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RESEARCH ARTICLE

Socioeconomic status and psychological stress: Examining intersection with race, sex and US geographic region in the REasons for Geographic and Racial Differences in Stroke study

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Abstract

Socioeconomic status (SES) is a well-established determinant of health. Disparities in stress are thought to partially account for SES-health disparities. We tested whether multiple indicators of SES show similar associations with psychological stress and whether race, sex, and geographic region moderate associations. Participants (n = 26,451) are from a well-characterized national cohort of Black and White US adults aged 45 years or older. Psychological stress was measured using the 4-item perceived stress scale. Income was assessed as annual household income and education as highest level of education completed. Occupation was assessed during a structured interview and subsequently coded hierarchically. For all sex-race-region groups, the largest SES-stress associations were for income and the smallest were for occupation. Race moderated SES-stress associations, such that income and education were more closely associated with stress in Black adults than White adults. Additionally, education was more strongly associated with stress in individuals living in the stroke belt region. Black Americans with lower income and education reported greater psychological stress and may be at higher risk for disease through stress-related pathways. Thus, which SES indicator is examined and for whom may alter the magnitude of the association between SES and psychological stress.

KEYWORDS
national cohort, race, sex, socioeconomic status, stress

1 | INTRODUCTION

Socioeconomic status (SES) is a well-established determinant of mental and physical health (Adler, 2009; Chetty et al., 2016). Disparities in stress are thought to partially account for socioeconomic disparities in health though the full mediational pathway is rarely tested (Cundiff et al., 2020; Seeman et al., 2014). For example, lower education and income are associated with more chronic everyday stress such as more severe daily hassles, as well as other forms of chronic stress such as intimate partner violence (Grzywacz et al., 2004). Few studies have examined multiple indicators of SES in the United States in relation to stress and in a large and diverse sample. Objective indicators of SES (education, income, occupation) are modestly correlated with one another, thus differential associations by

each specific indicator are possible (e.g., Winkleby et al., 1992). Further, much of the literature examining occupational class and stress is based on research from European countries, where occupational classifications are more clearly hierarchical compared to US classification systems (e.g., Marmot et al., 1984; Schieman & Koltai, 2017).

Psychological stress is thought to increase risk for disease when individuals perceive environmental demands as taxing or exceeding their resources to meet or cope with these demands (Cohen et al., 2016; Lazarus & Folkman, 1984). These perceptions of stress are thought to influence disease, at least in part, because they evoke frequent and severe negative affective states which influence physiology and behaviour so as to confer disease risk (Cohen & Janicki-Deverts, 2012). Consistently, perceived stress as measured by self-report has been associated with elevated biological and physiological markers of disease (e.g., telomeres, cortisol, proinflammatory cytokines) and poorer health behaviours as well as frank disease (Cohen et al., 2019). For example, perceived stress was associated with significantly increased risk for atrial fibrillation (OR = 1.60) compared to either low (OR = 1.12) or moderate (OR = 1.27) levels of perceived stress in a large national cohort (O'Neal et al., 2015).

In addition to socioeconomic disparities, stress is also thought to play a role in racial health disparities (APA Working Group on Stress and Health Disparities, 2017). Due to the historical context of slavery and racial hierarchy in the United States, race and SES are correlated with one another. Further, associations between SES and health can vary by race. For example, several studies have shown that higher SES may be less protective for Black Americans than White Americans (e.g., Farmer & Ferraro, 2005). For example, even at relatively high levels of income, non-Hispanic Black adults were more likely to report poor self-rated health compared to their White counterparts (Centers for Disease Control and Prevention, 2012). These 'diminishing returns' for Black adults are thought to be due, in part, to increased exposure to psychological stressors such as discrimination at higher levels of SES as Black adults with higher SES are more likely to live and work in integrated settings thus increasing the probability of discrimination (e.g., Colen et al., 2018; Farmer & Ferraro, 2005). Indeed, Black Americans with higher SES report more discrimination than those with lower SES (Krieger et al., 2011) and Black Americans living in integrated environments also report more discrimination (Hunt et al., 2007).

Sex may also intersect with race and/or SES in associations with stress. For example, associations between discrimination and health are often stronger in Black women compared to Black men (Lewis & Van Dyke, 2018). Such findings are consistent with theories of intersectionality, which have suggested at least additive, if not synergistic, effects of multiple marginalized identities on stress (e.g., Crenshaw, 1989). For example, a recent study examining minority stress (stressors related to minority identity) in sexual minority adults across race, ethnicity and SES found that non-White participants experienced more minority stress and that higher SES was less stress-protective for Black Americans (Shangani et al., 2020).

Further, geographic regions are associated with differential health risk and this could be due in part to differences in stress in these regions either for all groups or only some groups. For example, counties that have higher levels of stress in the form of racial prejudice (particularly explicit prejudice) also report the largest gaps in birth outcomes by race (Orchard & Price, 2017). The Southeastern Stroke Belt region of the United States is a particular geographic region showing higher incidence of stroke and also significant overlap with geographic regions with a history of slavery (Esenwa et al., 2018; Howard & Howard, 2020). This historical context may shape cultural practices and current day levels of stress in this region and/or associations between race and stress in this region compared to others. Examination of socioeconomic and racial differences in stress by sex and geographic region, acknowledges that each of these demographic categories represents a group of heterogeneous individuals and that other overlapping identities (sex) and social contextual factors (geographic region) may also influence stress.

2 | CURRENT STUDY

The current study examines the hierarchical patterning of perceived stress in a large and well-characterized national cohort of Black and White adults in the United States, the REasons for Geographic and Racial Differences in Stroke (REGARDS) study. REGARDS provides an opportunity to examine basic associations between psychological stress and multiple well-characterized indicators of SES (income, education, occupation). There is also an opportunity to examine whether SES-stress associations generalize across other demographic factors, such as race, sex and geographic region given the oversampling of participants in the stroke belt of the United States. We hypothesize that individuals with lower SES will report more psychological stress. However, the magnitude of this association may differ by SES indicator and other overlapping demographics such as race, sex and geographic region. This study contributes to our understanding of whether different indicators of SES are similarly associated with psychological stress and whether the SES–stress association is similar across intersecting demographic groups.

3 | METHODS

3.1 | Participants

The present study is a secondary analysis of self-reported demographic and stress data from the REGARDS study, a population-based national cohort of 30,239 Black and White adults aged 45 years or older residing in the contiguous United States. Participants were randomly selected from a commercially available list (Genesys), and enrolled from 2003 to 2007. The cohort oversampled Black adults and residents of the Southeastern Stroke Belt region of the United States (North Carolina, South Carolina, Georgia, Tennessee, Mississippi, Alabama and Arkansas). In this stratified random sample, 44% were men and 64% were White adults; 55% were recruited from the southeastern United States, while the remaining 45% represented other regions of the contiguous United States. Baseline data

were collected using a computer-assisted telephone interview (CATI) and an in-home examination. The CATI and in-home exam were conducted by trained research staff.

For this analysis, we started with the cohort of 30,239 participants, then removed 56 participants with consent form inconsistencies. We further removed 8 participants missing perceived stress for a sample of 30,175. For analyses with education, an additional 22 participants missing education level were removed, for a sample of 30,153. For income analyses, 3724 participants who refused to provide income at baseline were removed, leaving a sample of 26,451. Analyses with occupation were, by necessity, restricted to participants who completed an ancillary study 2011–2013 (both employed and unemployed) during a CATI follow-up, providing retrospective information on their job at time of enrolment (MacDonald et al., 2014). For occupation analyses, 6709 participants were employed at baseline with a coded occupation category. After removing military occupations (n = 15), as they do not fit into the hierarchical system of coding occupations used here, we were left with an analytical sample of 6693. Power simulations assuming this smaller sample size for analyses using occupation (n = 6693) revealed that we were able to detect a difference in slopes of 0.110 with at least 90% power. Power is lower for detecting higher order interactions of the same magnitude.

The REGARDS study participants provided written consent, and all participating universities' institutional review boards approved the protocol. For more information about the REGARDS study, please see prior publication (Howard et al., 2005).

3.2 | Measures

3.2.1 | Socioeconomic status

SES was operationalized using income, education and occupation. The coding of participant responses and frequency of each response is provided in Table 1. *Income* was assessed by asking participants a

TABLE 1 Socioeconomic characteristics of the sample

SES variable	Black men *n* (%)	Black women *n* (%)	White men *n* (%)	White women *n* (%)
Household income (N = 26,451)	N = 4272	N = 6654	N = 8018	N = 7507
<$5k	55 (1.29)	150 (2.25)	30 (0.37)	45 (0.60)
$5k–$10k	155 (3.63)	473 (7.11)	72 (0.90)	237 (3.16)
$10k–$15k	309 (7.23)	751 (11.29)	206 (2.57)	498 (6.63)
$15k–$20k	435 (10.18)	1033 (15.52)	374 (4.66)	655 (8.73)
$20k–$25k	514 (12.03)	923 (13.87)	637 (7.94)	815 (10.86)
$25k–$35k	774 (18.12)	1094 (16.44)	1234 (15.39)	1316 (17.53)
$35k–$50k	783 (18.33)	1007 (15.13)	1594 (19.88)	1327 (17.68)
$50k–$75k	624 (14.61)	735 (11.05)	1643 (20.49)	1199 (15.97)
$75k–$150k	530 (12.41)	432 (6.49)	1783 (22.24)	1128 (15.03)
>$150k	93 (2.18)	56 (0.84)	445 (5.55)	287 (3.82)
Highest education (N = 30,153)	N = 4741	N = 7755	N = 8799	N = 8858
Never attended or kindergarten only	12 (0.25)	13 (0.17)	17 (0.19)	14 (0.16)
Eighth grade or less	358 (7.55)	442 (5.70)	237 (2.69)	163 (1.84)
Some high school (9th–11th grade)	567 (11.96)	1106 (14.26)	367 (4.17)	496 (5.60)
High school graduate or GED certificate	1322 (27.88)	2166 (27.93)	1845 (20.97)	2469 (27.87)
Some technical school	69 (1.46)	120 (1.55)	131 (1.49)	185 (2.09)
Technical school graduate	128 (2.70)	199 (2.57)	207 (2.35)	302 (3.41)
Some college	1036 (21.85)	1763 (22.73)	1840 (20.91)	2109 (23.81)
College graduate	716 (15.10)	1103 (14.22)	2146 (24.39)	1745 (19.70)
Postgraduate or professional degree	533 (11.24)	843 (10.87)	2009 (22.83)	1375 (15.52)
Occupational class (N = 6693)	N = 907	N = 1445	N = 2301	N = 2040
White collar	455 (50.17)	481 (33.29)	575 (24.99)	281 (13.77)
Sales and admin support	141 (15.55)	320 (22.15)	411 (17.86)	625 (30.64)
Blue collar	311 (34.29)	644 (44.57)	1315 (57.15)	1134 (55.59)

Note: Occupation at enrolment was assessed by structured interview.

series of questions with appropriate skip patterns to determine the range of their yearly earned household income, including the questions: 'Is your annual household income from all sources: (1) less than $25,000, (2) less than $20,000, (3) less than $15,000, (4) less than $10,000, (5) less than $5000, (6) greater than $35,000, (7) greater than $50,000, (8) greater than $75,000 or, (9) greater than $150,000. *Education* was assessed by asking the following question 'What is the highest grade or year of school you have completed?' Participants selected from the following options: Never attended or kindergarten only, Eighth grade or less, Some high school (9th–11th grade), High school graduate or GED certificate, Some technical school, Technical school graduate, Some college, College graduate, Postgraduate or professional degree. *Occupation* was assessed by asking participants their self-reported job title, industry, responsibilities and relevant credentials (e.g., degrees or licences) during a structured interview. This information was used to classify participants into four-level Standard Occupation Classification (SOC) codes (US Bureau of Labor Statistics) based on primary job title (MacDonald et al., 2014). SOC codes were aggregated into three broad occupation groups for the purpose of analysis: blue-collar, sales and administrative support, and white-collar. This grouping is a higher-level aggregation of the standard 6 group aggregation (US Bureau of Labor Statistics) and parallels the 3 occupational classes used in other studies (Cundiff et al., 2016; Ferrario et al., 2011). Individuals with SOC codes within the 31-0000 through 39-0000 levels (service), 45-0000 level (agricultural), 47-0000 level (construction), 49-0000 level (installation, maintenance, and repair), 51-0000 level (production), and 53-0000 level (transportation and material moving) were considered blue-collar. Individuals with SOC codes within the 41-0000 level (sales) and 43-0000 level (administrative support) were considered to be in sales or administrative support positions. Individuals with SOC codes within the 11-0000 level (managerial), 13-0000 level (business operations), and 15-0000 through 29-0000 levels (professional) were considered white collar.

3.2.2 | Perceived stress

Perceived stress was measured during the CATI with the four-item version of the Cohen Perceived Stress Scale (PSS-4) (Cohen et al., 1983). The PSS is a validated measure of participant's perceptions that his/her life is unpredictable, uncontrollable, and/or overcommitted (Cohen et al., 1983). Reliability was good in this sample ($\alpha = 0.68$). Scores on this measure range from 0 to 16.

3.2.3 | Effect modifiers

Race (Black and White), sex (men and women) and geographic region (stroke belt vs. not) were examined as potential moderators of SES–stress associations.

3.3 | Overview of analyses

All correlational and regression analyses were performed using SAS® Version 9.4. Bivariate correlations were examined among primary study variables. Multiple linear regression analyses were performed to determine the association of the SES indicators with stress and to test for moderation. For significant interactions, InterActiv plots were used to visually represent the simple slope trends (McCabe et al., 2018). These plots display raw data of the association between the indicator of SES (predictor) and perceived stress (outcomes) across levels of the moderator (e.g., race) as indicated in the shaded headers above each column. The simple slope and 95% confidence interval for each level of the moderator is also displayed in the shaded header.

4 | RESULTS

4.1 | Descriptive statistics

A detailed description of socioeconomic measures by race-sex groups is shown in Table 1. Table 2 reports correlations among socioeconomic indicators and perceived stress as well as means and standard deviations on each of these variables overall and stratified by race and sex. Correlations between the three SES indicators ranged from $r = 0.36$ to $r = 0.51$. Correlations between perceived stress and SES ranged from $r = -0.22$ (income) to $r = -0.05$ (occupation). Thus, SES indicators were moderately correlated with one another and showed significant variability in associations with perceived stress. Mean perceived stress in the full sample was 3.2 out of a possible 16, indicating that most people reported at least mild stress. All three indicators of SES were lower in Black compared to White participants. Black women had the highest levels of perceived stress of any group and the lowest levels of income.

4.2 | Incremental utility of SES indicators for predicting perceived stress

Controlling for age, race, sex and geographic region, we examined the relative effect size of each SES indicator and whether each remained a significant predictor of stress when entered into the model simultaneously (Table 3). Each individual indicator of SES was significantly associated with perceived stress, with income showing the largest association, followed by education, and then occupation. When all three indicators were entered into the model simultaneously, only income remained a significant predictor of stress, and the effect size was similar to the income-only model, despite a much smaller sample size in the mutually adjusted model due to loss of participants associated with occupational coding.

TABLE 2 Descriptive statistics and correlations among primary study variables

	Perceived stress	Income	Education	Occupation
Perceived stress		−0.22*	−0.15*	−0.05*
Income	26,451		0.49*	0.36*
Education	30,153	26,440		0.51*
Occupation	6693	6193	6693	
N	30,175	26,451	30,153	6693
Range	0–16	1–10	0–8	1–3
Full sample, mean (SD)	**3.2 (2.9)**	**6.4 (2.1)**	**5.1 (2.2)**	**2.2 (0.8)**
Black men, mean (SD)	3.1 (3.0)	6.2 (2.1)	4.6 (2.3)	1.8 (0.9)
Black women, mean (SD)	3.9 (3.1)	5.4 (2.1)	4.6 (2.2)	2.1 (0.9)
White men, mean (SD)	2.5 (2.6)	7.2 (1.8)	5.7 (2.1)	2.3 (0.8)
White women, mean (SD)	3.4 (2.9)	6.5 (2.1)	5.3 (2.1)	2.4 (0.7)

Note: Correlation values are shown above the diagonal. The *n* for each correlation is shown below the diagonal. Bolding was added simply to draw attention to the statistics for the full sample (as distinct from the subgroups below).

*$p < 0.05$.

TABLE 3 Results of multivariate regression analyses examining the predictive utility of SES indicators in separate and combined models

Model	*N*	Predictor(s)	Standardized beta	Unstandardized beta	SE	*p*	Partial correlation
Single predictor model	26,451	Income	−0.217	−0.301	0.009	<0.001	0.021
Single predictor model	30,153	Education	−0.134	−0.178	0.008	<0.001	0.011
Single predictor model	6693	Occupation	−0.057	−0.176	0.038	<0.001	0.002
Mutually adjusted model	6191	Income	−0.132	−0.199	0.023	<0.001	0.022
		Education	−0.025	−0.033	0.020	0.099	0.000
		Occupation	−0.001	−0.002	0.047	0.960	0.000

Note: Covariates for all analyses are age, race, sex and geographic region.

4.3 | Associations among indicators of SES and perceived stress by demographic group

Correlations between indicators of SES and perceived stress by race, sex and geographic region are shown in Figure 1. Black men and women showed stronger associations between SES and stress across all three indicators of SES, compared to White men and women. For all groups, the largest SES–stress associations were seen for income and the smallest associations were seen for occupation.

To test statistical significance of differences between SES and perceived stress across demographic combinations (race, sex, geographic region) while controlling for multiple main effects, we performed a series of regression analyses with simple (i.e., two-way) interactions as well as higher order (e.g., three- and four-way) interactions (Table 4). Results shown in Table 4 are organized by SES indicator. Each row of the table represents a separate regression model with coefficients and *p*-values reported only for the highest order interaction in the model. All analyses controlled for the main effects of age, race, sex, and geographic region. There were main effects of race, sex, and geographic region on perceived stress in the models for both income ($B = 0.026$, $p < 0.001$; $B = 0.094$, $p < 0.001$; $B = 0.016$, $p = 0.007$) and education ($B = 0.057$, $p < 0.001$; $B = 0.130$, $p < 0.001$; $B = 0.024$, $p < 0.001$), indicating that Black Americans, women, and those living in the stroke belt reported greater stress on average. In the model using occupation, only sex showed a significant main effect on stress ($B = 0.135$, $p < 0.001$).

Regarding interactions with SES, analyses revealed a significant interaction of race with both income and education. There was a stronger association between income and stress for Blacks ($b = -0.28$, 95% CI [−0.32 to −0.25]) compared to Whites ($b = -0.17$, 95% CI [−0.19 to −0.16]). Similarly, there was a stronger association between education and stress for Blacks [$b = -0.35$, 95% CI (−0.39 to −0.32)] compared to Whites ($b = -0.30$, 95% CI [−0.32 to −0.28]). Gender did not further moderate income by race effects on perceived stress (see Table 4) despite appearances in Figure 1. The only other statistically significant interaction with any indicator of SES was between education and geographic region, such that there was a stronger association between education and stress for Americans living in the stroke belt region ($b = -0.23$, 95% CI [−0.26 to −0.19]) compared to those who do not ($b = -0.18$, 95% CI [−0.19 to −0.16]).

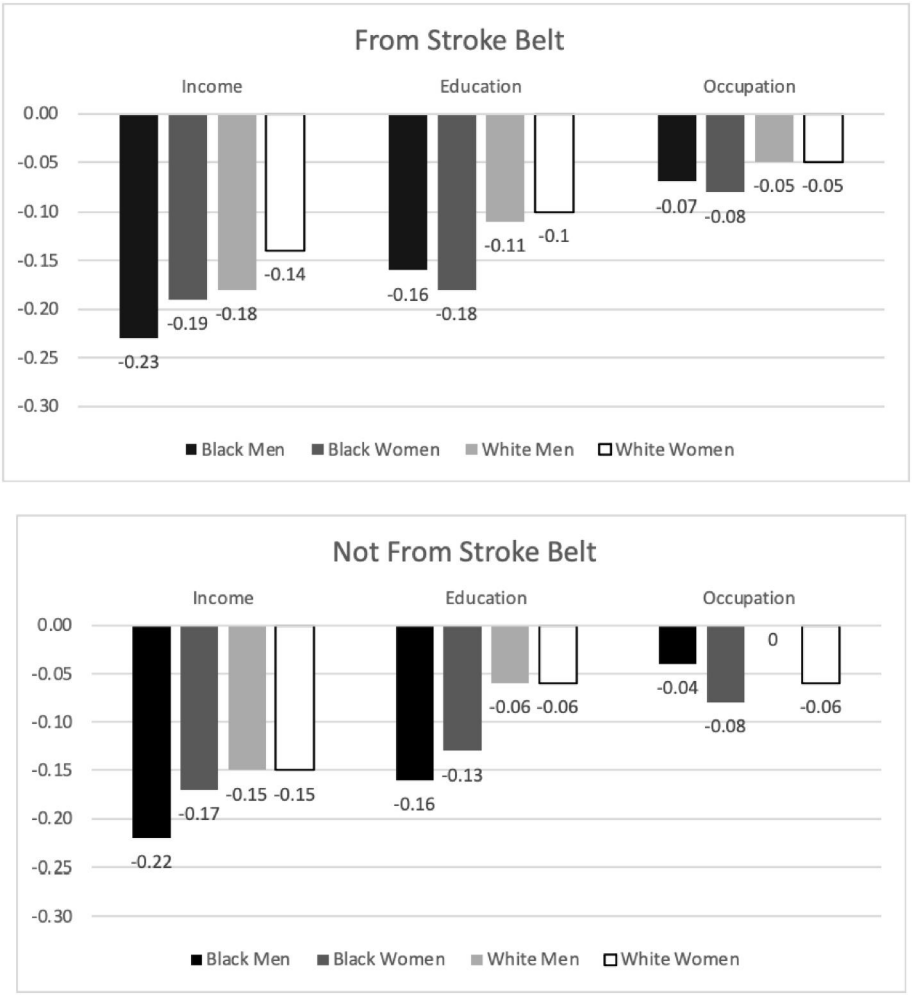

FIGURE 1 Correlations (*r*) between perceived stress and socioeconomic status (SES) by SES indicator and demographic group

A visual summary of the raw data as well as simple slopes are presented in Figure 2.

5 | DISCUSSION

The current study examined the social patterning of psychological stress by multiple indicators of SES and race in a large, diverse, and well-characterized national cohort. The REGARDS study oversampled Black adults and residents of the Southeastern Stroke Belt region of the United States, making it possible to examine multiple social and identity-based influences on health and their association with stress. This design also allowed for statistically well-powered examination of the intersection of these factors (e.g., whether sex significantly modifies associations between SES, race and stress), which is still very rare in the literature. We were also able to examine the role of geographic regions such as the stroke belt and how multiple other identities (e.g., race, sex) may overlap with multiple indicators of SES in the association with psychological stress.

Psychological stress was significantly associated with all indicators of SES, but most strongly associated with income. Effect sizes were similar to recent studies using smaller and less diverse population-based samples to examine the SES–perceived stress association (e.g., Schieman & Koltai, 2017; Wharton & Zivin, 2017). Differences in stress between SES indicators may indicate increased risk for disease. Although health outcomes were not examined in this study, the finding that income is most closely associated with perceived stress mirrors findings from a nationally representative sample specifically designed to examine the differential influence of SES on mortality. That study found that income was more closely associated with mortality than education or occupation (Duncan et al., 2002). A recent report from the Multi-ethnic Study of Atherosclerosis (MESA) also showed that income was the SES indicator most closely associated with depressive symptoms across demographic groups (Peplinski et al., 2018). It is possible that differences in stress among SES indicators are accounting for differences in health amongst SES indicators; however, the full implied mediational pathway should be directly examined in future research (Cundiff et al., 2020). Further, not all stress-related health outcomes show similar associations across SES. For example, another large study showed that education may be the most important SES indicator in predicting cardiovascular risk specifically (Winkleby et al., 1992). In so

TABLE 4 Results of regression models examining whether associations between SES and stress differ by race, sex, geographic region or their combination

SES indicator	Highest order interaction tested	Standardized beta	Unstandardized beta (SE)	*p*	Partial correlation	*N*
Income						
	Income × race	**−0.200**	−0.056 (0.017)	0.001	0.0004	26,451
	Income × sex	0.008	0.021 (0.017)	0.217	0.0001	26,451
	Income × geographic region	−0.011	−0.030 (0.017)	0.073	0.0001	26,451
	Income × race × sex	0.002	0.016 (0.035)	0.646	0.0000	26,451
	Income × race × sex × geographic region	−0.005	−0.056 (0.072)	0.438	0.0000	26,451
Education						
	Education × race	**−0.040**	−0.109 (0.015)	<0.001	0.0017	30,153
	Education × sex	−0.013	−0.036 (0.015)	0.107	0.0002	30,153
	Education × geographic region	**−0.018**	−0.050 (0.015)	0.001	0.0004	30,153
	Education × race × sex	0	−0.001 (0.031)	0.960	0.0000	30,153
	Education × race × sex × geographic region	−0.006	−0.064 (0.063)	0.311	0.0000	30,153
Occupation						
	Occupation × race	−0.016	−0.113 (0.077)	0.146	0.0003	6693
	Occupation × sex	−0.019	−0.132 (0.075)	0.079	0.0005	6693
	Occupation × geographic region	−0.012	−0.082 (0.076)	0.227	0.0002	6693
	Occupation × race × sex	0.004	0.053 (0.159)	0.740	0.0000	6693
	Occupation × race × sex × geographic region	0	−0.011 (0.323)	0.973	0.0000	6693

Note: Results are presented by SES indicator, with each row containing the model results from a separate regression model and only the results for the highest-order interaction in the model are reported. Significant interactions are bolded. Covariates for all analyses are age, race, sex, and geographic region. All appropriate lower order interactions were included in models of higher order interactions (e.g., interactions of more than two independent variables).

much as stress is considered an important pathway linking SES to disease, the current examination of differential associations among indicators of SES and psychological stress complements the large body of work documenting differential associations among indicators of SES and disease.

Differences in stress between demographic groups may also indicate increased risk for disease in these populations. Lower SES was associated with increased psychological stress, and consistent with the history of slavery and racial hierarchy in the United States, mean levels of all three indicators of SES were lower in Black participants compared to White participants. Further, race and SES showed independent main effects on psychological stress, so even after accounting for the fact that Black participants in REGARDS on average had lower education and lower annual income, greater levels of stress were still observed among Black adults compared with White adults. Beyond these additive main effects, results here show that perceived stress is more closely associated with lower income and education for Black participants. Although Black women had the lowest incomes and highest stress levels on average, there was no significant difference in the association of income with perceived stress by gender, after accounting for the main effects of income, race, and their interaction (Table 4). A previous study examining perceived stress in three national survey samples also found that lower income and education were associated with greater perceived stress, but in these smaller cohorts there was no significant main effect of race after controlling for socioeconomic status and no interaction between race and SES was tested (Cohen & Janicki-Deverts, 2012).

The significant interaction between education and geographic region showed that education was more strongly associated with stress in individuals living in the stroke belt region versus other regions. The standardized effect for this interaction was significant but very small ($B = -0.013$, Table 3). Nonetheless, this suggests that lower education may be a stronger risk factor for stress, and thus perhaps stress-related diseases, in the Southeastern Stroke Belt region of the United States. Notably, this interaction did not differ by race, consistent with findings that stroke incidence is higher in both Black and White adults in this region. In a recent review of the current state of literature on contributing factors to the higher incidence of stroke in this region, the authors concluded that lower SES is one of the larger contributing factors and that the potential contribution of stress remains uninvestigated (Howard & Howard, 2020). The current analyses suggest that the contribution of lower education may be heightened in this region, in part, due to a closer association with increased stress.

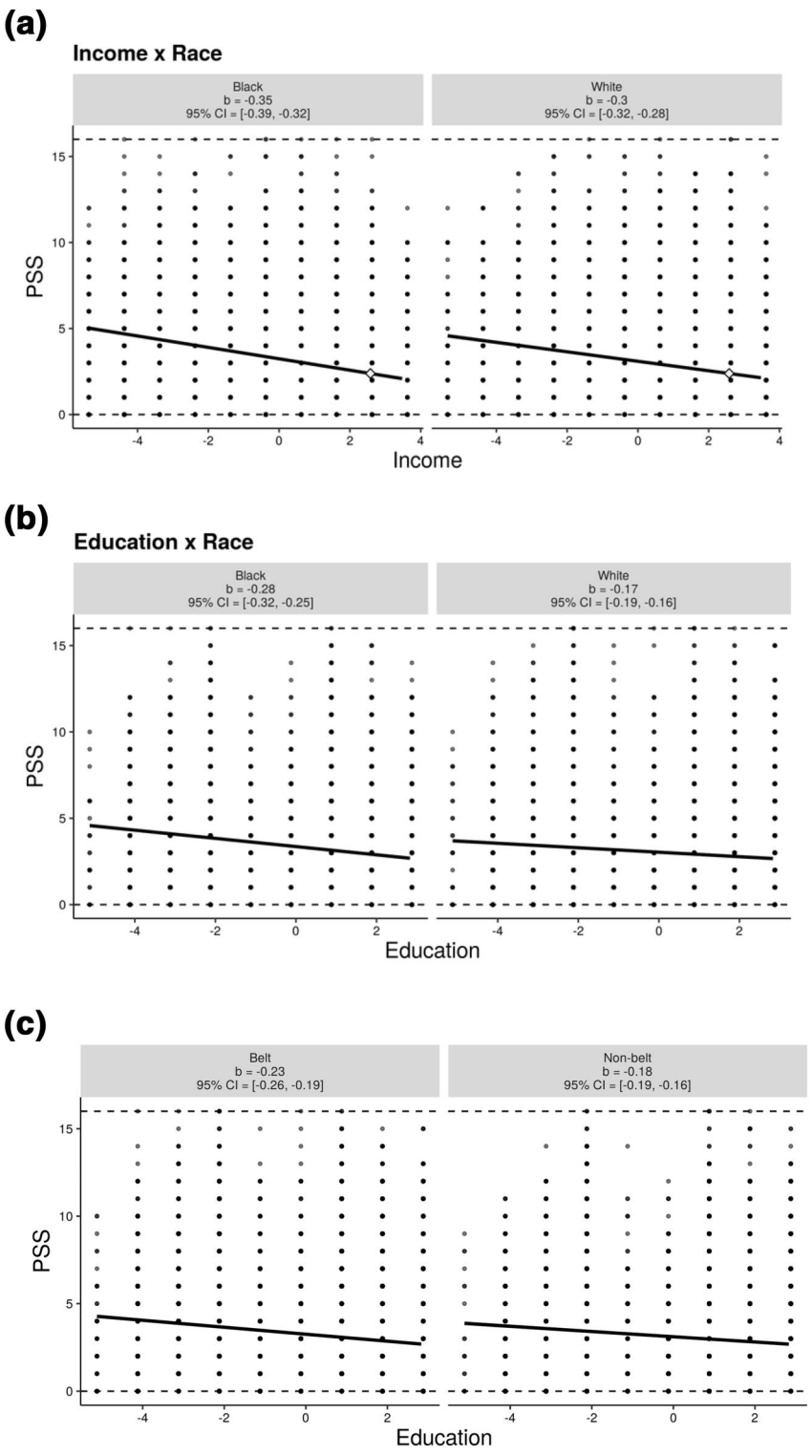

FIGURE 2 Visual representation of significant moderation effects (Table 4). The dots represent raw data and the lines represent simple slopes for each group. (a) *Income* by race. There is a stronger association between income and stress for Black Americans compared to White Americans. (b) *Education* by race. There is a stronger association between education and stress for Black Americans compared to White Americans. (c) *Education* by geographic region. There is a stronger association between education and stress for Americans in the stroke belt compared to Americans in other geographic regions

Lastly, our findings did not find support for the concept of diminishing returns for the outcome of psychological stress (Farmer & Ferraro, 2005). When the slope of the relationship between SES and stress differed by race, as was the case for income and education, the slope was steeper (rather than flatter) for Black adults compared to White adults. Such findings are counter to the idea that increases in SES 'level off' in terms of their protective effect for Black adults compared to White adults. Thus, the finding that higher SES is associated with more stress in the form of racial discrimination (e.g., Krieger et al., 2011) may be specific and not generalizable to psychological stress measured more broadly, as in the current study.

5.1 | Limitations

The current study has many strengths including a large sample size to examine Black–White and socioeconomic disparities in psychological stress and test interactions among intersecting demographic factors. However, there are details of this study that represent interpretative limitations. This study examined middle-aged and older adults as participants had to be 45 years of age or older to participate in REGARDS. Hence, results could be specific to age group or cohort. Given that the REGARDS study data were collected approximately 20 years ago and inequality in the United States appears to have increased over this time period (Hussey & Jetter, 2017) the current study may underestimate the associations between SES and stress for the current time period. Fewer participants had information on occupational class and a significant portion of the sample was retired, but a very large number of participants was still available for each analysis (e.g., occupation analyses were still conducted in well over 6000) and the sampling method for this large study (e.g., oversampling for race and geographic region of high disease risk) allowed for more in-depth investigation in the current analysis. We examined a snapshot of perceived stress, not an estimation of lifetime stress or an assessment of other forms of stress. Similarly, we examined a snapshot of SES and it is not possible in this sample to examine changes in SES over time, though arguably SES is likely relatively stable in the age group examined here. Also, our study included Black and White adults so the current findings may not be generalizable to other racial and ethnic groups in the United States.

6 | CONCLUSIONS

The findings here contribute to more nuanced and specific conceptualizations of associations among socioeconomic status and stress. Which SES indicator is examined and for whom (e.g., White vs. Black adults) may affect the magnitude of the association between SES and psychological stress. Inasmuch as psychological stress is thought to contribute to the socioeconomic gradient in a health outcomes, the potential influence of stress likely depends not only on the outcome being examined but also the indicator of SES examined, and for whom. Attention to such distinctions may be important for understanding the psychology and pathophysiology of how SES gets under the skin, as this study suggests that associations between SES and stress may differ across other forms of social hierarchy in the United States such as race, which may affect risk for disease through psychobiological stress pathways.

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CONFLICT OF INTERESTS

The authors have declared that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

Jenny M. Cundiff drafted the manuscript. Aleena Bennett performed data analysis in collaboration with Jenny M. Cundiff and Virginia J. Howard. Aleena Bennett, April P. Carson, Suzanne E. Judd and Virginia J. Howard all provided critical input regarding project conceptualization and critical revisions to the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the REGARDS advisory board on request.

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