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Social and economic factors and black-white disparities in cardiovascular health: A decomposition analysis

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A B S T R A C T

Background: Cardiovascular health (CVH) in Black adults, and particularly in Black women, has lagged behind White adults for decades and contributes to higher mortality rates for Black adults. We quantified the contribution of five social and economic factors to observed racial disparities in CVH by gender.
Methods: We analyzed data from N = 8,019 adults aged ≥20 years free of cardiovascular disease assessed in the National Health and Nutrition Examination Survey, 2011–2018. Social and economic factors included self-reported education, income, employment, food security, and marital status. CVH was measured using eight behavioral and clinical indicators. We utilized Kitagawa-Blinder-Oaxaca decomposition to quantify gendered racial differences in CVH accounted for by these factors.
Results: Black women (mean CVH = 79.3) had a lower age-adjusted CVH score compared to White women (mean CVH = 82.3) (mean difference [MD] = −3.01; 95% CI: -5.18, −0.84). Social and economic factors accounted for a 3.26-point disadvantage (95% CI: -4.12, −2.40) and a 0.25-point CVH score advantage due to factors not accounted for in the model. In women, income had the largest coefficient associated with CVH score (b = −1.48; 95% CI: -2.04, −0.92). Among men, social and economic factors accounted for a 2.27-point disadvantage (95% CI: -2.97, −1.56) with educational attainment being the largest coefficient associated with CVH score (b = −1.55; 95% CI: -2.03, −1.06). However, the disadvantage in men was offset by a 1.99 CVH score advantage that was not accounted for by factors in the model resulting in no racial difference in age-adjusted CVH score (MD = −0.28; 95% CI: -3.78, 3.22).
Conclusions: Racial differences in social and economic factors may contribute a large portion to the observed disparity in CVH between U.S. Black and White women.

1. Introduction

Though rates of cardiovascular disease (CVD) are declining, CVD still affects nearly half of Americans and remains the leading cause of death in the US (Virani et al., 2021). Racial disparities persist in CVD between non-Hispanic Black adults (hereafter "Black adults") and non-Hispanic White adults (hereafter "White adults") (Carnethon et al., 2017). Compared to White adults, Black adults are more likely to be diagnosed with CVD (Safford et al., 2012), experience a fatal CVD event (Kyalwazi et al., 2022), and experience recurring CVD events after their first myocardial infarction (Blackston et al., 2020). In addition, racial disparities in CVD outcomes are strongly patterned along gender lines. For example, based on national survey data, Black *women* (58.8%) have higher rates of CVD compared to White women (42.1%) (Tsao et al., 2022). More recently, there has been a shift to focus on cardiovascular health (CVH) versus disease. Ideal CVH, defined as the presence of favorable health states (e.g., non-smoker, body mass index <25 kg/m^2), is associated with greater longevity and lower incidence of cardiovascular disease and associated mortality (Ford et al., 2012; Ramírez-Vélez et al., 2018). However, racial disparities in CVH are also well-documented. Black adults consistently have worse CVH, compared to White adults, with Black women having the worst CVH (Brown et al., 2018; Bundy et al., 2021; Lee et al., 2021; Pool et al., 2017).

We hypothesize that racial and gender disparities in CVH are predominately driven by differential distribution of social determinants of health (SDoH). Following Powell-Wiley and colleagues, we consider SDoH as the "economic, social, environmental, and psychosocial factors that influence health" (Powell-Wiley et al., 2022). Powell-Wiley et al. posit that poor CVD outcomes in racial minorities and other vulnerable populations must be understood through the integration of structural and intermediary determinants of health equity. In their SDoH framework, the structural domain is comprised of the sociopolitical and economic context and its downstream impacts on discrimination, access, and quality of institutions (e.g., education, healthcare), socioeconomic status (e.g., occupation and income), and neighborhood environment (e.g., built and socioeconomic environment). The structural domain in turn impacts intermediary determinants of health equity, which include (1) social and community context (e.g., food environment), (2) social risk

Abbreviations: CI, confidence interval; CVD, cardiovascular disease; CVH, cardiovascular health; IPR, income to poverty ratio; NHANES, National Health and Nutrition Examination Survey; SDoH, social determinants of health.

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(e.g., food insecurity and financial strain), and (3) lived personal experience (e.g., racism and sexism) (Powell-Wiley et al., 2022).

Mounting evidence demonstrates the inverse relationship between favorable SDoH and cardiovascular burden (Jilani et al., 2021; Powell-Wiley et al., 2022). In particular, socioeconomic status indicators including income, education, and employment status have been shown to inversely associate with cardiovascular outcomes (Davis et al., 2014; Javed et al., 2022; Shah et al., 2022). For instance, higher income provides access to health-promoting material resources and services, such as quality housing and health care, as well as enhanced means to adopt health-promoting behaviors (Kawachi et al., 2010; Schultz et al., 2018). Educational attainment is related to the acquirement of health knowledge, adoption of health-promoting behaviors (e.g, consumption of healthy diet, being physically active), and greater opportunities for employment that reduce social risks like financial strain. In addition, food insecurity is an important social risk that drives CVD through multiple pathways including poor nutritional quality of affordable foods, worse mental health, and inability to seek medical care due to cost constraints (Palakshappa et al., 2021). Marital status may also impact health through multiple mechanisms including provision of social support, economic stability and well-being, healthcare access, and adoption of health-promoting behaviors (Dupre & Nelson, 2016; Eng et al., 2005; Hosseinpoor et al., 2012).

Neither social nor economic risks are equitable across Black and White adults. On average, Black adults are less likely to have a college degree, more likely to be unemployed, and earn fewer cents on the dollar compared to White adults (Pager & Shepherd, 2008; Williams et al., 2016). Even with the same education, Black adults still earn less income or obtain the same opportunities for economic and career advancement compared to White adults (Williams et al., 2016). Black households are also twice as likely to be food insecure compared to White households (Coleman-Jensen et al., 2021).

Another key dimension of the relationship between SDoH, race, and CVD risk is gender. Few studies of racial disparities in cardiovascular outcomes have utilized an intersectional approach to understand why Black women experience worse cardiovascular outcomes, including the presence of traditional CVD risk factors (e.g., obesity, hypertension) at younger ages (Hines et al., 2022; Vatsa et al., 2021). The social and economic circumstances of Black women are shaped by a combination of racism and sexism, which together are argued to have produced unique systems of oppression (Essed, 1991; King, 2005; Thomas et al., 2008). Consequently, Black women are less likely to earn a college degree, more likely to be unemployed, less likely to be married, and earn substantially less than their White counterparts (Chinn et al., 2021). Despite being more socioeconomically disadvantaged, Black women are twice as likely to be the head of household (Chinn et al., 2021). Achieving health equity requires understanding the magnitude of disparities in these social and economic factors and quantifying how these factors relate to outcomes for Black women.

Building on the existing literature, we sought to address two primary questions. First, what magnitude of the racial disparity in CVH, by gender, is accounted for by social and economic factors? Second, which specific social and economic factors account for the largest fraction of the disparity? Using regression decomposition analysis, we focused on five social and economic factors widely investigated in the CVD literature: income levels, educational attainment, employment status, marital status, and food security.

2. Methods

2.1. Study population

The National Health and Nutrition Examination Survey (NHANES) is a nationally representative serial cross-sectional survey that collects annual population-level data through both a home interview and physical examination. Participants are selected from the non-institutionalized, civilian US population using a stratified, multistage probability sampling design (Centers for Disease Control and Prevention, 2017). Self-reported race and ethnicity information was collected including Hispanic origin and included the following categories: Mexican American, Other Hispanic, Non-Hispanic White, Non-Hispanic Black, and Other Including Multi-Racial. As we were focused on Black-White disparities, we restricted our sample to include only non-pregnant and non-lactating participants aged ≥20 years without self-reported history of a CVD event assessed in the 2011–2018 survey waves who self-identified as Non-Hispanic White or Non-Hispanic Black (N = 11,014).We excluded from analysis: individuals missing on any of the eight CVH factors (N = 2,376) or social and economic factors (N = 619) resulting in a final analytic sample of 8,019 participants (Fig. 1).

2.1.1. Cardiovascular health

To measure CVH, we used the Life's Essential 8 (LE8) index developed by the American Heart Association and has been widely adopted in the health science literature (Lloyd-Jones et al., 2022). LE8 includes 8 modifiable risk factors associated with optimal health among individuals free of CVD: diet, physical activity, sleep, nicotine exposure, body mass index (BMI), glucose, lipids, and blood pressure. Detailed information on the LE8 scoring algorithm for each metric was outlined in the AHA Presidential Advisory (Lloyd-Jones et al., 2022). We briefly summarized metric specific and overall CVH scoring in Table 1.

Following AHA scoring, each metric was scored from 0 to 100, with higher scores suggesting more desirable health states for that specific metric. A composite CVH score was calculated for each participant which was the unweighted average of the eight metrics, ranging from 0 to 100 with a higher composite CVH score indicating more favorable CVH. We additionally categorized CVH, based on recommendations from AHA, as: low (0–49), moderate (50–79), and high (≥80) CVH. In addition to composite CVH, we also examined the contributions of social and economic factors to both the unweighted average of the health behaviors and health factors scores. The Health Behaviors score (0–100) was the unweighted average of diet, smoking, physical activity, and sleep factors. The Health Factors (0–100) score was the unweighted average of the BMI, blood pressure, blood glucose, and non-HDL cholesterol factors.

Nicotine exposure, physical activity, and sleep health were measured using questionnaires. Diet was measured using the Healthy Eating Index (HEI)-2015 based on 2015–2020 US dietary guidelines (Krebs-Smith et al., 2018). Health factors were measured during physical examination.

2.1.2. Social and economic factors

Educational attainment was defined as the highest level of education completed and was categorized as: less than high school, high school or GED, some college or associate degree, bachelor's degree or higher. Income was measured using the income to poverty ratio (IPR) which was calculated comparing household income to the federal poverty level based on the number of individuals living in a household (National Center for Health Statistics, 2015). IPR was measured continuously. Participants were asked about their employment status in the week prior to the interview which included the following responses: "working at a job or business", "with a job or business but not at work", "looking for work", "not working at a job or business". We dichotomized employment status as employed ("working at a job or business"; "with a job or business but not at work") and unemployed ("looking for work"; "not working at a job or business"). Participants who were either students or retired were classified as employed (Bundy et al., 2023). Food security, a measure of nutritional quality and economic stability, was assessed through 10 of 18 items in the US Food Security Survey Module. Participants were asked a series of questions including whether they were hungry but did not eat because they did not have enough money in the past 12 months. Affirmative responses were summed across the 10 items to determine level of food security: full food security (no affirmative

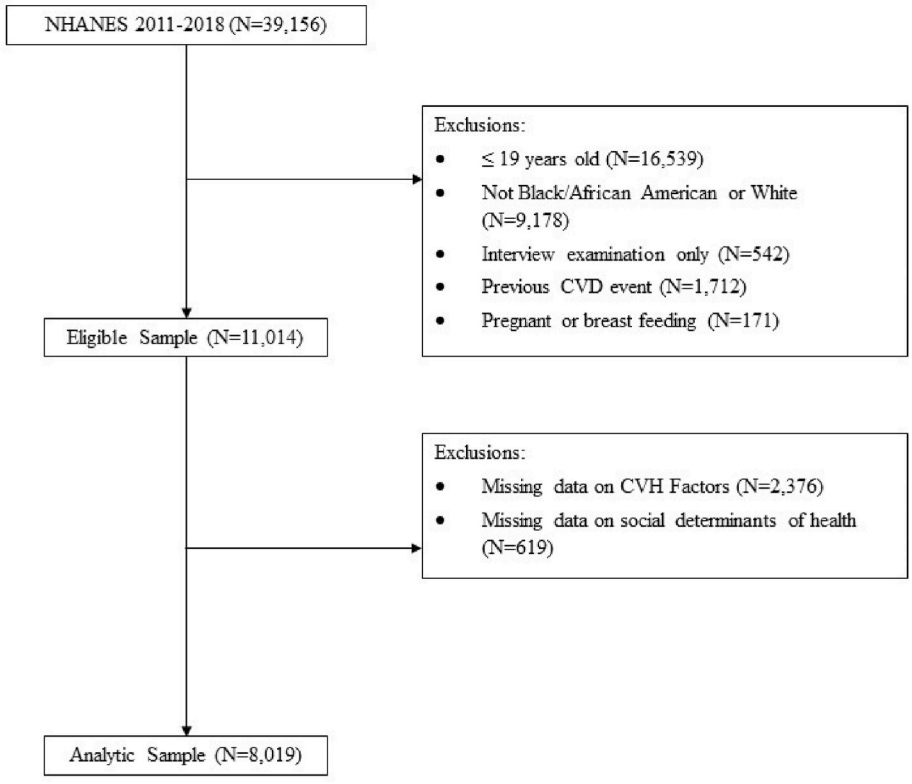

Fig. 1. Participant flowchart, nhanes 2011–2018. Nhanes: National health nutrition and examination survey.
Legend: Participant Flowchart. Individuals were included in analysis if they aged ≥20 years without self-reported history of a CVD event in the 2011–2018 NHANES survey waves. Individuals were excluded due to missing data on any of the eight CVH factors or social and economic factors. CVD indicates cardiovascular disease; CVH, cardiovascular health; NHANES, National Health Nutrition and Examination Survey.

responses), marginal food security (1–2 affirmative responses), low food security (3–5 affirmative responses), very low (6 or more affirmative responses). Participants were defined as "food secure" if they had fewer than 2 affirmative responses and "food insecure" if they had 3 or more affirmative responses. Marital status, a measure of social connectedness, was defined categorically as: married/living with partner, divorced/-separated/widowed, or never married.

2.2. Statistical analysis

We examined racial disparities stratified by gender throughout this analysis. Gender-stratified analyses of racial disparities in social and economic factors and CVH outcomes were assessed using survey-adjusted chi-square and t-tests. To identify the contribution of these factors to gendered racial CVH disparities, we utilized the Kitagawa-Blinder-Oaxaca (KBO) decomposition method (Blinder, 1973; Kitagawa, 1955; Oaxaca, 1973). KBO decomposition is a regression-based method that has been used in health science to decompose, or quantify, the contribution of multiple independent variables in the disparity of an outcome across two groups (Huckfeldt et al., 2020; Jackson & VanderWeele, 2018; Kino & Kawachi, 2020; Lee et al., 2021; Sen, 2014; Singleton et al., 2016). Decomposition is illustrated by the following equation:

$$CVH^{B}_{mean} - CVH^{W}_{mean} = \left[\sum_{j=1}^{J}\left(X^{B}_{mean} - X^{W}_{mean}\right)\beta^{B}_{j}\right] + \left[\left(\beta^{B}_{0} - \beta^{W}_{0}\right) + \sum_{j=1}^{J}\left(\beta^{B}_{j} - \beta^{W}_{j}\right)X^{W}_{j\,mean}\right] \quad (1)$$

where X represents a set of *J* measured social and economic factors for each race group, B and W indicate Black and White race respectively, β is the vector of coefficients relating X_j and CVH outcomes. The regression is run separately for Black and White individuals. The equation estimates (1) the "explained difference" as the aggregate difference in CVH accounted for by differences in measured social and economic factors and the "unexplained difference" due to factors associated with the outcome that were not in the model. Our KBO models first adjusted for age to account for the wide age range of our sample. We repeated decomposition analyses for the CVH Health Behaviors and Health Factors sub-scores. For additional detail describing decomposition methods, see Supplementary Material A.

To evaluate the potential for selection bias, we compared and reported demographic characteristics of participants included in analysis and those excluded due to missing data. All analyses were performed in Stata 17.1 (StataCorp, 2021) which allowed for the incorporation of survey weights specific to NHANES in the decomposition analyses.

3. Results

3.1. Social and economic factors by race and gender

Weighted descriptive characteristics of social and economic factors among NHANES participants are presented in Table 2. The mean (SE) age was 47.7 (0.4) years. Black adults, regardless of gender, were younger, less likely to be college-educated, food secure, married/living with a partner, and had less income compared to White adults. While there were no differences in employment status among women, Black men were significantly less likely to be employed compared to White men (76.6% vs. 88.3%, $p < .0001$).

3.1.1. CVH characteristics by race and gender

In examining CVH score categorically, Black adults were also less likely to have high or better CVH compared to White adults (Table 3). Across race and gender groups, Black women had the lowest CVH score (mean [SE], 65.1 [0.4]) while White women had the highest CVH score (70.6 [0.5]). Among women, White women were more likely to have higher (optimal) mean scores for individual CVH components except for nicotine exposure and blood lipids. There was no difference in mean nicotine exposure (75.1 [1.2] v. 72.6 [1.0], $p = .14$); Black women had a

Table 1
Scoring of individual and overall cardiovascular health factors: Life's essential 8.

CVH Domain	CVH Factor	Scoring
Health Behaviors	Nicotine Exposure[a]	100 = never smoker 75 = former smoker, quit ≥5 years ago 50 = former smoker quit 1-<5 years ago 25 = former smoker, quit <1 years ago, currently using e-cigs 0 = current smoker
	Diet[b]	100 = ≥95th percentile 80 = 75th-94th percentile 50 = 50th-74th percentile 25 = 25th-49th percentile 0 = 1st-24th percentile
	Physical Activity	100 = ≥150 min per week (moderate to vigorous) 90 = 120–149 min per week 80 = 90–119 min per week 60 = 60–89 min per week 40 = 30–59 min per week 20 = 1–29 min per week 0 = no physical activity
	Sleep Health	100 = average of 7-<9 h per night 90 = average of 9-<10 h per night 70 = average of 6-<7 h per night 40 = average of 5-<6 or ≥10 h per night 20 = average of 4-<5 h per night 0 = average of <4 h per night
Health Factors	BMI	100 = <25 kg/m^2 70 = 25.0–29.9 kg/m^2 30 = 30.0–34.9 kg/m^2 15 = 35.0–39.9 kg/m^2 0 = ≥40 kg/m^2
	Blood Lipids[c]	100 = <130 mg/dL 60 = 130–159 mg/dL 40 = 160–189 mg/dL 20 = 190–219 mg/dL 0 = ≥220 mg/dL
	Blood Glucose[d]	100 = no history of diabetes with HbA1c < 5.7 60 = no history of diabetes with HbA1c 5-7-<6.4 40 = diabetes (or no diabetes) with HbA1c < 7.0 30 = HbA1c 7.0–7.9 with or without history of diabetes 20 = HbA1c 8.0–8.9 10 = diabetes (or no diabetes) with HbA1c 9.0–9.9 0 = diabetes (or no diabetes) with HbA1c ≥ 10.0
	Blood Pressure[e]	100 = SBP<120 mmHg/DBP<80 mmHg 75 = SBP 120–129 mmHg/DBP<80 mmHg 50 = SBP 130–139 mmHg/DBP 80–89 mmHg 25 = SBP 140–159 mmHg/DBP 90–99 mmHg 0 = SBP ≥160 mmHg/DBP≥100 mmHg
Total CVH		≥80–100 = High CVH 50-<80 = Moderate CVH <50 = Low CVH

Adapted from Lloyd-Jones et al., 2022. Abbreviations: BMI = Body Mass Index; CVH = cardiovascular health; DBP = diastolic blood pressure; SBP = systolic blood pressure.

[a] If a participant reported living with an active smoker, 20 points were subtracted from their original smoking score. Beginning in the 2013–2014 NHANES cycle, participants were asked if they currently used e-cigarettes; e-cigarette use is not captured among 2011–2012 survey participants.

[b] Diet was measured using the 2015 Healthy Eating-Index score based on 2015–2020 US dietary guidelines. The score was based on 13 components including 9 components of diet adequacy: total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids and 4 components of diet moderation: refined grains, sodium, added sugars, and saturated fats. Percentiles were based on data from NHANES participants.

[c] Non-HDL cholesterol was calculated subtracting HDL cholesterol from total cholesterol. We subtracted 20 points for participants taking medication.

[d] Participants (n = 17) who were diagnosed with prediabetes, had normoglycemic levels, and were taking metformin to prevent diabetes onset had 20 points subtracted from their score.

[e] If a participant reported taking antihypertensive medications, 20 points were subtracted from their original blood pressure score.

higher blood lipids score (73.1 [1.0] v. 66.2 [0.8], $p < .001$). Among men, White men had a higher overall CVH score (69.1 [0.4] v. 65.2 [0.4], $p < .001$) and had higher mean scores across individual factors except for physical activity, BMI, and blood lipids. There was no difference in either physical activity (80.0 [1.1] v. 82.5 [0.8], $p = .06$) or BMI score (62.7 [1.1] v. 62.4 [0.8], $p = .85$). Similar to Black women, Black men also had higher blood lipids scores compared to White men (70.8 [0.9] v. 63.4 [0.8], $p < .001$).

3.2. Decomposition of CVH among women

3.2.1. Overall CVH

In age-adjusted decomposition analyses (Table 4), Black women had a 3.01 lower CVH score compared to White women (observed mean difference [MD] = −3.01; 95% CI: 5.18, −0.84). Of the total −3.01 difference, −3.26 units were accounted for by differences in social and economic factors (95% CI: 4.12, −2.40); in other words, if these factors were "equal" across race, Black women would see an increase of 3.26 units in their overall CVH score. The remaining +0.25 units were not accounted for by model covariates (95% CI: 1.97, 2.48). Of the −3.26-

Table 2
Distribution of Demographic Characteristics in US Adults aged ≥20 years, by gender and race, NHANES 2011–2018.

	Mean (SE) or % (95% CI)					
	Women (N = 4,095)			Men (N = 3,924)		
	NH Black (N = 1,477)	NH White (N = 2,618)	*P*	NH Black (N = 1,359)	NH White (N = 2,565)	*P*
Age, years	43.9 (0.5)	49.6 (0.5)	<.0001	42.8 (0.6)	47.0 (0.5)	<.0001
Social and Economic Factors						
Education Status			<.0001			<.0001
Less Than High School	12.8 (11.0, 14.8)	7.0 (5.7, 8.7)		17.1 (14.8, 19.7)	8.2 (6.5, 10.4)	
High School Graduate/GED	24.0 (21.9, 26.2)	19.7 (17.8, 21.8)		30.3 (27.6, 33.1)	23.3 (20.6, 26.3)	
Some College	40.8 (38.1, 43.6)	35.9 (33.4, 38.6)		34.4 (32.1, 36.9)	31.1 (28.8, 33.5)	
College Graduate or Above	22.5 (19.5, 25.9)	37.3 (33.8, 40.9)		18.2 (15.5, 21.2)	37.3 (33.4, 41.4)	
Income to Poverty Ratio	2.2 (1.0)	3.3 (1.0)	<.0001	2.5 (0.1)	3.4 (0.1)	<.0001
Food Secure	76.0 (73.1, 78.8)	88.0 (86.4, 89.4)	<.0001	75.7 (72.4, 78.7)	88.9 (87.0, 90.6)	<.0001
Currently Employed	79.1 (76.5, 81.5)	81.0 (78.9, 82.9)	0.267	80.1 (76.7, 83.0)	89.5 (87.5, 91.3)	<.0001
Marital Status			<.0001			<.0001
Married/Living with Partner	36.3 (33.6, 39.0)	64.4 (62.3, 66.4)		52.0 (47.9, 56.1)	69.0 (66.4, 71.5)	
Divorced/Separated/Widowed	25.4 (22.5, 28.4)	22.7 (21.3, 24.2)		14.1 (12.3, 16.1)	11.0 (9.4, 12.9)	
Never Married	38.4 (35.6, 41.2)	12.9 (11.2, 15.0)		33.9 (30.0, 38.0)	20.0 (17.8, 22.5)	

Abbreviations: CI = confidence interval, NH = non-Hispanic, NHANES = National Health and Nutrition Examination Survey.

unit difference associated with social and economic factors, −1.20 (95% CI: 1.60, −0.79), −1.48 (95% CI: 2.04, −0.92), and −0.53 (95% CI: 0.74, −0.32) were associated with inequitable levels of education, income, and food security, respectively. Neither marital status nor employment contributed to a statistically significant portion of the modeled difference between optimal CVH scores in Black and White women.

3.2.2. CVH health behaviors

With respect to health behaviors, there was no significant disparity comparing Black and White women (observed MD = −3.27; 95% CI: 7.04, 0.51). However, of the total difference, disparities in social and economic factors accounted for −4.58 units (modeled MD = −4.58; 95% CI: 5.69, −3.47) while +1.31 units were not accounted for by model covariates (95% CI: 2.39, 5.02). Of the −4.58-unit difference associated with social and economic factors, −1.85 (95% CI: 2.46, −1.24), −2.00 (95% CI: 2.71, −1.29), and −0.61 (95% CI: 0.88, −0.33) were associated with inequitable levels of education, income, and food security, respectively.

3.2.3. CVH health factors

There was no significant Black-White difference in CVH Health Factors score for women (observed MD = −2.75; 95% CI: 6.11, 0.62). Though social and economic factors accounted for a −1.94-unit difference in CVH health factors score between Black and White women (modeled MD = −1.94; 95% CI: 2.79, −1.08), −0.81-unit difference remained unaccounted for by model covariates (unexplained MD = −0.81; 95% CI: 4.33, 2.72).

3.3. Decomposition of CVH among men

3.3.1. Overall CVH

In men, differences in the distribution of social and economic factors and unobserved characteristics related to CVH balanced one another out such that there was no racial disparity in CVH score among men (observed MD = −0.28; 95% CI: 3.78, 3.22).Whereas social and economic factors accounted for −2.27-unit difference in the CVH score between Black and White men (modeled MD = −2.27; 95% CI: 2.97, −1.56), a +1.99-unit difference in the CVH score was unaccounted for by model covariates (unexplained MD = 1.99; 95% CI: 1.40, 5.38). Of the −2.27-unit difference accounted for by social and economic factors, −1.55 (95% CI: 2.03, −1.06), −0.40 (95% CI: 0.64, −0.17), and −0.39 (95% CI: 0.63, −0.16) were associated with inequitable levels of education, food security, and employment status, respectively.

Table 3
Distribution of CVH Metrics in US Adults aged ≥20 years, by gender and race, NHANES 2011–2018.

	Mean (SE) or % (95% CI)					
	Women (N = 4,095)			Men (N = 3,924)		
	NH Black (N = 1,477)	NH White (N = 2,618)	*P*	NH Black (N = 1,359)	NH White (N = 2,565)	*P*
Overall CVH Score (range: 0–100)	65.1 (0.4)	70.6 (0.5)	<.0001	65.2 (0.4)	69.1 (0.4)	<.0001
Categorization of CVH			<.0001			<.0001
Low (0–49)	15.3 (13.6, 17.1)	9.5 (8.3, 10.9)		13.9 (12.1, 15.9)	9.1 (7.9, 10.5)	
Moderate (50–79)	68.6 (66.0, 71.1)	60.0 (57.2, 62.8)		70.5 (67.3, 73.6)	67.5 (64.9, 70.0)	
High (≥80)	16.1 (14.0, 18.4)	30.4 (27.4, 33.6)		15.6 (13.1, 18.3)	23.4 (21.0, 26.0)	
Cardiovascular HealthBehavior Scores (range: 0–100)						
Behavior Scores (range: 0–100)						
Nicotine exposure	75.1 (1.2)	72.6 (1.0)	0.141	61.8 (1.5)	68.0 (1.0)	0.0004
Diet	39.9 (1.2)	46.4 (1.0)	<.0001	35.0 (1.1)	38.2 (1.0)	0.014
Physical activity	67.3 (1.7)	72.7 (1.0)	0.009	80.0 (1.1)	82.5 (0.8)	0.063
Sleep health	76.1 ()	86.6 (0.5)	<.0001	75.1 (0.8)	85.2 (0.6)	<.0001
Cardiovascular Health Factor Scores (range: 0–100)						
BMI	47.2 (0.8)	63.1 (1.0)	<.0001	62.7 (1.1)	62.4 (0.8)	0.853
Blood lipids	73.1 (1.0)	66.2 (0.8)	<.0001	70.8 (0.9)	63.4 (0.8)	<.0001
Blood pressure	65.6 (1.0)	71.9 (0.7)	<.0001	60.6 (1.0)	67.8 (0.9)	<.0001
Blood glucose	76.7 (0.7)	85.0 (0.5)	<.0001	75.7 (0.7)	85.3 (0.6)	<.0001

Abbreviations: BMI = body mass index, CI = confidence interval, CVH = cardiovascular health, NH = non-Hispanic, NHANES = National Health and Nutrition Examination Survey.

Table 4
The contribution of social and economic factors to racial disparities in overall cardiovascular health score, behavioral and health factors by gender, NHANES 2011–2018.

	Overall CVH Score	
	Women	Men
	Absolute Disparity (95% CI)	Absolute Disparity (95% CI)
Total Difference[a]	**−3.01 (-5.18, -0.84)**	−0.28 (−3.78, 3.22)
Explained Difference[b]	**−3.26 (-4.11, -2.40)**	**−2.27 (-2.97, -1.56)**
Educational Attainment	**−1.20 (-1.60, -0.79)**	**−1.55 (-2.03, -1.06)**
Income	**−1.48 (-2.04, -0.92)**	−0.13 (−0.48, 0.22)
Food Security	**−0.53 (-0.74, -0.32)**	**−0.40 (-0.64, -0.17)**
Employment Status	−0.04 (−0.10, 0.03)	**−0.39 (-0.63, -0.16)**
Marital Status	−0.01 (−0.43, 0.40)	0.20 (−0.03, 0.44)
Unexplained Difference[c]	0.25 (−1.97, 2.48)	1.99 (−1.40, 5.38)
	CVH Health Behaviors	
	Women	Men
	Absolute Disparity (95% CI)	Absolute Disparity (95% CI)
Total Difference	−3.27 (−7.04, 0.51)	−0.88 (−6.05, 4.28)
Explained Difference	**−4.58 (-5.69, -3.47)**	**−4.62 (-5.71, -3.53)**
Educational Attainment	**−1.85 (-2.46, -1.24)**	**−2.34 (-3.06, -1.62)**
Income	**−2.00 (-2.71, -1.29)**	**−1.02 (-1.51, -0.53)**
Food Security	**−0.61 (-0.88, -0.33)**	**−0.60 (-0.89, -0.31)**
Employment Status	−0.06 (−0.16, 0.05)	**−0.55 (-0.85, -0.26)**
Marital Status	−0.07 (−0.57, 0.44)	−0.11 (−0.40, 0.18)
Unexplained Difference	1.31 (−2.39, 5.02)	3.73 (−1.18, 8.66)
	CVH Health Factors	
	Women	Men
	Absolute Disparity (95% CI)	Absolute Disparity (95% CI)
Total Difference	−2.74 (−6.11, 0.62)	0.33 (−3.83, 4.49)
Explained Difference	**−1.94 (-2.79, -1.08)**	0.09 (−0.57, 0.75)
Educational Attainment	**−0.54 (-0.83, -0.25)**	**−0.76 (-1.11, -0.40)**
Income	**−0.96 (-1.65, -0.28)**	**0.77 (0.21, 1.32)**
Food Security	**−0.46 (-0.71, -0.20)**	−0.21 (−0.52, 0.11)
Employment Status	−0.01 (−0.06, 0.03)	−0.23 (−0.50, 0.04)
Marital Status	0.04 (−0.50, 0.58)	**0.52 (0.22, 0.82)**
Unexplained Difference	−0.81 (−4.33, 2.72)	0.24 (−3.88, 4.36)

Note. CVH health behaviors include diet, physical activity, sleep health, and nicotine exposure. CVH health factors include body mass index, blood glucose, blood lipids, and blood pressure. White women and men are the referent groups, respectively.

[a] Total difference in CVH scores by gender is comparing Black and White adults.

[b] Explained difference are derived as coefficients obtained from a decomposition model that equalized education, income, food security, employment status, and marital status levels across race adjusted for age.

[c] Unexplained difference are derived as coefficients obtained from the decomposition model that are attributed to characteristics not in the model (i.e., unobserved characteristics).

3.3.2. CVH health behaviors

There was also no Black-White difference in CVH health behavior score for men (observed MD = −0.88; 95% CI: 6.05, 4.28). Though social and economic factors accounted for a −4.62-unit difference in CVH health behaviors score (modeled MD = −4.62; 95% CI: 5.71, −3.53), +3.73 units remained unaccounted for by model covariates (unexplained MD = 3.73; 95% CI: 1.18, 8.66). Of the −4.62-unit difference accounted for by social and economic factors, −2.34 (95% CI: 3.06, −1.62), −1.02 (95% CI: 1.51, −0.53), −0.60 (95% CI: 0.89, −0.31), and −0.55 (95% CI: 0.85, −0.26) were associated with inequitable levels of education, income, food security, and employment status, respectively.

3.3.3. CVH health factors

Similar to women, there was no significant racial disparity in the health factors score for men (observed MD = 0.33; 95% CI: 3.83, 4.49). For men, social and economic factors accounted for a +0.09-unit difference in the CVH health factors score (modeled MD = 0.09; 95% CI: 0.57, 0.75) and +0.24 units remained unexplained by covariates (unexplained MD = 0.24; 95% CI: 3.88, 4.36). Of the 0.09-unit difference accounted for by social and economic factors, −0.76 (95% CI: 1.11, −0.40), 0.77 (95% CI: 0.21, 1.32), 0.52 (95% CI: 0.22, 0.82) were associated with inequitable levels of education, income, and marital status, respectively.

4. Discussion

Using nationally representative data, we investigated racial disparities in CVH by gender among individuals without history of CVD. We observed a racial difference in CVH among women with racial disparities in several socioeconomic factors—education, income, and food security accounting for the entire explained difference in CVH. While there were differences in these factors between Black and White men, we did not detect Black-White disparities in CVH score.

Several studies have consistently documented that Black adults, particularly Black women, are less likely to achieve ideal CVH (Bundy et al., 2021; Lee et al., 2021; Pool et al., 2017). Our finding that Black *women* were the least likely to have ideal CVH across all race-gender groups is in line with the intersectionality framework, which posits that individuals with multiple marginalized societal positions face more obstacles in achieving optimal health through denial of opportunities (Bowleg, 2012).

Black-White disparities in overall CVH among women were explained predominately by education, income, and food security. Our findings are consistent with previous decomposition analyses examining the previous metric of CVH, Life's Simple 7 (Lee et al., 2021; Shah et al., 2023), and individual risk factors of CVD such as obesity (Sen, 2014). However, our findings must be contextualized within the larger sociopolitical and cultural climate in which Black women live. While

improving socioeconomic status (SES) has been proposed as a means to reduce Black-White disparities among women, health disparities persist for Black women of higher SES suggesting "diminishing returns"— Black women do not realize the same health benefits of improved SES compared to White women (Braveman et al., 2005, 2010; Ciciurkaite, 2021; Farmer & Ferraro, 2005). For Black women, there is often a "cost" associated with upward mobility including stress and heightened vigilance as they navigate predominately White spaces (Hudson et al., 2020). Health equity for Black women cannot be realized without addressing the systems and institutions that give rise to health disparities and discrimination in the first place.

Despite Black men having lower education attainment, income, and food security levels than White men, we did not find a Black-White difference in overall CVH as well as health behaviors and health factors of CVH scores among men. Findings are mixed as some studies found no racial difference in CVH scores among men (Pool et al., 2017) while other studies found that Black men had worse CVH scores (Lee et al., 2021) and greater prevalence of traditional risk factors (e.g., diabetes) compared to White men (Kanchi et al., 2018; Shah et al., 2023). The observed null disparities across CVH scores, despite the observed social disadvantages experienced by Black men, may indicate that important risk and protective factors for outcomes have not been sufficiently captured by standard CVH metrics. Future research is needed to better understand nuances in CVH and CVD outcomes in Black adults.

4.1. Strengths and limitations

A strength of this study was the use of an updated measure of CVH, including quality of sleep health which is an important marker of cardiovascular health and a risk factor for CVD (Caraballo et al., 2022; Johnson et al., 2019). Additionally, the use of a large nationally representative sample increases generalizability to Black and White adults free of cardiovascular disease in the US. We also had data on biomarkers for objective assessment of clinically important risks. However, there are several limitations that must be acknowledged. Because NHANES is a cross-sectional survey, we are unable to assess temporality in associations of social determinants of health with CVH. Second, the CVH score itself may be an imperfect measure of cardiovascular health due to issues of reporting and measurement. Third, there may be selection bias due to differential participation in NHANES by race as well as social and economic factors. Fourth, we did not have information on early life socioeconomic factors (e.g., childhood food security, participation in federal nutrition assistance programs) which may be related to present CVH and current social and economic position. Lastly, there are limitations with the KBO decomposition method. In conducting this analysis, we assume that there is no unmeasured confounding either of the outcome or the measured characteristics. While we have less concerns regarding confounding of the included SDoH, there may be confounding of the outcome. Differences in CVH may be partly explained by racial discrimination as studies have found that racial discrimination is associated with CVD risk factors, including BMI and hypertension (Cozier et al., 2014; Dolezsar et al., 2014). We were unable to examine racial discrimination as this information is not collected in NHANES.

5. Conclusions

Our study is one of the first to quantify the role of SDoH in racial disparities in CVH by gender. Our results suggest that SDoH contributed similarly to CVH disparities in both groups, but observed differences only exist in women. Our work highlights the potential role of equitable access to and quality of SDoH to promote cardiovascular health of Black adults.

Drawing on our findings, we posit that addressing equitable access to social and economic factors is necessary to eliminate CVH health disparities. Nevertheless, this may not be sufficient given the legacy of racism in the US which gives rise to health disparities in the first place. This work has contributed to a robust body of literature that establishes a link between inequitable distribution to SDoH and disparities in CVH. The data further strengthens the justification for future studies to directly investigate the systems and policies that have allowed SDoH inequities to proliferate. Additional research examining sociopolitical and economic contextual drivers of social and economic disparities between Black and white adults is needed.

Data statement

Data are made publicly available through the U.S. National Centre for Health Statistics as part of the Centers for Disease Control and Prevention at: https://wwwn.cdc.gov/nchs/nhanes/Default.aspx.

Author statement

N.D. Fields and S.A. Patel designed the study and directed the study's implementation. N.D. Fields and D. Choi acquired and prepared the dataset. N.D. Fields conducted the statistical analysis; all authors contributed to the interpretation of results. N.D. Fields drafted the initial manuscript; all authors provided critical revision of the manuscript and approved the final version.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2023.101485.

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