ORIGINAL RESEARCH

Individual Characteristics of Resilience are Associated With Lower-Than-Expected Neighborhood Rates of Cardiovascular Disease in Blacks: Results From the Morehouse-Emory Cardiovascular (MECA) Center for Health Equity Study

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***Background*—**Factors promoting cardiovascular health in the face of high risk, ie, resilience, are unknown and may identify novel areas of intervention for reducing racial health disparities. We examined neighborhood perceptions and psychological attributes of blacks living in high and low cardiovascular–risk neighborhoods, as potential characteristics of resilience promoting cardiovascular health.

***Methods and Results*—**We identified 1433 blacks residing in census tracts of Atlanta, GA, with higher-than-expected ("high" risk) or lower-than-expected ("low" risk) rates of cardiovascular mortality, hospitalizations, and emergency department visits during 2010–2014. Domains of psychosocial well-being and neighborhood quality were assessed via telephone survey between August 2016 and October 2016. Using multilevel logistic regression, odds of reporting better resilient characteristics were compared between individuals living in low- versus high-risk neighborhoods. Those from low-risk (versus high-risk) neighborhoods reported better neighborhood aesthetic quality (odds ratio [OR], 1.84), healthy food access (OR, 1.69), and absence of violence (OR, 0.67). Individuals from low-risk neighborhoods reported greater optimism (OR, 1.38), purpose in life (OR, 1.42), and fewer depressive symptoms (OR, 0.69). After full adjustment, these associations remained significant for neighborhood factors (aesthetic quality, healthy food access, violence) and psychosocial well-being (purpose in life). We found no evidence of differences in self-reported cardiovascular risk factors or disease history between low- versus high-risk neighborhoods.

***Conclusions*—**Positive neighborhood environments and psychological characteristics are associated with low cardiovascular–risk neighborhoods, despite similar prevalence of cardiovascular risk factors, in the census tracts studied. These factors may confer cardiovascular resilience among blacks. **(*J Am Heart Assoc*. 2019;8:e011633. DOI: 10.1161/JAHA.118.011633.)**

Key Words: cardiovascular disease • community • health disparities • neighborhood • psychology and behavior • psychosocial factors • social determinants of health

Blacks have worse cardiovascular health (CVH) and higher rates of cardiovascular morbidity and mortality compared with other racial/ethnic groups in the United States.[1] Additionally, although the entire US population has experienced reductions in cardiovascular-related mortality, blacks have seen a slower rate of improvement relative to other groups.[2] These trends are concerning but mask significant heterogeneity within blacks that, if better understood,

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Accompanying Tables S1 and S2 and Figure S1 are available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.118.011633

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Clinical Perspective

What Is New?

- We examined how neighborhood- and individual-level factors differed between areas characterized as at-risk (ie, higher-than-expected rates of cardiovascular disease) versus "resilient" (eg, lower-than-expected rates of cardiovascular disease) among blacks living in a large metropolitan area.
- Blacks living in neighborhoods with lower-than-expected cardiovascular rates of cardiovascular disease were more likely to report positive neighborhood environment and psychological characteristics than those living in neighborhoods with higher-than-expected rates of cardiovascular disease, despite no evidence of differences in their cardiovascular risk factor profiles.

What Are the Clinical Implications?

- Desirable neighborhood characteristics and positive psychological well-being may be important determinants of cardiovascular health among blacks.
- Interventions to improve neighborhood characteristics and psychosocial well-being should be further studied as novel strategies to promote cardiovascular resilience among blacks.

may lead to improved outcomes for this group at the population level.[1,3,4] For example, although a number of factors have been identified as potential explanations for excess risk for cardiovascular morbidity and mortality in blacks,[5] what factors promote CVH, or *resilience* to cardiovascular disease (CVD), among blacks, despite their higher risk of CVD have been largely underexplored.

Researchers have argued that social risk and resilience are integral to CVH among blacks. Several large cohort studies have examined the associations between CVH and a range of neighborhood or psychosocial attributes.[6,7] Individual perceptions of neighborhood quality, including social cohesion,[8] safety,[9] and healthy food access,[10] have been associated with cardiovascular-related risk factors and disease; however, the majority of evidence has come from a single multiethnic cohort that was unable to adequately assess associations between neighborhood characteristics and cardiovascular risk within blacks.[6] Similarly, most of the literature supporting associations between psychosocial attributes and cardiovascular risk in blacks has focused on psychosocial distress—depressive symptoms, anxiety, and experiences of discrimination.[11–13] While many investigations have shown that positive psychosocial well-being,[14] measured as optimism,[15] environmental mastery,[16] and purpose in life,[17] are associated with resilience to CVD,[18,19] few have included blacks or have been significantly powered to identify interactions by race.[20]

Given the dearth of evidence regarding mechanisms of resilience within blacks, we sought to identify and describe potential factors of CVD resilience by examining the subjective neighborhood perceptions and psychosocial attributes associated with living in neighborhoods with lower-than-expected compared with higher-than-expected rates of cardiovascular morbidity and mortality in the Atlanta, GA, metropolitan area. We hypothesized that blacks living in neighborhoods at lower risk for adverse cardiovascular outcomes, but similar household incomes and demographic distributions, would report greater neighborhood quality and psychosocial well-being and lower cardiovascular risk factors compared with those living in higher-risk neighborhoods.

Methods

The data that support the findings of this study are available from the corresponding author upon reasonable request. The current study was conducted as part of the MECA (Morehouse-Emory Cardiovascular) Center for Health Equity study. Census tracts (neighborhoods) of Atlanta, GA, with high and low risk of cardiovascular morbidity and mortality for blacks were identified, and individuals residing in the selected census tract groups were subsequently surveyed to obtain individual-level data (Figure).

Selection of Census Tracts

A detailed explanation of the selection of census tracts for the current analysis is presented elsewhere.[21] Briefly, data for 992 census tracts within the 36-county Atlanta—Athens-Clarke—Sandy Springs combined statistical area were utilized for the selection of census tracts. Cardiovascular mortality data for the 5-year interval from 2010 to 2014 were obtained from the Georgia Department of Public Health. For blacks aged 35 to 64 years, we received counts for all cardiovascular-related deaths, defined as *International Classification of Diseases, Tenth Revision* (*ICD-10*) code I00–I78 or *International Classification of Diseases, Ninth Revision* (*ICD-9*) codes 390–434 and 436–448. Tracts with <5 deaths were censored for confidentiality, and mortality rates averaged over 5 years were determined by dividing the number of deaths per tract by the black population aged 35 to 64 years at the tract level, as determined by the 2010 US Census. Cardiovascular morbidity data for the 5-year interval from 2010 to 2014 were obtained from the Georgia Hospital Association. We obtained aggregated counts for cardiovascular-related hospitalizations and emergency department visits for blacks aged 35 to 64 in these census tracts, using the aforementioned

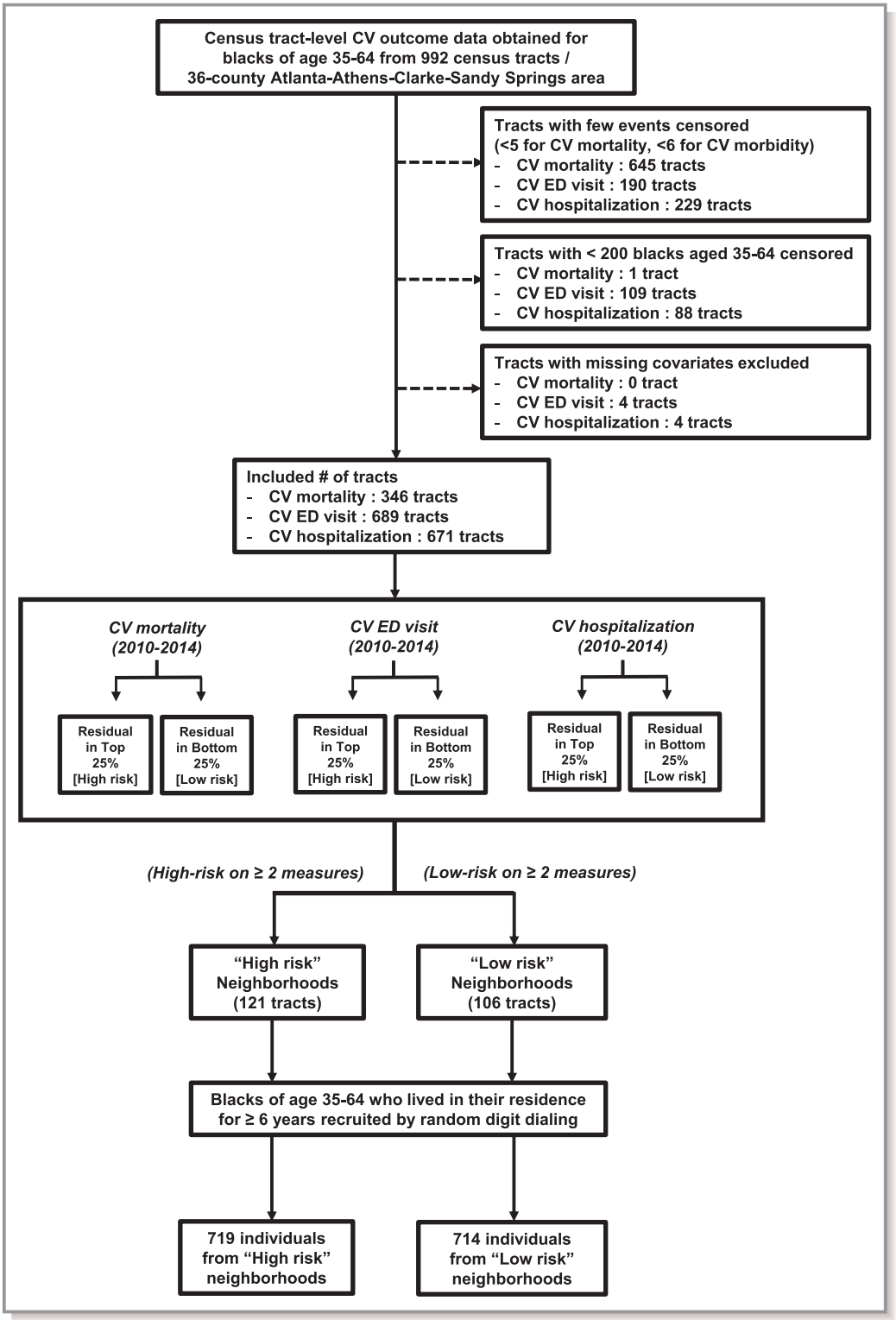

Figure. Flowchart of the study design. CV indicates cardiovascular; ED, emergency department.

ICD-9 and *ICD-10* codes. Tracts with <6 events were censored, and event rates were calculated as previously described for the mortality rates (Figure).

To ensure stable event rates, we estimated negative binomial models for all of the 3 outcome rates (mortality, hospitalizations, emergency department visits) for those census tracts with at least 200 blacks aged 35 to 64 years. This age range was selected to capture those most at risk for CVD and most impacted by racial disparities in cardiovascular outcomes, while excluding elderly individuals in order to

minimize confounding by noncardiac comorbidities.[22] Models were adjusted for census tract–level sociodemographic variables, such as age distribution (by 5-year intervals), percentage of men, and median black household income. Census tracts with residuals that were in the highest 25% were considered to have higher-than-expected risk for adverse cardiovascular mortality, hospitalizations, and/or emergency department visits and were labeled "high risk." Tracts with the lowest 25% of residuals were considered to have lower-than-expected risk for adverse cardiovascular mortality, hospitalizations, and/or emergency department visits and were labeled "low risk." To identify the census tracts most likely to have high or low rates of cardiovascular morbidity and mortality, only those deemed "high risk" or "low risk" in at least 2 of the 3 outcomes were included for analysis. Any tract labeled "high risk" for one outcome and "low risk" for any other outcomes was excluded. This process yielded 106 low-risk tracts and 121 high-risk tracts, which were similar in sociodemographic characteristics (Figure; Table S1).

Study Participants

From August 2016 to October 2016, a total of 1433 adults who self-identified as black or African American (mean age 51.6±10.1 years, 62% women) were recruited via random-digit dialing for participation in a detailed telephone survey from low-risk (n=714) and high-risk (n=719) neighborhoods (Figure). The overall response rate was 53%, which is comparable with those observed in large-scale cohorts such as MESA (Multi-Ethnic Study of Atherosclerosis) (47%)[23] and the California Health Interview Survey (47% for 2016).[24] The median (interquartile range) number of participants from an individual census tract was 5 (1, 12) and 6 (2, 17) for high- and low-risk neighborhoods, respectively. Verbal consent was obtained before conducting the telephone survey, and all items and methods were approved by the institutional review boards of Morehouse School of Medicine and Emory University. Individuals outside of the target age range (35–64 years) were excluded, as were those living at their residence for <6 years to ensure that individuals: (1) were residents during the same time of measured census tract–level events and (2) had adequate time for exposure to the neighborhood environment.

In addition to age, self-reported sex, highest level of education, household income, marital status, and employment/retirement status were collected. A dichotomous individual-level socioeconomic status (SES) variable was created for analysis, such that low individual–level SES was defined as a household income <$50 000 (based on the median of the current sample) or an education level of high school graduate or less for those whose household income was missing.

Self-Reported Neighborhood Characteristics

Perceptions of neighborhood quality were assessed by the Neighborhood Health Questionnaire, a reliable and valid questionnaire widely used in studies of CVH.[23] Participants answered questions across several domains of neighborhood quality, including: aesthetic quality (5 questions, α=0.80), walking environment (7 questions, α=0.79), availability of healthy foods (3 questions, α=0.93), safety (3 questions, α=0.80), violence (4 questions, α=0.85), social cohesion (4 questions, α=0.88), and activities with neighbors (5 questions, α=0.80). For the domains of violence and activities with neighbors, responses ranged from 1 ("never") to 4 ("often"). For all other domains, responses ranged from 1 ("strongly disagree") to 5 ("strongly agree").

Positive Psychosocial Well-Being

Several questionnaires were used to assess various domains of positive psychological well-being. Optimism was assessed with the 6-item Life Orientation Test-Revised,[25,26] which asks participants to rate their level of agreement with both positive (eg, "In uncertain times, I usually expect the best") and negative (eg, "If something can go wrong for me, it will") statements. Responses ranged from 1 ("I disagree a lot") to 5 ("I agree a lot"), and responses to negative statements were reverse-coded so that higher scores corresponded to greater optimism (α=0.63).

Purpose in life, a measure of directedness, and environmental mastery, a measure of ability in maintaining a strong locus of control, were assessed using the full 14-item measures from the Ryff Psychological Well-Being Scales.[27,28] Each scale asks participants to rate their level of agreement from 1 ("strongly disagree") to 6 ("strongly agree"), with both positive and negative statements (purpose in life: α=0.80; environmental mastery; α=0.82). Example statements for purpose in life include "I am an active person in carrying out the plans I set for myself" and "My daily activities often seem trivial and unimportant to me." Example statements for environmental mastery include "I generally do a good job of taking care of my personal finances and affairs" and "I do not fit very well with the people and the community around me." All responses to negative statements were reverse-coded so that higher scores corresponded to greater purpose in life and environmental mastery.

Resilient coping, a measure of persisting in the face of significant adversity, was assessed with the 10-item Connor-Davidson Resilience Scale,[29] which asks participants to rate how often they feel each statement applies to their lives. Example statements include "I can deal with whatever comes my way" and "I believe I can achieve my goals, even if there are obstacles." Responses ranged from 1 ("not true at all") to 5 ("true nearly all the time"), and higher scores correspond to higher coping (α=0.92).

Psychosocial Distress

Self-reported experiences of discrimination were assessed with the Everyday Discrimination Scale,[30] a 9-item scale that sums the frequency of discriminatory events (eg "you are treated with less respect than other people"). Responses ranged from 1 ("never") to 4 ("almost every day"), such that higher scores correspond to a greater burden of discrimination (α=0.88).

Depressive symptom level was measured with the Center for Epidemiologic Studies Depression Scale (CES-D), a 20-item measure used extensively and reproducibly in diverse populations, including blacks.[31] Participants were asked to rate how frequently they experience either positive (eg, "I enjoyed life") or negative (eg, "I felt that everything I did was an effort") emotions and/or behaviors. Responses ranged from 0 ("rarely or none of the time") to 3 ("all of the time"), and all responses to positive items were reverse-coded so that higher scores corresponded to more depressive symptom frequency (α=0.89).

Personal Health and Risk Factor History

Participants self-reported medical history and age at diagnosis (if applicable) for hypertension, diabetes mellitus, heart attack, heart failure, stroke, atrial fibrillation, chronic kidney disease, cancer, lupus, HIV/AIDS, or any surgeries and/or procedures related to CVD, such as coronary bypass surgery and percutaneous coronary intervention.

Modifiable health behaviors of ideal CVH were assessed using Life's Simple 7 metrics as defined by the American Heart Association, including history of smoking, obesity (via self-reported height and weight for calculation of body mass index), diet quality, and physical activity.[32]

Statistical Methods

Data were analyzed from December 2016 to January 2018. A summary score for each domain of neighborhood characteristics and psychosocial well-being/distress was calculated as the mean response value per item of the respective survey. Sociodemographic and clinical risk factors, neighborhood characteristics, and psychosocial factors were reported by high- versus low-risk neighborhood as number (percentage) or mean±SD. For continuous variables, 2-sample *t* tests were used for normally distributed variables and Wilcoxon tests were used for non-normally distributed variables. For categorical variables, chi-square tests were used to compare proportions. Pairwise Spearman correlation coefficients were calculated for neighborhood characteristics and psychosocial measures to assess the degree of correlation among the variables being examined. Median values of the summary scores were used to dichotomize all neighborhood and psychosocial variables as "high" versus "low" for further analyses, except for neighborhood violence, which was dichotomized as "any" versus "none" (Table S2).

Generalized linear mixed models were used to assess the association between each neighborhood or psychosocial characteristic (treated as a binary variable) and residence in a low cardiovascular–risk neighborhood, with census tract-specific random intercepts to account for correlations among people living within the same neighborhood. A series of models were performed to assess the effect of covariate adjustments. Model 1 was for age and sex (men versus women); model 2 adjusted for age, sex, and marital status; model 3 adjusted for age, sex, marital status, and individual SES (low versus high). The same regression models and covariate adjustments were used to investigate the difference in proportions of self-reported cardiometabolic disease (hypertension, diabetes mellitus, high cholesterol, and stroke/CVD) and ideal CVH metrics between low versus high cardiovascular–risk neighborhoods. Statistical significance was defined as $P<0.05$ (2-sided), and SAS version 9.4 (SAS Institute) was used for all analyses.

Results

A total of 1433 individuals (mean age 51.6±10.1 years, 62% women) were enrolled in the study from 149 census tracts ("neighborhoods"; 82 high cardiovascular–risk and 67 low cardiovascular–risk tracts). While there was no difference in age between participants from low versus high cardiovascular–risk neighborhoods, those from low-risk neighborhoods were more likely to be women, married, college graduates, employed, and make at least $50 000 per year (Table 1). Individuals from low cardiovascular–risk neighborhoods were more likely to be lifetime nonsmokers compared with individuals from high cardiovascular–risk neighborhoods; however, there were no other differences in self-reported health conditions or behaviors (Table 1). Compared with those from high cardiovascular–risk neighborhoods, individuals from low cardiovascular–risk neighborhoods reported better perceptions of neighborhood attributes, as demonstrated by higher scores of aesthetic quality, safety, healthy food access, and social cohesion, as well as lower scores of violence (Table 1). They also reported greater psychosocial well-being, as demonstrated by higher scores of environmental mastery, purpose in life, and optimism, and lower scores of depressive symptoms (Table 1). There was no evidence of differences in CVH factors, behaviors, or outcomes between low verse high cardiovascular–risk neighborhoods (excluding smoking). There were significant bivariate associations between self-reported neighborhood characteristics, measures of psychosocial well-being, and psychosocial distress

Table 1. Baseline Characteristics of the Cohort by Neighborhood Cardiovascular Risk

	All (N=1433)	High Cardiovascular Risk (n=719)	Low Cardiovascular Risk (n=714)	*P* Value
Age, y	51.6±10.1	51.3±10.5	51.8±9.9	0.30
Men	550 (38.4)	308 (42.8)	242 (33.9)	<0.001*
Marriage status				
Married	617 (43.3)	258 (36.0)	359 (50.6)	
Divorced, separated, or widowed	416 (29.2)	240 (33.5)	176 (24.8)	<0.001*
Never married or unmarried	392 (27.5)	218 (30.5)	174 (24.5)	
Education status				
High school graduate or less	376 (26.4)	228 (32.0)	148 (20.9)	
Some college, 2-y degree	468 (32.9)	242 (33.9)	226 (31.9)	<0.001*
4-y college graduate	578 (40.7)	243 (34.1)	335 (47.3)	
Employment status				
Employed full- or part-time	864 (60.8)	423 (59.4)	441 (62.1)	
Not working or employed	168 (11.8)	100 (14.0)	68 (9.6)	0.068
Homemaking	74 (5.2)	38 (5.3)	36 (5.1)	
Retired	316 (22.2)	151 (21.2)	165 (23.2)	
Annual household income				
≤$25 000	193 (18.7)	129 (25.7)	64 (12.0)	
$25 000 to $50 000	279 (27.0)	151 (30.2)	128 (24.1)	<0.001*
≥$50 000	563 (54.4)	223 (44.3)	340 (63.9)	
Hypertension	643 (44.9)	334 (46.5)	309 (43.3)	0.23
Diabetes mellitus	245 (17.1)	130 (18.1)	115 (16.1)	0.32
High cholesterol	328 (22.9)	168 (23.4)	160 (22.4)	0.67
Combined stroke/CVD	130 (9.1)	65 (9.0)	65 (9.1)	0.97
Life's Simple 7 Metrics				
Ideal nonsmoking	1198 (86.6)	583 (81.1)	615 (86.1)	0.010*
Ideal activity	754 (53.0)	372 (52.1)	382 (54.0)	0.48
Ideal diet	39 (2.7)	19 (2.6)	20 (2.8)	0.85
Ideal body mass index	292 (20.4)	157 (21.8)	135 (19.0)	0.19
Neighborhood characteristics				
Aesthetic quality, score†	3.95±0.70	3.85±0.75	4.06±0.64	<0.001*
Walking environment, score†	3.82±0.70	3.81±0.69	3.83±0.71	0.47
Safety, score†	3.54±0.97	3.45±1.01	3.62±0.93	0.005*
Healthy food access, score†	3.48±1.15	3.31±1.18	3.65±1.10	<0.001*
Cohesion, score†	3.92±0.69	3.88±0.69	3.97±0.68	0.016*
Activities with neighbors, score‡	2.78±0.73	2.76±0.73	2.79±0.73	0.26
Violence, score‡	1.25±0.51	1.30±0.55	1.20±0.45	<0.001*
Discrimination, score‡	1.60±0.57	1.63±0.60	1.57±0.53	0.21
Depressive symptoms, score§	0.34±0.41	0.38±0.43	0.31±0.38	0.003*
Environmental mastery, score‖	5.07±0.72	5.00±0.76	5.15±0.66	0.002*
Purpose in life, score‖	5.12±0.65	5.05±0.69	5.19±0.60	<0.001*

Continued

Table 1. Continued

	All (N=1433)	High Cardiovascular Risk (n=719)	Low Cardiovascular Risk (n=714)	*P* Value
Optimism, score[†]	4.27±0.69	4.19±0.75	4.34±0.62	<0.001*
Resilient coping, score[‡]	4.28±0.68	4.24±0.74	4.32±0.60	0.27

Results are expressed as mean±SD or number (frequency). CVD indicates cardiovascular disease.
*Denotes a significant *P*-value <0.05.
[†]Scaled 1 to 5, where 1 is the least and 5 is the most.
[‡]Scaled 1 to 4, where 1 is the least and 4 is the most.
[§]Scaled 0 to 3, where 0 is the least and 3 is the most.
[‖]Scaled 1 to 6, where 1 is the least and 6 is the most.

(Figure S1). In general, correlation coefficients were larger within neighborhood characteristics (eg, aesthetic quality, walking environment, social cohesion) and within psychosocial measures (eg, optimism, purpose in life, environmental mastery) compared with across neighborhood and psychosocial domains. However, positive neighborhood characteristics and psychosocial well-being positively correlated with one another, and negatively with negative features of neighborhood (violence) and psychosocial characteristics (discrimination and depressive symptoms).

In multilevel logistic regression analyses, individuals from low versus high cardiovascular–risk neighborhoods had increased odds of reporting higher aesthetic quality (odds ratio [OR], 1.84; 95% CI, 1.25–2.70) and healthy food access (OR, 1.69; CI, 1.25–2.30), and decreased odds of reporting any violence (OR, 0.67; CI, 0.48–0.95) (Table 2). Additionally, individuals from low-risk neighborhoods had increased odds of reporting higher optimism (OR, 1.38; CI, 1.08–1.75) and purpose in life (OR, 1.42, CI, 1.14–1.76), and decreased odds of reporting higher depressive symptoms (OR, 0.69; CI, 0.54–0.88) (Table 2). After fully adjusting for sociodemographic covariates, estimates for aesthetic quality, healthy food access, violence, and purpose in life remained significant, but those for optimism and depressive symptoms were attenuated after adjusting for individual SES (Table 2; Model 3). In fully adjusted models, there were no significant associations between neighborhood of residence and self-reported CVH conditions or behaviors (Table 3).

Discussion

In the current study, we found that blacks living in census tracts with lower-than-expected rates of cardiovascular morbidity and mortality reported better neighborhood characteristics and psychosocial well-being, compared with those living in census tracts with higher-than-expected cardiovascular morbidity and mortality, even after adjustment for individual income and education. Interestingly, however, there was no evidence of differences in the self-reported prevalence of traditional cardiovascular risk factors or behaviors for blacks living in higher-than-expected– versus lower-than-expected–risk census tracts, suggesting that social determinants could potentially play a larger role in these areas. These findings are novel and add to the expanding literature on social determinants of CVH in that they: (1) utilize data exclusively among blacks at both the neighborhood and individual levels; (2) focus on measures of individual resilience, rather than risk, among blacks; and (3) suggest that characteristics of resilience among blacks at the individual level are associated with cardiovascular morbidity and mortality among blacks at the census tract level.

Many large cohort studies have demonstrated that individual perceptions of neighborhood quality are associated with CVH and CVD.[6,30,33] The most studied of these cohorts is the MESA, a prospective, multiracial cohort of middle-aged individuals at risk for CVD.[34] In the preceding decade, MESA investigators have shown that perceived neighborhood quality is associated with improved CVH and reduced CVD. Healthy food availability, a favorable physical activity environment, and positive social attributes, such as safety and aesthetic quality, have been associated with decreased rates of obesity and hypertension, as well as increased odds of achieving ideal CVH.[10,35,36] Conversely, perceived violence and a lack of neighborhood safety was associated with increased odds of obesity in patients with diabetes mellitus.[9] While these studies generally lack statistical power to assess effect modification by race, findings from the JHS (Jackson Heart Study), a prospective cohort of blacks from Jackson, MS, demonstrate similar findings. Neighborhood violence and lack of safety have been associated with increased odds of smoking, adverse cardiometabolic factors, and risk of CVD events.[37–39] Within the context of previous results, our study is unique in that we have shown an association between *individual* perceptions of positive neighborhood characteristics—specifically, aesthetic quality, healthy food availability, and a lack of violence—and lower-than-expected *neighborhood* rates of CVD events. Interestingly, although positive neighborhood attributes are thought to affect health through improved behaviors (ie, better diet, more physical activity), as previously noted, we found no evidence

Table 2. ORs of Reporting Higher Neighborhood Quality or Psychosocial Measures for Individuals Living in Low Cardiovascular–Risk Neighborhoods Compared With Those Living in High Cardiovascular–Risk Neighborhoods

	Model 1		Model 2		Model 3	
Characteristic	OR	95% CI	OR	95% CI	OR	95% CI
Neighborhood factors						
Aesthetic quality	1.84*	1.25–2.70*	1.65*	1.13–2.42*	1.54*	1.05–2.26*
Walking environment	1.13	0.82–1.56	1.10	0.80–1.52	1.04	0.76–1.44
Safety	1.13	0.85–1.51	1.03	0.78–1.37	1.01	0.76–1.34
Healthy food access	1.69*	1.25–2.30*	1.65*	1.21–2.25*	1.58*	1.16–2.15*
Cohesion	1.30	0.98–1.74	1.20	0.90–1.59	1.14	0.86–1.52
Activities with neighbors	1.25	0.99–1.57	1.17	0.93–1.48	1.16	0.93–1.47
Violence	0.67*	0.48–0.95*	0.70*	0.50–0.98*	0.67*	0.48–0.95*
Everyday discrimination	1.01	0.79–1.29	1.03	0.80–1.32	1.00	0.78–1.29
Depressive symptoms	0.69*	0.54–0.88*	0.74*	0.58–0.94*	0.80	0.63–1.01
Environmental mastery	1.24	0.98–1.56	1.14	0.91–1.43	1.07	0.85–1.34
Purpose in life	1.42*	1.14–1.76*	1.33*	1.07–1.66*	1.24*	1.00–1.54*
Optimism	1.38*	1.08–1.75*	1.28*	1.01–1.63*	1.20	0.95–1.52
Resilient coping	1.07	0.87–1.33	1.03	0.83–1.28	0.99	0.80–1.23

Model 1 is adjusted for age and sex. Model 2 is adjusted for age, sex, and marital status. Model 3 is adjusted for age, sex, marital status, and individual socioeconomic status. OR indicates odds ratio.
*Denotes significant results (*P*-value <0.05).

of differences in ideal CVH metrics between individuals living in low versus high cardiovascular–risk census tracts. Further study, including objective measurement of individual cardiovascular risk factor profiles, is needed to better understand the association between neighborhood quality and CVH among blacks.

In addition to neighborhood characteristics, positive psychosocial well-being is increasingly being recognized as an important contributor to CVH.[20] In a combined systematic review and meta-analysis among individuals with CVD, ≈65% of studies showed an association between psychosocial well-being and CVD outcomes.[19] Other meta-analyses have shown that optimism is associated with better CVH behaviors, while higher purpose in life is associated with lower all-cause mortality and CVD events; however, these studies are mostly composed of white, non-US individuals.[17,40] In general, psychosocial well-being in blacks and other racial/ethnic minorities in the United States is understudied, especially given its consistent association with resilience to CVD in white cohorts. Furthermore, even when study populations are racially diverse, results are rarely reported by race.[41–44] While this is concerning in its own right, a landmark study from the Women's Health Initiative demonstrated that the association between optimism and all-cause mortality was modified by race, such that optimistic black women had a greater reduction in all-cause mortality when compared with white women.[45] Our findings were generally in agreement with these previous studies and demonstrated that blacks from low cardiovascular–risk neighborhoods reported higher purpose in life and trended towards greater optimism, losing statistical significance after adjusting for individual SES.

These findings are novel because historically, psychosocial distress, rather than well-being, has been studied as a risk factor for CVD in blacks. Several studies from the JHS have shown that discrimination, negative affect, and life stressors are associated with increased smoking prevalence, worse sleep, and lower overall CVH.[12,13,46] While we did not observe an association between neighborhood cardiovascular risk and discrimination, individuals living in low versus high cardiovascular–risk neighborhoods reported fewer depressive symptoms. These findings were modestly attenuated following adjustment for individual SES but are consistent with results from the JHS which showed that a higher level of depressive symptoms among blacks was associated with increased risk of stroke and coronary heart disease events.[11] That study also demonstrates the complex and heterogeneous relationships between psychosocial distress and well-being in blacks, as the association between depressive symptoms and adverse events was attenuated after adjusting for coping.[11] Similarly, while we demonstrated weak correlations between positive psychosocial well-being and more desirable neighborhood characteristics in the current analysis, it remains unclear whether healthier psychosocial well-being can mitigate the negative impact of less desirable neighborhood

Table 3. ORs of Self-Reported Cardiometabolic Disease and Ideal Cardiovascular Health Metrics Among Individuals in Low vs High Cardiovascular–Risk Neighborhoods

	Model 1		Model 2		Model 3	
Characteristic	OR	95% CI	OR	95% CI	OR	95% CI
Hypertension	0.80	0.63–1.02	0.83	0.65–1.07	0.88	0.69–1.12
Diabetes mellitus	0.85	0.64–1.13	0.83	0.62–1.10	0.87	0.65–1.17
High cholesterol	0.94	0.73–1.21	0.94	0.72–1.22	0.95	0.73–1.24
History of CVD	1.01	0.69–1.49	1.10	0.75–1.60	1.18	0.80–1.74
Life's Simple 7 Metrics						
Ideal nonsmoking	1.48*	1.06–2.08*	1.32	0.95–1.84	1.24	0.89–1.71
Ideal activity	1.14	0.93–1.41	1.14	0.92–1.41	1.08	0.87–1.34
Ideal diet	1.00	0.53–1.90	0.96	0.50–1.85	0.94	0.49–1.81
Ideal body mass index	0.82	0.63–1.06	0.85	0.65–1.10	0.88	0.67–1.14

Model 1 is adjusted for age and sex. Model 2 is adjusted for age, sex, and marital status. Model 3 is adjusted for age, sex, marital status, and individual socioeconomic status. CVD indicates cardiovascular disease; OR, odds ratio.
*Denotes significant results (*P*-value <0.05).

characteristics on CVH at the individual level. Clearly, more research is needed regarding the effects that both psychosocial well-being and distress have on cardiovascular health and disease in blacks, and this will require both dedicated study of black cohorts as well as the inclusion and harmonization of appropriate, reproducible survey items.[1,20,33,47]

Study Limitations

There are also several limitations to the current study that warrant consideration. Census tracts may not be an appropriate proxy for neighborhoods, as other contexts, such as individual work and activity spaces, may differ significantly from the boundaries of a census tract. Furthermore, our study was cross-sectional, and we are not able to establish temporality between individual resilience factors and cardiovascular outcomes of the census tract. This was also a nonrandom sample, and individuals who were available to participate may not represent the general population within the neighborhoods we sampled (ie, they may be healthier). Relatedly, although the high and low cardiovascular–risk neighborhoods had similar demographic and SES attributes, our survey respondents did not. Although we did not collect data on response rate by high versus low cardiovascular–risk census tracts, it is possible that participants from our low- (or high-) risk neighborhoods are less representative of the individuals living in those areas, which limits interpretability of our findings. Self-reported cardiovascular risk factors have several limitations: individuals may not be aware that they have them and/or they may also not know the severity to which they have them. Incorporating individuals' objective cardiovascular risk profiles, including prevalent subclinical disease, is an important area for future study. Other areas of future investigations also include: (1) to examine objective aspects of the high- and low-risk neighborhoods for a more comprehensive understanding of the neighborhoods with higher-than-expected and lower-than-expected CVD rates, and (2) to investigate whether certain forms of CVDs (eg, chronic heart failure or acute coronary syndrome) drive the rate difference between low- and high-risk neighborhoods, which may further help identify areas for intervention.

Study Strengths

Despite these limitations, our study has several strengths. We have focused solely on blacks living in a large, socioeconomically diverse metro area. While this clearly limits the generalizability of our findings to the general population, blacks have the highest burden of CVD and identifying characteristics of resilience to CVD in blacks addresses a significant gap in knowledge. Because the racial disparity in cardiovascular outcomes is most pronounced at earlier ages, we restricted our cohort to adults younger than 65 years. We have also accounted for the well-known contribution of neighborhood poverty to disparities in CVD within blacks by sampling our population from census tracts with similar socioeconomic and demographic profiles. Additionally, we have limited the confounding effects of residential mobility by requiring study participants to have resided at their current address for at least 6 years, thus ensuring that our individual survey participants also contributed to the census data used to define our high and low cardiovascular–risk census tracts.

Conclusions

We found that blacks living in neighborhoods with low cardiovascular risk had a more favorable neighborhood environment and had more positive psychosocial characteristics than those from neighborhoods with high cardiovascular risk, despite similar individual clinical and behavioral cardiovascular risk profiles. Further studies are needed to determine how improved neighborhood characteristics and psychosocial well-being among blacks may confer resilience to CVD and reduce racial disparities in black individuals and communities.

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Disclosures

None.

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SUPPLEMENTAL MATERIAL

Table S1. Sociodemographic characteristics of high and low CV risk census tracts.

Characteristic	High CV Risk (n=121)	Low CV Risk (n=106)	P-value
CV Mortality Rate*, per 5000 person-years	13.8	8.1	<0.001
CV ED Visit Rate*, per 5000 person-years	146.3	32.3	<0.001
CV Hospitalization Rate*, per 5000 person-years	130.0	26.7	<0.001
African American, %	45.3	48.8	0.38
Female, %	55.6	54.8	0.29
Median age*, years	32.1	32.3	0.77
Median income*, $	45,306	46,123	0.79
Median home value, $	176,008	181,761	0.62

CV = cardiovascular
* Among African Americans

Table S2. Median cutoff values and distribution of the cohort.

	Median	Lower half (n)	Upper half (n)
NBH – Aesthetic quality, score*	4.00	546	887
NBH – Walking environment, score*	3.85	666	765
NBH – Safety, score*	3.66	631	794
NBH – Healthy food access, score*	4.00	613	804
NBH – Cohesion, score*	4.00	492	913
NBH – Activities with Neighbors, score†	3.00	697	727
NBH – Violence, score†`	1.00	934	413
Discrimination, score†	1.50	680	750
Depressive symptoms, score‡	0.20	665	765
Environmental mastery, score§	5.21	713	718
Purpose in life, score§	5.21	705	726
Optimism, score*	4.33	579	852
Resilient coping, score*	4.40	694	738

n = number of subjects; NBH = neighborhood
* Scaled 1 to 5, where 1 is the least and 5 is the most
† Scaled 1 to 4, where 1 is the least and 4 is the most
‡ Scaled 0 to 3, where 0 is the least and 3 is the most
§ Scaled 1 to 6, where 1 is the least and 6 is the most

A) Low Cardiovascular-risk Neighborhoods

Low-risk Neighborhoods (N=714)	Aesthetic Quality	Walking Environment	Safety	Health Food Access	Cohesion	Activity with Neighbors	Violence	Environmental Mastery	Purpose in Life	Optimism	Resilient Coping	Everyday Discrimination	Depressive Symptoms
Aesthetic Quality		0.57**	0.49**	0.40**	0.55**	0.24**	-0.24**	0.23**	0.14**	0.12**	0.25**	-0.13**	-0.26**
Walking Environment	0.57**		0.47**	0.54**	0.57**	0.29**	-0.14**	0.24**	0.11**	0.11**	0.24**	-0.19**	-0.23**
Safety	0.49**	0.47**		0.32**	0.49**	0.22**	-0.34**	0.29**	0.14**	0.16**	0.26**	-0.16**	-0.21**
Health Food access	0.40**	0.54**	0.32**		0.47**	0.17**	-0.09*	0.20*	0.04	0.08*	0.19**	-0.15**	-0.22**
Cohesion	0.55**	0.57**	0.49**	0.47**		0.38**	-0.22**	0.26**	0.11**	0.14**	0.28**	-0.20**	-0.28**
Activity with Neighbors	0.24**	0.29**	0.22**	0.17**	0.38**		-0.09*	0.22**	0.14**	0.07	0.12**	0.04	-0.12**
Violence	-0.24**	-0.14**	-0.34**	-0.09*	-0.22**	-0.09*		-0.16**	-0.05	-0.07	-0.13**	0.18**	0.08
Environmental Mastery	0.23**	0.24**	0.29**	0.20**	0.26**	0.22**	-0.16**		0.57**	0.37**	0.36**	-0.17**	-0.42**
Purpose in Life	0.14**	0.11**	0.14**	0.04	0.11**	0.14**	-0.05	0.57**		0.47**	0.30**	0.04	-0.28**
Optimism	0.12**	0.11**	0.16**	0.08*	0.14**	0.07	-0.07	0.37**	0.47**		0.32**	-0.05	-0.39**
Resilient Coping	0.25**	0.24**	0.26**	0.19**	0.28**	0.12**	-0.13**	0.36**	0.30**	0.32**		-0.15**	-0.36**
Everyday Discrimination	-0.13**	-0.19**	-0.16**	-0.15**	-0.20**	0.04	0.18**	-0.17**	0.04	-0.05	-0.15**		0.16**
Depressive Symptoms	-0.26**	-0.23**	-0.21**	-0.22**	-0.28**	-0.12**	0.08	-0.42**	-0.28**	-0.39**	-0.36**	0.16**	

B) High Cardiovascular-risk Neighborhoods

High-risk Neighborhoods (N=719)	Aesthetic Quality	Walking Environment	Safety	Health Food Access	Cohesion	Activity with Neighbors	Violence	Environmental Mastery	Purpose in Life	Optimism	Resilient Coping	Everyday Discrimination	Depressive Symptoms
Aesthetic Quality		0.52**	0.53**	0.37**	0.60**	0.20**	-0.32**	0.29**	0.21**	0.24**	0.22**	-0.21**	-0.23**
Walking Environment	0.52**		0.44**	0.51**	0.50**	0.24**	-0.16**	0.27**	0.14**	0.18**	0.20**	-0.19**	-0.22**
Safety	0.53**	0.44**		0.28**	0.52**	0.24**	-0.50**	0.25**	0.15**	0.14**	0.21**	-0.23**	-0.21**
Health Food access	0.37**	0.51**	0.28**		0.42**	0.15**	-0.12**	0.23**	0.12**	0.23**	0.19**	-0.21**	-0.27**
Cohesion	0.60**	0.50**	0.52**	0.42**		0.39**	-0.24**	0.27**	0.12**	0.19**	0.23**	-0.24**	-0.24**
Activity with Neighbors	0.20**	0.24**	0.24**	0.15**	0.39**		-0.02	0.18**	0.10**	0.11**	0.12**	-0.01	-0.11**
Violence	-0.32**	-0.16**	-0.50**	-0.12**	-0.24**	-0.02		-0.11**	-0.05	-0.10**	-0.07	0.26**	0.14**
Environmental Mastery	0.29**	0.27**	0.25**	0.23**	0.27**	0.18**	-0.11**		0.62**	0.45**	0.51**	-0.31**	-0.47**
Purpose in Life	0.21**	0.14**	0.15**	0.12**	0.12**	0.10**	-0.05	0.62**		0.52**	0.42**	-0.17**	-0.35**
Optimism	0.24**	0.18**	0.14**	0.23**	0.19**	0.11**	-0.10**	0.45**	0.52**		0.40**	-0.20**	-0.45**
Resilient Coping	0.22**	0.20**	0.21**	0.19**	0.23**	0.12**	-0.07	0.51**	0.42**	0.40**		-0.20**	-0.37**
Everyday Discrimination	-0.21**	-0.19**	-0.23**	-0.21**	-0.24**	-0.01	0.26**	-0.31**	-0.17**	-0.20**	-0.20**		0.28**
Depressive Symptoms	-0.23**	-0.22**	-0.21**	-0.27**	-0.24**	-0.11**	0.14**	-0.47**	-0.35**	-0.45**	-0.37**	0.28**	

***P<0.05; **P<0.01**

Figure S1. Correlation matrices of neighborhood characteristics and psychosocial measures reported by the study respondents living in low cardiovascular-risk neighborhoods (A) and high cardiovascular-risk neighborhoods (B). Spearman correlation coefficients are depicted. Blue color represents positive correlations and red represents negative correlations, and the intensity of color corresponds to the magnitude of the correlation coefficients.