.714)
Missing mother's SEI	−0.119	−0.877	0.773	−0.183
	(0.558)	(0.514)	(0.509)	(0.524)
Constant	−5.543**	−0.875	−5.178***	−6.115***
	(1.984)	(1.390)	(1.535)	(1.470)
N	829	678	862	703

Note: Center and birth year fixed effects included. Standard errors are in parentheses.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

significant in the college attendance model ($p = 0.25$), but is significant by the college completion model ($p = 0.01$). In sum, for White men, the skin color coefficients across models indicate a weak relationship, and one that behaves as expected were it mainly capturing social background. For White women, on the other hand, the pattern is opposite of what we would expect were skin color mainly a proxy for background characteristics.

3.2. Education and occupational prestige

We have thus far addressed our initial research questions of whether skin color is associated with educational attainment, and explored which pathways might explain the relationship found. But as discussed, education is only the first of many later socioeconomic outcomes found in past literature to be associated with skin color. In light of our findings, we pose an additional question: can we ascertain anything about the consequences of the relationship between skin color and educational attainment? In particular, might the associations between skin color and later socioeconomic outcomes extend predominantly from educational disparities by skin color, or do they likely signify independent sites of discrimination?

As a final step in our analysis, we evaluate the extent to which the association between skin color and education can explain the association between skin color and one subsequent social outcome, occupational prestige. A significant bivariate association has been found between skin color and occupation using interviewer-coded skin color data in the NSBA, and for Black females this relationship persisted even net of educational attainment and an array of other social background characteristics (Keith and Herring, 1991). We hypothesize a similar pattern of association for Black respondents in our data, and based on our findings with respect to educational attainment, we further hypothesize a significant association between skin color and occupation for White females. For White males we expect no significant relationship.

In Table 7, we present coefficients on skin color and education for Black and White males and females. The first model presented is the bivariate relationship between skin color and SEI score at age 35, including fixed effects for both birth year and survey center. In the second model, we introduce our measure of educational attainment at age 30. In the final model, we include the full set of family background measures, including parents' education and occupation, number of siblings, and whether either parent was reported as being of a different race than the respondent.

As in our initial models of educational attainment, in the bivariate model the association between SEI score and skin color is significant for all groups except for White men. However, with the introduction of our measure of education, coefficients on skin color for all groups become non-significant and decrease in magnitude by over half in each case. The family-level controls do little to attenuate the remaining association for White respondents or for Black men, though for Black women the coefficient on skin color net of family-level controls is not only non-significant but approaching zero. In sum, while

Table 7
Ordinary least squares regression models: SEI score at ~age 35 on percent skin reflectance (coefficients on reflectance and education).[a]

Model	White men	White women	Black men	Black women
Bivariate				
% Reflectance	0.201	0.343**	0.264**	0.141*
	(0.150)	(0.140)	(0.096)	(0.067)
Education				
% Reflectance	0.087	0.152	0.121	0.037
	(0.120)	(0.127)	(0.074)	(0.063)
Education at ~age 30	3.238***	2.710***	3.620***	2.535***
	(0.187)	(0.195)	(0.248)	(0.248)
Full model				
% Reflectance	0.089	0.165	0.121	0.002
	(0.123)	(0.128)	(0.080)	(0.064)
Education at ~age 30	3.083***	2.756***	3.561***	2.484***
	(0.209)	(0.214)	(0.273)	(0.274)
N	705	702	492	695

Note: Center and birth year fixed effects included in all models. Standard errors are in parentheses. The full model includes measures of parental education and occupation with indicators for missingness; number of siblings; and whether either parent is of a different race than the respondent.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
[a] SEI is measured at the wave after a respondent turns 35.

we do observe a bivariate relationship between skin color and occupational prestige, for all groups this relationship is non-significant and substantively small after accounting for prior educational attainment.

4. Discussion

When assessing the relationship between skin color and socioeconomic outcomes—as in any quantitative study—the measurement tools available both inform, and are informed by, the questions that researchers seek to answer (Espeland and Stevens, 2008). While interviewer-coded skin color measurements may better proxy for social treatment based on visible phenotype, mechanical measurement of skin color represents an advance in precision and replicability, allowing us to interrogate basic untested assumptions regarding whether and for whom skin color is associated with educational attainment. We began this investigation asking two questions: first, whether there exists a relationship between skin color and educational attainment among Black and among White Americans, and second, which pathways seem likely explanations for any relationship found. We measure skin color using a spectrophotometer reading at the volar upper arm, eliminating the potential for interviewer bias in skin color judgment present in all past studies using categorical interviewer-coded skin measures. As our spectrophotometer measure allows us to observe a unique degree of skin color variation among White respondents not available when color is operationalized as a categorical scale, we include analyses of both Black and White respondents separately.

Our findings for Black respondents were consistent with much of the past literature: when using a mechanical rather than interviewer-based measure of skin color, there remains a significant relationship between skin color and educational attainment. This relationship does not appear to differ by sex. Our estimates of the magnitude of this relationship fall between the relatively high two-year average difference in educational attainment between lightest- and darkest-skinned Black respondents found by Keith and Herring (1991), and Gullickson's (2005) finding of no difference in education by skin color. Since observed family background measures account for only a small percentage of the skin color-education association, these results suggest that skin color has a direct impact on educational attainment via contemporaneous discrimination, rather than the association simply reflecting the legacy of discrimination in generations past. As we remain unable to rule out the impact of an omitted variable bias, we make this assertion cautiously.

Interviewer-coded skin color data is becoming increasingly available in social surveys, and so the substantive similarity between our results for Black respondents and those found in past studies serves as a well-needed validity check. However, our findings also emphasize an important weakness in interviewer-coded color data, as no categorical coding scale has thus far captured sufficient variation for a comparative analysis of White respondents to be feasible. Given the assumption in prior literature that skin color should not matter for White respondents, our results for Whites were surprising: for White men, our hypothesis of no significant coefficient on skin color was confirmed in our initial OLS models, whereas for White women, we find an association between skin color and education approximately equal in magnitude to the association found for Black respondents. When we look across educational transitions, there appears a significant association between skin color and the transition to college for White men, and a smaller and non-significant relationship between skin color and college completion, mirroring the pattern expected were skin color primarily capturing social background. For White females, we find the opposite relationship: skin color is not significantly associated with the transition to college, but is significant for college completion, contrary to what we would expect were skin color simply a proxy for unmeasured family characteristics.

We see one possible explanation for this finding if the association between lightness and perceived attractiveness functions within-race across the full spectrum of skin color for American women. It has long been known that the physical attractiveness stereotype is more strongly applied to females than males (Bar-Tal and Saxe, 1976), and that attractiveness is associated with higher educational attainment (Umberson and Hughes, 1987), higher teacher appraisals of academic ability (Lerner and Lerner, 1977) and higher peer evaluations of academic performance (Landy and Sigall, 1974). While for White men, the definition of ''attractiveness'' itself is notably variable, for White women standards of attractiveness are widely shared and narrowly defined (Schulman, 1986) and include a preference for lighter coloration (Feinman and Gill, 1978), mirroring the sex difference observed in our sample. Although this explanation would contradict popular intuition that being tan is seen as desirable among White females, research suggests that this intuition is not supported in an experimental setting, where facial lightness remains a correlate of perceived health and increased attractiveness (Stephen et al., 2009).

That lighter skin has been also found to be monotonically associated with attractiveness for Black women but not for Black men (Hill, 2002a,b; Hamilton et al., 2009) potentially complicates this explanation, in light of the lack of sex difference in the association between color and educational attainment for Black respondents in our sample. However, the studies of attractiveness cited here all assess perceptions within-race, complicating extrapolation of these results for Black Americans if educational gatekeepers are predominantly White.[35] We emphasize that even if skin color is socially relevant for educational attainment in White women and in Black men and women, it need not be socially relevant via the same mechanisms, as different processes by race, sex, or the intersection of the two may lead to the associations observed.

With respect to the association between skin color and occupational prestige, our results diverge from previous findings: where Keith and Herring (1991) found a significant relationship between skin color and occupation for Black women even net of attainment, we find the skin color-occupation association to be non-significant and substantively small for all respondents after accounting for prior education. While this difference in findings could reflect differences between the CARDIA and NSBA color-coding instruments, we also note the possibility of birth cohort as an alternate explanation. CARDIA respondents represent the first wave of Americans to face education and labor markets in the post-Civil Rights era, with the oldest respondents only nine years old by the 1964 passage of the Civil Rights Act; in contrast, about 60% of the original NSBA respondents were 18 or older by 1964. That a significant increase in legal protections from workplace discrimination would result in a decreasing association between appearance and occupation in these two cohorts seems certainly plausible, though remains speculative. We take care to note that our findings do not refute evidence of between-race discrimination in the labor market, the possibility of within-race wage differences by color, or color-based differences in employment versus unemployment (Goldsmith et al., 2007). Furthermore, the bivariate association that we find between color and occupation suggests that one will still observe a color gradient by occupation within race. However, for those respondents in our sample with a recorded occupation, this gradient appears to now extend from differentials generated in the educational sphere as opposed to reflecting additional color-based barriers to occupation entry.

Our research suggests that more attention should be paid to skin color (and other associated phenotypical characteristics) among Whites, particularly among females. While many narrative accounts can be found detailing the ''not-all-the-way White'' experiences of ethnic Whites in the US (Raffo, 1998)—particularly of ethnic White women— in the social science literature assessing the effects of skin color, 'White' has tended to be dealt with as a blanket category in which members are exempt from discrimination. We encourage researchers to interrogate the reasons why skin color differences among White Americans have been presumed inconsequential, despite extensive evidence that lightness has long been privileged among women in many diverse populations globally (Van den Berghe and Frost, 1986). Second, our occupational prestige analysis emphasizes the extent to which educational disparities by skin color can have an ongoing impact on later-life socioeconomic outcomes. While this point itself deserves further study, if the educational sphere functions as a primary location in which socioeconomic inequities by skin color are produced, it becomes imperative to better understand how such appearance-based discrimination may operate day-to-day in the school environment. Finally, while our educational transition models represent one attempt to assess whether skin color is primarily a proxy for family background, the ideal approach would be to better control for family background in the first place. Sibling data would be particularly useful in this case, and while we are not aware of any data sources that currently include both measures of social outcomes and skin reflectance for siblings, spectrophotometer readings have the advantage of being relatively non-invasive and simple to collect.

Implicit in the question of how skin color and education are associated is a valuation of the different potential mechanisms, given what each reveals about contemporary American society. While opinions vary regarding intergenerational transmission of educational privilege (for which skin color may serve as a proxy), appearance-based discrimination is unequivocally inequitable. Our findings suggest that such discrimination appears to be still a salient force in modern American society, and may transcend racial categories in ways not previously thought.

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[35] Whereas 75% of Americans classified themselves as White in the 2010 census, 84% of public school teachers in 2011 were White; conversely, whereas 12% of Americans self-reported as Black in 2010, only 7% of public school teachers in 2011 were Black (Humes et al., 2011; Feistritzer, 2011).

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