SSM - Population Health 24 (2023) 101475

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

Distinct moderating pathways for psychosocial risk and resilience in the association of neighborhood disadvantage with incident heart failure among Black persons

Ganga S. Bey[a,*], James R. Pike[b], Priya Palta[c]

[a] University of North Carolina at Chapel Hill, Department of Epidemiology, USA
[b] Johns Hopkins University Bloomberg School of Public Health, USA
[c] University of North Carolina School of Medicine, Department of Neurology, USA

ARTICLE INFO

Keywords:
Health disparities
Psychosocial resilience
Optimism
Negative affect
Moderation
Cardiovascular disease

ABSTRACT

Objective: To assess whether psychosocial factors moderate the associations between neighborhood disadvantage and incident heart failure (HF).

Methods: Among 1448 Non-Hispanic (NH) Black persons dually enrolled in two community-based cohorts in Jackson, Mississippi who were free of HF as of January 1, 2000, 336 HF events classified by reviewer panel accrued through December 31, 2017. Multilevel, multivariable Cox regression models were used to examine whether optimism and negative affect moderated the associations of two measures of neighborhood characteristics (the national Area Deprivation Index (ADI) and perceived neighborhood problems) on incident hospitalized HF.

Results: Optimism moderated the association of the ADI with incident HF. Compared to participants reporting the lowest tertile of optimism, those in the highest tertile of optimism had a 29% lower rate of HF associated with increasing ADI in fully adjusted models. We found no evidence for a moderating effect of negative affect.

Conclusions: This study supports optimism as a source of resilience to the detrimental effects of neighborhood disadvantage on HF risk. Population-level strategies to promote sociocultural antecedents to optimism may serve as a viable method of reducing the disproportionate burden of HF among NH Black persons.

1. Introduction

Heart failure (HF), a set of syndromes characterized by a diminished heart filling or ejection of blood, is marked by striking ethnoracial disparities in age at onset, incidence, and associated mortality. Non-Hispanic (NH) Black persons in the United States experience the highest risk of any ethnoracial group in developing HF (Bahrami et al., 2008), with the rate of HF hospitalizations in this population approximately twice that of NH White persons (Chang et al., 2018). As for many other chronic disease outcomes, evidence for the cause of this persistent disparity in HF risk increasingly points to elements of the exposome, or the external environment to which an individual is exposed over the life course, shaped by structural inequity (Krieger, 2001; Phelan et al., 2010).

Ethnoracial patterns in who lives where are known to be influenced by a variety of historical and current policies and practices that disadvantage NH Black persons (Diez Roux, 2016; Williams et al., 2019). Practices of ethnoracial discrimination in housing and social service access, for example, included segregation, redlining, (the systematic denial of various services to residents of specific neighborhoods), and corporate exclusionary policies that targeted urban, impoverished, or majority Black neighborhoods (Krieger, 2001; Phelan et al., 2010; Williams et al., 2019). One well-characterized effect of this structural inequity is the concentration of Black persons in the deprived neighborhood environments of which a large body of research describes the adverse health consequences (Barber et al., 2016; Egede et al., 2023; Messer et al., 2010). Whether through shaping access to effective healthcare, healthy food options, or safe opportunities for physical activity, neighborhoods determine health and disease. These objective features of the neighborhood environment are captured in measures such as the Area Deprivation Index (Kind & Buckingham, 2018), a widely implemented measure available for every census block in the U.

* Corresponding author. University of North Carolina at Chapel Hill, Department of Epidemiology, 123 W. Franklin St., Chapel Hill, NC, 27516, USA.
E-mail address: gbeyster@email.unc.edu (G.S. Bey).

https://doi.org/10.1016/j.ssmph.2023.101475
Received 11 April 2023; Received in revised form 20 June 2023; Accepted 23 July 2023
Available online 24 July 2023

S.

Subjective experiences of neighborhood disadvantage may be equally damaging. Although physiological mechanisms for NH Black persons' increased risk of HF and earlier age at onset are not fully explicated, evidence also suggests that sustained stress associated with perceiving oneself in a problematic living environment may also act independently of objective neighborhood disadvantage to confer risk via chronic dysregulation of the hypothalamus-pituitary-adrenal axis (Brosschot et al., 2018; Sampson, 2013). These objective and subjective modifiable characteristics of the exposome are particularly influential in conditions such as HF, which has several cardiometabolic and cardiovascular precursors that develop in response to repeated physiological injury over the life course (Gary et al., 2008; Gebreab et al., 2016; Keita et al., 2011).

Still, within-race variation in HF burden even among residents of deprived and chronically stressful neighborhood environments (Barber et al., 2016; Wang et al., 2017) suggests that risk and resilience are not homogenously distributed among NH Black populations. Individual health-relevant psychosocial factors may influence to what extent disadvantaged neighborhood environments impact on HF risk. Specifically, evidence has consistently revealed an association of dispositional optimism, a resilience factor, and negative affect, a risk factor, with cardiovascular (CV) disease (Nabi et al., 2008; Rozanski et al., 2019; Sims et al., 2019). While a clear consensus does not exist, several prominent frameworks (e.g. Seligman, 2006), position what are often characterized as affective "traits" of optimism and pessimism as modifiable characteristics, that, while stable and indicative of one's disposition, are influenced by environmental exposures shaped by structural inequity. Such exposures include, for example, experiences of abuse, trauma, neglect, deprivation, and race-based discrimination (Carter et al., 2020; Chen et al., 2021) that disproportionately impact ethnoracially minoritized populations over the life-course (Mersky et al., 2021).

Despite increased risk of exposure to adverse experiences that promote development of negative affective dispositions, cultural norms and practices characteristic of NH Black communities (Myers et al., 1991) may enable members of these populations to retain psychosocial characteristics, for example optimism, that facilitate physiological resilience in the context of material disadvantage (Graham, 2015, 2017). There is also indication that these psychosocial risk and resilience factors operate along distinct pathways to affect CV disease outcomes (Kubzansky et al., 2018; Watson et al., 1988), suggesting a need for further exploration of their moderating effects on HF risk. However, no identifiable studies have assessed whether individual differences in psychosocial characteristics may contribute within-race variation to the impact of neighborhood disadvantage on HF risk. Such studies are needed to identify additional culturally-tailored population-level interventions on CV disease disparities that draw on the strengths of ethnoracially minoritized groups and work synergistically with interventions targeting the inequitable social structures at the root of health disparities.

To this end, we used data from NH Black participants dually enrolled in two community-based prospective cohorts to examine the moderating role of a measure of psychosocial resilience (optimism) and risk (negative affect) in the relationship of objective and subjective measures of neighborhood disadvantage with incident HF.

2. Methods

2.1. Study population

Data used for this study come from self-identified NH Black residents of Jackson, Mississippi dually enrolled in the Atherosclerosis Risk in Communities (ARIC) study and the Jackson Heart Study (JHS). The ARIC study is a community-based longitudinal investigation of atherosclerosis and its risk factors in four geographic areas: Forsyth County, North Carolina; Jackson, Mississippi; Minneapolis, Minnesota; and Washington County, Maryland. From 1987 to 1989, a baseline examination was given to 15,792 mostly Black and White persons aged 45–64 years of age selected using probability sampling (Wright et al., 2021). Follow-up examinations occurred at discrete intervals and participants are contacted annually by telephone between clinic examinations and semi-annually since 2012. Similarly, JHS is a prospective, community-based study of CV disease among Black persons in Jackson, Mississippi. Four sampling approaches were used to select 5306 adults aged 21–84 years for participation: a random sampling of adults drawn from a commercially available list of households with adults, volunteers recruited through participant referral or outreach activities, participants from the Jackson field center of the ARIC study, and relatives of JHS participants. The baseline examination occurred between 2000 and 2004 and involved the collection of data on clinical, demographic, social, cultural, and behavioral information through a home interview, an on-site clinical examination, and 42-h follow-up data. Two follow-up clinical visits took place in 2005–2008 and 2009–2012, and study staff contacted participants each year via telephone for an annual follow-up survey. The JHS design and methods have been previously described in greater detail (Taylor et al., 2005). The integration of measures from both cohorts facilitated the analysis of JHS-based measures of neighborhood disadvantage and psychosocial risk and resilience with ARIC-based measures of cardiovascular risk factors, comorbidities, and outcomes.

Of the 5306 Black persons enrolled in JHS at baseline in 2000–2004, 1662 participants were already enrolled in ARIC at the Jackson, MS site. With exclusions for a HF diagnosis prior to the JHS baseline and lack of linkage to a 1990 census tract, our final analytic sample included 1448 participants (Fig. 1) dually enrolled in ARIC and JHS residing in 67 neighborhoods as defined by U.S. census tracts. Participants were geocoded to their neighborhood of residence by their home address at the ARIC baseline examination.

2.2. Study variables

2.2.1. Exposure: neighborhood disadvantage

Our exposure of neighborhood disadvantage was operationalized in a measure of objective neighborhood disadvantage, the National ADI, and a measure of subjective neighborhood disadvantage, the perceived neighborhood problems (PNP) scale.

The ADI, used extensively in research on neighborhood health effects, has been previously calculated for every U.S. census block group (Kind & Buckingham, 2018). The measure includes 17 metrics for the theoretical domains of income, education, employment, and housing quality. For additional details on the construction of the ADI, see (Kind & Buckingham, 2018). Each census block group is assigned a rank ranging from 1 to 100, representing the least and most deprived neighborhoods of the U.S., respectively. For this study, we standardized these rankings at the census tract level and categorized the 67 census tracts spanning the ARIC-JHS catchment area into quartiles, with quartile 1 including the lowest 25% and quartile 4 the highest 25% ranked tracts.

The validated PNP scale (Ross & Mirowsky, 1999) is comprised of six survey items assessing perceptions of neighborhood noise, traffic and speeding, access to food, shopping, or parks, and the persistence of trash and litter which were measured in JHS at the baseline examination. The measure has been shown to correlate highly with objective measures of neighborhood quality (Elo et al., 2009) but can be used to contrast the health effects of objective disadvantage with those which may be attributable to subjective experiences of disadvantage. An examination of the distribution of responses revealed sizable skew (>1) and kurtosis (<0 or >6). Consequently, each item was treated as a categorical indicator in a multilevel confirmatory factor analysis model that computed census tract-level PNP. To produce valid estimates, we combined tracts with fewer than 10 participants with neighboring tracts, resulting in 32 analytic census tracts. Adjustments for sex and age were made at the

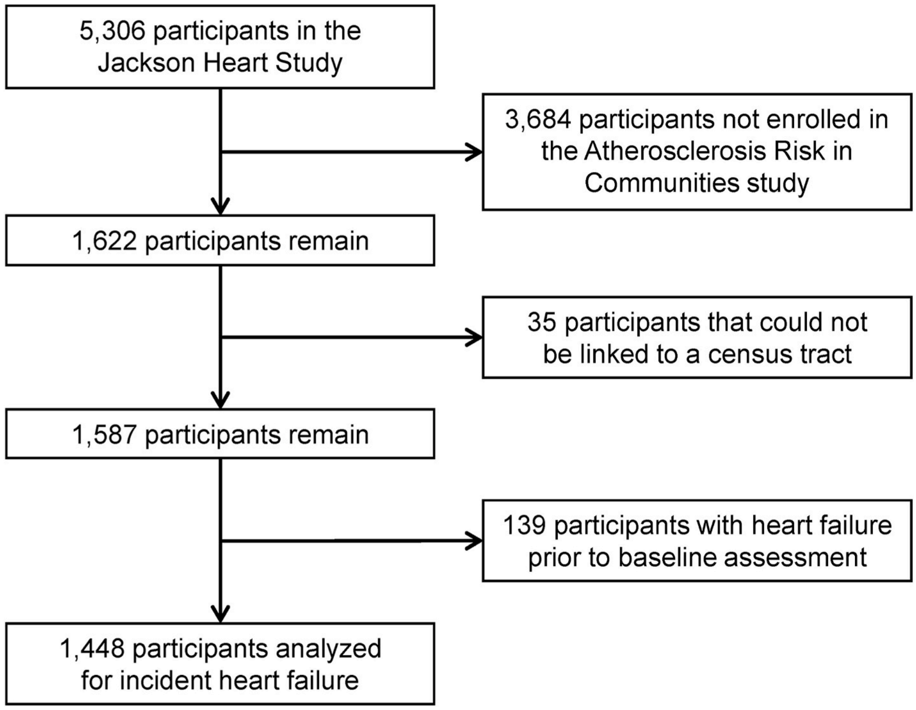

Fig. 1. Flowchart of participants selected for analysis: ARIC-JHS cohort 2000–2017 (n = 1448).

person-level to produce neighborhood-level measurements that accounted for demographic imbalances among participants sampled from a specific tract. The computed census tract scores were standardized and discretized into quartiles.

2.2.2. *Outcome: incident hospitalized HF*

The outcome of interest was adjudicated incident hospitalized HF. We included as incident HF any events occurring between January 1, 2000 and December 31, 2017. HF was ascertained in the ARIC study by reviewing medical records from local hospitals with a discharge ICD code of HF (Rosamond et al., 2012) ICD9: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 415.0, 416.9, 425.4, 428.x, 518.4, 786.0x; ICD10: J18.9, J96.01, J98.11, J21.9, T17.890A, E11.65, T38.0 × 5A, I13.0, E11.22, N18.3, I50.9, I48.0, I71.2, I95.1, M19.011, M25.551, I44.0, I44.4, E78.5, R42, Z91.81, E66.9, F32.9, Z68.29, Z79.4, Z86.73). Events occurring at non-local hospitals were identified by self-report and from death certificates and the corresponding medical records were obtained and reviewed.

2.2.3. *Moderators: individual psychosocial risk and resilience characteristics*

Optimism was assessed using the validated 10-item Life Orientation Test-Revised (Scheier et al., 1994). Four of the ten items are filler items; the remaining six are scored on a Likert scale of 0 (I disagree a lot) to 4 (I agree a lot). Therefore, the score range is 0–24. The LOT-R is conceptualized as a single bipolar scale, and in our models, we treated optimism as a continuous standardized variable.

Consistent with JHS methodology, negative affect was assessed as a composite of cynicism, depressive symptoms, and anger expression. Cynicism was measured using items 1–13 of the Cook-Medley Hostility scale (Barefoot et al., 1989), depressive symptoms using the 20-item Center for Epidemiologic Studies Depression (CES-D) scale, and anger expression using the State-Trait Anger Expression Inventory (Spielberger et al., 1988). We calculated a standardized factor score using summary scores of each of these scales. All measures have been shown as valid and reliable (Sims et al., 2017) and were administered at the JHS baseline visit.

2.2.4. *Covariates*

Measures of demographics, health conditions, and health behaviors were administered in both ARIC and JHS. Demographics characteristics included age (ARIC; continuous years), sex (ARIC; binary female, male), education (JHS; continuous years), and individual-level income (JHS; binary yes/no below the federal poverty line as determined by poverty-to-income ratio). The health conditions included were hypertension medication (ARIC; binary yes/no) and diabetes (ARIC; binary yes/no as determined by medication use, self-report, fasting glucose ≥126 Mg/dl, or non-fasting glucose ≥200 Mg/dl). Included health behaviors were physical activity (ARIC; binary yes/no as determined by weekly vigorous physical activity meeting recommended levels), binge drinking (JHS; binary yes/no greater than 5+ drinks/day ever consumed), and smoking status (ARIC; never, former, current). Covariates that varied with time, such as smoking status, were measured in the cohort examination closest to January 1, 2000.

2.3. *Statistical analysis*

Trends in the baseline characteristics of the participants across quartiles of ADI and PNP were evaluated utilizing linear regression, Cochran-Armitage trend tests, and Cochran-Mantel-Haenszel trend tests. Multilevel cause-specific Cox proportional hazards regression models with robust error variance were utilized to estimate hazard ratios (HRs) and 95% confidence intervals (CI). A shared frailty term with a gamma distribution (Austin et al., 2017) was specified to account for similarities among participants in the same neighborhood (census tract). Follow-up time was measured from January 1, 2000 until the first documented instance of hospitalized HF, censoring due to a cause unrelated to heart failure, or administrative censoring on December 31, 2017. Ties were handled by applying the Efron method. The assumption of linearity was evaluated by examining Martingale residuals and the proportional hazards assumption was assessed by inspecting Schoenfeld residuals. Neither modeling assumption was violated.

Prior to model fitting, all continuous neighborhood-level measures were grand-mean centered and all continuous individual-level measures were centered at the neighborhood mean. The initial models estimated the association of continuous neighborhood disadvantage (ADI or PNP) with incident HF. The next set of models examined tertiles of psychosocial risk (negative affect) or resilience (optimism). The final set of models integrated these measures and specified an interaction between neighborhood disadvantage and either psychosocial risk or resilience. All models were adjusted for demographics, health conditions, and health behaviors. Interactions were visualized by using model parameters to produce estimated values for a hypothetical male participant with continuous covariates set to the sample mean and categorical covariates set to the reference group.

Two separate sensitivity analyses were conducted to evaluate the robustness of the results. The first sensitivity analysis generated crude or partially-adjusted estimates of the interaction between neighborhood disadvantage and psychosocial risk or resilience. The first model provided unadjusted estimates. The second model adjusted for age and sex. The third model additionally adjusted for behavioral cardiovascular disease risk factors including smoking and physical activity at baseline. A fourth model accounted for baseline demographics by adjusting for sex, age, years of education, and whether the participant was living below the federal poverty line. A fifth model addressed lifestyle factors and comorbidities by adjusting for baseline smoking, physical activity, binge-drinking, diabetes, and the use of hypertension medication. The second sensitivity analysis accounted for bias stemming from informative censoring caused by competing events such as death by applying stabilized inverse probability of censoring weights (Robins et al., 1995; Robins & Rotnitzky, 1992).

Although the outcome and exposures had no missing values, there was sizable missingness in the measures of optimism (16.6%) and negative affect (35.8%). To mitigate bias and loss of power, multiple imputation by chained equations was utilized (van Buuren, 2007). The imputation model included all variables from all analytic models as well as baseline measures from ARIC of height, weight, body mass index, fasting glucose, systolic blood pressure, diastolic blood pressure, high-density lipoprotein, cholesterol, and triglycerides as auxiliary variables. Documented instances of hypertension, coronary heart disease, stroke, cognitive impairment, hospitalization, and self-report poor health recorded during annual and semi-annual follow-up phone calls conducted for ARIC were also incorporated into the imputation model as auxiliary variables. Each auxiliary variable had less than 11% missing and exhibited a statistically significant association with optimism, negative affect, or an analytic covariate with missing data. Statistically significant interactions between the various covariates and sex or age were specified to improve the precision of imputed values. To validate the imputation model, a supplemental analysis (Nguyen et al., 2017) was performed in which 20% of the observed values for optimism or negative affect were randomly selected and converted to missing. The imputation model generated 5 imputed values for each selected value and the imputed values were compared to the observed values. The correlation between the observed and imputed values was acceptable for optimism ($r = 0.79$) and negative affect ($r = 0.77$). One hundred imputed datasets were generated although results from a two-stage analysis (von Hippel, 2020) indicated that only 81 imputed datasets were needed. Parameter estimates from models fit to each imputed dataset were combined according to Rubin's rules (Rubin, 1987). All analyses were executed in SAS 9.4 (SAS Institute, Cary, NC).

3. Results

Among the 1448 participants in the analytic sample, the mean (standard deviation, SD) age at the baseline was 64.3 (5.5) years, 66.3% (960/1448) were female, and 14.3% (184/1290) were classified as living below the federal poverty line. The ADI ranges from 1 to 100; quartiles in the analytic sample ranged from 31 to 100 and one SD was equal to 14.77. Quartiles of PNP in the analytic sample ranged from −2.04 to 1.46. Tertiles of negative affect ranged from −1.71 to 4.83 (T1 = −1.71 to −0.38, T2 = −0.37 to 0.23, T3 = 0.24 to 4.83). Optimism scores ranged from 6 to 24; a one SD was equal to 3.3 and tertiles (T) ranged from 8 to 24 (T1 = 8 to 18, T2 = 19 to 22, T3 = 23 to 24). Participants residing in census tracks with higher ADI rankings or higher levels of PNP were more likely to be older, female, and have less years of formal education (Table 1). The median (interquartile range) follow-up was 18.0 (6.1) years. By the time of administrative censoring at the end of 2017, 334 instances of incident HF hospitalizations were recorded.

In covariate-adjusted main effects models (Table 2), a one SD higher ADI score was associated with a 22% increase (HR 1.22, 95% CI 1.05–1.42) in the hazard rate of incident HF and a one standard deviation higher PNP score was associated with a 13% increase (HR 1.13, 95% CI 1.00–1.29). Higher tertiles of negative affect were associated with greater risk of HF while the inverse was true for optimism, although the confidence intervals of the point estimates were too large to draw definitive conclusions. Interaction models revealed that optimism moderated the effect of ADI (HR 0.71, 95% CI 0.51–0.99). Compared to participants in the lowest tertile, participants in the highest optimism tertile were largely protected against the effects of increasing levels of ADI (Fig. 2). A similar pattern was observed for the interaction between optimism and PNP, although the effect was attenuated (HR 0.90, 95% CI 0.69–1.18). Neither ADI nor PNP appeared to be moderated by negative affect.

In sensitivity analyses involving crude and partially-adjusted models (eTable 1) the parameter estimates were comparable as exemplified by the unadjusted interaction between ADI and optimism (HR 0.73, 95% CI 0.52–1.02). Estimates of the interaction in a theoretical, immortal cohort created by applying inverse probability of censoring weights (eTable 2) were further attenuated in the primary model (HR 0.81, 95% CI 0.55–1.19).

4. Discussion

Among a community-based sample of NH Black persons in a southern urban city, we found evidence for optimism as a moderator of the effect of objective neighborhood disadvantage, measured using the national ADI, on incident HF. Evidence for optimism as a moderator of the subjective neighborhood disadvantage-HF pathway was less pronounced, and no support for negative affect as a moderator of either objective or subjective neighborhood disadvantage was found.

4.1. Relationships of neighborhood contexts, psychosocial risk and resilience, and HF

Our results are consistent with a well-established body of research outlining disadvantaged neighborhood environments, whether objectively or subjectively measured, as influential in HF risk (Barber et al., 2016; Diez Roux, 2016; Diez-Roux et al., 1997). Much of this evidence is based in the elements of neighborhoods that influence access to and quality of healthcare, engagement in physical activity, smoking behavior, and consumption of fruits and vegetables (Gary et al., 2008; Keita et al., 2011; Wang et al., 2017). Other evidence highlights neighborhood disadvantage as a source of sustained stress that acts directly to cause dysregulation of the stress response system (Gebreab et al., 2016; Sampson, 2013). This physiological dysregulation contributes to chronic inflammation (Felix et al., 2019) and associated conditions such as coronary heart disease, diabetes, and hypertension (Lu et al., 2019; McEwen, 2000; Wellen & Hotamisligil, 2005), which are primary risk factors for HF.

Our study findings also align with existing work highlighting a role for optimism in CV outcomes. A recent meta-analysis of 15 studies including over 200,000 individuals of different racial and ethnic backgrounds found optimism to be associated with reduced risk of cardiovascular events (Rozanski et al., 2019). When examining HF risk specifically, one prospective study found up to a 48% decrease in HF incidence among those endorsing the highest levels of dispositional optimism (Kim et al., 2014).

Table 1
Characteristics of the study population by quartiles: ARIC-JHS cohort 2000–2017 (n = 1448).

Area Deprivation Index	N	All	Quartile 1	Quartile 2	Quartile 3	Quartile 4	P-Trend
			31 to 77	78 to 87	88 to 93	94 to 100	
Baseline							
Age, mean (SD), y	1448	64.3 (5.5)	62.4 (4.9)	63.7 (5.2)	65.1 (5.6)	65.6 (5.6)	<.001
Female sex, No. (%)	1448	960 (66.3)	197 (62.3)	226 (66.1)	257 (67.1)	273 (69.5)	.05
Education, mean (SD), y	1439	13.4 (4.5)	15.3 (4.2)	13.2 (4.0)	13.5 (4.8)	11.9 (4.4)	<.001
Below federal poverty line, No. (%)	1290	184 (14.3)	22 (7.9)	38 (12.3)	50 (14.8)	73 (20.7)	<.001
Smoking history, No. (%)							
Current	1294	197 (15.2)	27 (9.4)	60 (20.1)	46 (13.2)	62 (17.9)	.008
Former		466 (36.0)	111 (38.5)	108 (36.1)	122 (35.1)	119 (34.3)	
Never		631 (48.8)	150 (52.1)	131 (43.8)	180 (51.7)	166 (47.8)	
Physical activity, mean (SD), min/week	1308	110.9 (150.3)	130.2 (155.2)	111.2 (149.5)	109.4 (148.3)	94.8 (142)	.03
Binge drinking, No. (%)	951	145 (15.2)	26 (11.8)	33 (14.0)	41 (16.9)	44 (17.9)	.05
Diabetes, No. (%)	1277	283 (22.2)	47 (16.6)	62 (20.9)	84 (24.6)	88 (25.6)	.004
Hypertension medication, No. (%)	1326	728 (54.9)	139 (47.4)	180 (58.6)	201 (56.6)	203 (56.9)	.04
Negative affect, mean (SD)	930	0.0 (0.8)	−0.2 (0.7)	0.0 (0.8)	0.1 (0.9)	0.1 (0.8)	.003
Optimism, mean (SD)	1208	19.0 (3.5)	19.9 (3.2)	18.9 (3.3)	18.8 (3.5)	18.5 (3.6)	<.001
Follow-Up							
Heart failure, No. (%)	1448	334 (23.1)	55 (17.4)	66 (19.3)	100 (26.1)	110 (28.0)	<.001
Death, No. (%)	1448	640 (44.2)	113 (35.8)	149 (43.6)	165 (43.1)	205 (52.2)	<.001
Perceived neighborhood problems			***−2.04 to -0.56***	***−0.55 to 0.00***	***0.01 to 0.55***	***0.56 to 1.4***	
Baseline							
Age, mean (SD), y	1448	64.3 (5.5)	63.3 (5.1)	64.5 (5.4)	64.1 (5.3)	65.3 (5.8)	<.001
Female sex, No. (%)	1448	960 (66.3)	164 (62.8)	217 (71.1)	207 (70.6)	212 (76.0)	.002
Education, mean (SD), y	1439	13.4 (4.5)	14.7 (4.3)	14.9 (4.4)	12.8 (3.9)	12.1 (4.4)	<.001
Below federal poverty line, No. (%)	1290	184 (14.3)	22 (9.4)	20 (7.1)	45 (17.2)	43 (17.6)	<.001
Smoking history, No. (%)							
Current	1294	197 (15.2)	33 (13.9)	25 (9.0)	55 (20.6)	29 (11.5)	<.001
Former		466 (36.0)	97 (40.8)	89 (32.1)	99 (37.1)	86 (34.0)	
Never		631 (48.8)	108 (45.4)	163 (58.8)	113 (42.3)	138 (54.5)	
Physical activity, mean (SD), min/week	1308	110.9 (150.3)	131.1 (162.0)	124 (163.3)	96 (140.4)	93 (142.5)	.006
Binge drinking, No. (%)	951	145 (15.2)	27 (14.4)	16 (8.7)	28 (14.1)	30 (17.0)	.25
Diabetes, No. (%)	1277	283 (22.2)	45 (19.2)	52 (19.0)	62 (23.6)	52 (20.9)	.40
Hypertension medication, No. (%)	1326	728 (54.9)	115 (47.7)	153 (54.1)	158 (57.9)	147 (57.0)	.03
Negative affect, mean (SD)	930	0.0 (0.8)	−0.1 (0.8)	−0.1 (0.7)	0.0 (0.8)	0.1 (0.9)	.01
Optimism, mean (SD)	1208	19.0 (3.5)	19.7 (3.5)	19.4 (3.2)	18.7 (3.4)	18.5 (3.6)	<.001
Follow-Up							
Heart failure, No. (%)	1448	334 (23.1)	59 (22.6)	55 (18.0)	72 (24.6)	78 (28.0)	.04
Death, No. (%)	1448	640 (44.2)	99 (37.9)	112 (36.7)	122 (41.6)	131 (47.0)	.01

Study baseline defined as January 1st, 2000. The Area Deprivation Index ranges from 1 to 100. Quartiles in the analytic sample ranged from 31 to 100. Perceived neighborhood problems was calculated from a standardized multilevel categorical confirmatory factor analysis model. Quartiles in the analytic sample ranged from −2.04 to 1.46. Univariate baseline differences in study variables were assessed using linear regression, Cochran-Armitage trend tests, Cochran-Mantel-Haenszel trend tests as appropriate.

Studies have previously indicated diverging mechanisms for psychosocial risk and resilience on health (Kubzansky et al., 2018; Watson et al., 1988). The novel contribution of our study is the identification of the potentially distinct effects of objective and subjective neighborhood disadvantage on HF risk that are differentially moderated by psychosocial risk and resilience. While our results demonstrate that higher optimism is likely to buffer the effect of objectively measured indicators of neighborhood deprivation on increased risk of HF, optimism is less likely to impact how subjective perceptions of neighborhood problems affect HF risk, and that negative affect moderates the (direct) effect of neither objective nor subjective disadvantage on HF risk. We specify "direct" effect here because we do not interpret these results as evidence that negative affect does not operate to influence the impact of neighborhood stressors on HF outcomes—indeed another of our recent analyses (Bey et al., 2022) found that negative affect does moderate the *indirect* (mediated) effect of PNP through accelerated biological aging on incident HF. Instead, we take these findings as support for the necessity of efforts that both promote resilience factors and ameliorate risk factors for HF given indication of their distinct mechanisms.

4.2. Potential mechanisms for optimism's protective effect

Theoretical frameworks accounting for the substantial buffering quality of optimism have largely identified the psychological disposition as a determinant of health-promoting behaviors (Boehm et al., 2018; Rozanski et al., 2019; Sims et al., 2019). Those who are more optimistic tend to engage in healthier behaviors even when accounting for social disadvantage (Boehm et al., 2018; Kubzansky et al., 2018). While the literature base is smaller, some studies have also found optimism to directly correlate with physiological processes related to stress (Boehm & Kubzansky, 2012). Other studies have identified optimism as influential on coping behavior, where higher levels of optimism predict active rather than passive coping (Strutton & Lumpkin, 1992) which in turn may yield engagement in healthier behaviors, increased care seeking, and reduced psychological distress in response to stressor exposure (Baumgartner et al., 2018; David et al., 2006). Although we did not directly test the influence of optimism on coping behaviors in this study, our finding that optimism's moderating effect was more pronounced for objective neighborhood disadvantage, an exposure hypothesized to act primarily through shaping health behaviors and healthcare access to affect HF risk (Barber et al., 2016; Diez Roux, 2016; Kind & Buckingham, 2018) speaks to the validity of this assertion.

To optimize the utility of findings such as these in effectively targeting the disproportionate burden of HF among NH Black persons, it is also important to identify modifiable antecedents of optimism within this group. Counter to some understandings of dispositional optimism as

Table 2
Moderating role of psychosocial risk and resilience in the relationship between neighborhood disadvantage and incident heart failure: ARIC-JHS cohort 2000–2017 (n = 1448).

	Main Effects		Interaction
	HR (95% CI)	HR (95% CI)	HR (95% CI)
Area Deprivation Index (Standardized)	1.22 (1.05–1.42)		1.24 (0.94–1.62)
Negative Affect (T2 vs T1)		1.25 (0.88–1.77)	1.24 (0.85–1.82)
Negative Affect (T3 vs T1)		1.28 (0.91–1.80)	1.28 (0.88–1.85)
Area Deprivation Index X Negative Affect (T2 vs T1)			0.98 (0.68–1.43)
Area Deprivation Index X Negative Affect (T3 vs T1)			0.97 (0.66–1.43)
Area Deprivation Index (Standardized)	1.22 (1.05–1.42)		1.37 (1.09–1.71)
Optimism (T2 vs T1)		0.79 (0.59–1.06)	0.80 (0.55–1.16)
Optimism (T3 vs T1)		0.97 (0.70–1.34)	1.11 (0.79–1.57)
Area Deprivation Index X Optimism (T2 vs T1)			0.99 (0.66–1.48)
Area Deprivation Index X Optimism (T3 vs T1)			0.71 (0.51–0.99)
Perceived Neighborhood Problems (Standardized)	1.13 (1.00–1.29)		1.15 (0.92–1.43)
Negative Affect (T2 vs T1)		1.25 (0.88–1.77)	1.22 (0.86–1.74)
Negative Affect (T3 vs T1)		1.28 (0.91–1.80)	1.26 (0.90–1.77)
Perceived Neighborhood Problems X Negative Affect (T2 vs T1)			0.96 (0.72–1.28)
Perceived Neighborhood Problems X Negative Affect (T3 vs T1)			0.98 (0.73–1.32)
Perceived Neighborhood Problems (Standardized)	1.13 (1.00–1.29)		1.13 (0.96–1.33)
Optimism (T2 vs T1)		0.79 (0.59–1.06)	0.80 (0.59–1.07)
Optimism (T3 vs T1)		0.97 (0.70–1.34)	0.97 (0.70–1.36)
Perceived Neighborhood Problems X Optimism (T2 vs T1)			1.13 (0.84–1.52)
Perceived Neighborhood Problems X Optimism (T3 vs T1)			0.90 (0.69–1.18)

Abbreviations: CI, confidence intervals; HR, hazard ratio.
Area Deprivation Index ranges from 1 to 100. One standard deviation is equal to 14.77. Perceived neighborhood problems was calculated from a standardized multilevel categorical confirmatory factor analysis model. Factor scores range from −2.04 to 1.46. Negative affect was calculated from a single level continuous confirmatory factor analysis model. Tertiles (T) ranged from −1.71 to 4.83 (T1 = −1.71 to −0.38, T2 = −0.37 to 0.23, T3 = 0.24 to 4.83). Optimism ranges from 6 to 24. One standard deviation is equal to 3.3 and tertiles (T) ranged from 8 to 24 (T1 = 8 to 18, T2 = 19 to 22, T3 = 23 to 24). The outcome of adjudicated incident heart failure was determined from medical records. Hazard ratios (HR) and 95% confidence intervals (CI) were estimated utilizing cause-specific, multilevel Cox proportional hazards regression models with robust error variance and a shared frailty term with a gamma distribution. Multivariate imputation by chained equations was employed to impute missing values. All models included adjustments for sex, age, years of education, whether or not the participant was below the federal poverty line, smoking, physical activity, binge-drinking, diabetes, and the use of hypertension medication as time-invariant covariates.

an innate individual difference (Seligman, 2006; Sohl et al., 2011), some compelling work conceptualizes optimism as a learned frame of reference (Seligman, 2006; Sohl et al., 2011). This characterization of optimism is consistent with research demonstrating an Afrocentric orientation as predictive of optimism among Black persons (Myers et al., 1991) and other recent work identifying effective interventions to promote optimism (Malouff & Schutte, 2017). With this understanding of optimism as a health-relevant, modifiable characteristic, promoting the sociocultural determinants of optimism among Black persons may be a viable complementary method of addressing their disproportionate risk for HF.

4.3. *Strengths and limitations*

This analysis uses robust multilevel models that capture the complex pathways linking neighborhood disadvantage with the development of HF outlined by a comprehensive theoretical framework. Additionally, we took an innovative approach to investigating within-race variability in HF risk and resilience factors among Black persons. Despite the many strengths of this work, we note some important limitations that should be considered in interpretation of our findings. Our findings are not based on a nationally-representative sample and should only be cautiously generalized beyond Black persons in Jackson, MS. For this analysis we assumed that the level of perceived neighborhood problems was consistent over time and indicative of chronic rather than acute stress although this exposure was assessed only at the JHS baseline visit. Even considering potential changes to the neighborhood environment over time, the low level of residence transition within our study population (~14%) (Wang et al., 2017) as well as studies showing that stressors tend to accumulate over the life course (Sternthal et al., 2011) over the study period suggests the validity of this assumption.

4.4. *Public health implications*

Many health disparities scholars have expressed concerns regarding the implications of focusing on promoting what have been characterized as “individual-level” sources of resilience (Howe et al., 2022). According to these schools of thought, such methods are in danger of placing undue responsibility on the individual to counter harmful effects of the system-level policies and practices at the root of health inequities and are likely to be less effective at the population level when implemented absent structural interventions (Churchwell et al., 2020; Gómez et al., 2021; Howe et al., 2022; Krieger, 2001). These critiques accurately identify the structural and environmental constraints that may influence individual behaviors, attitudes, and choices, as described earlier. Still, despite clear evidence for a compelling role of deprived and disadvantages social environments in poorer health outcomes in the U.S. (Nayak et al., 2020), the potential of policy change has yet to be realized as evidenced by the persistence, and in some cases, increases, in disparities in HF incidence, prevalence, hospitalization, and mortality be Black and White populations (Lewsey & Breathett, 2021; Ziaeian et al., 2017).

The literature on structural interventions to promote health equity is robust and documents several evidence-based policy-level strategies for eliminating practices that reinforce inequitable health outcomes (Brown et al., 2019; Gómez et al., 2021). This recommendations have been slow to be implemented, however, given the substantial investment—political, economic, and temporal—in the context of vacillating public support for such policies. As noted by Lett et al., 2022, increased public awareness of, and attention to, the impact of structural racism on Black persons—for example, the mass participation in protests following the murder of George Floyd (Reny & Newman, 2021)—can quickly decline as the challenges to enacting effective structural changes become apparent (Bunn, 2023). These include resistance or reversal from individuals with decision-making authority (Bunn, 2023; Gonzales, 2023), the emotional and psychological toll on members of minoritized ethnoracial groups engaging in diversity, equity, and inclusion advocacy

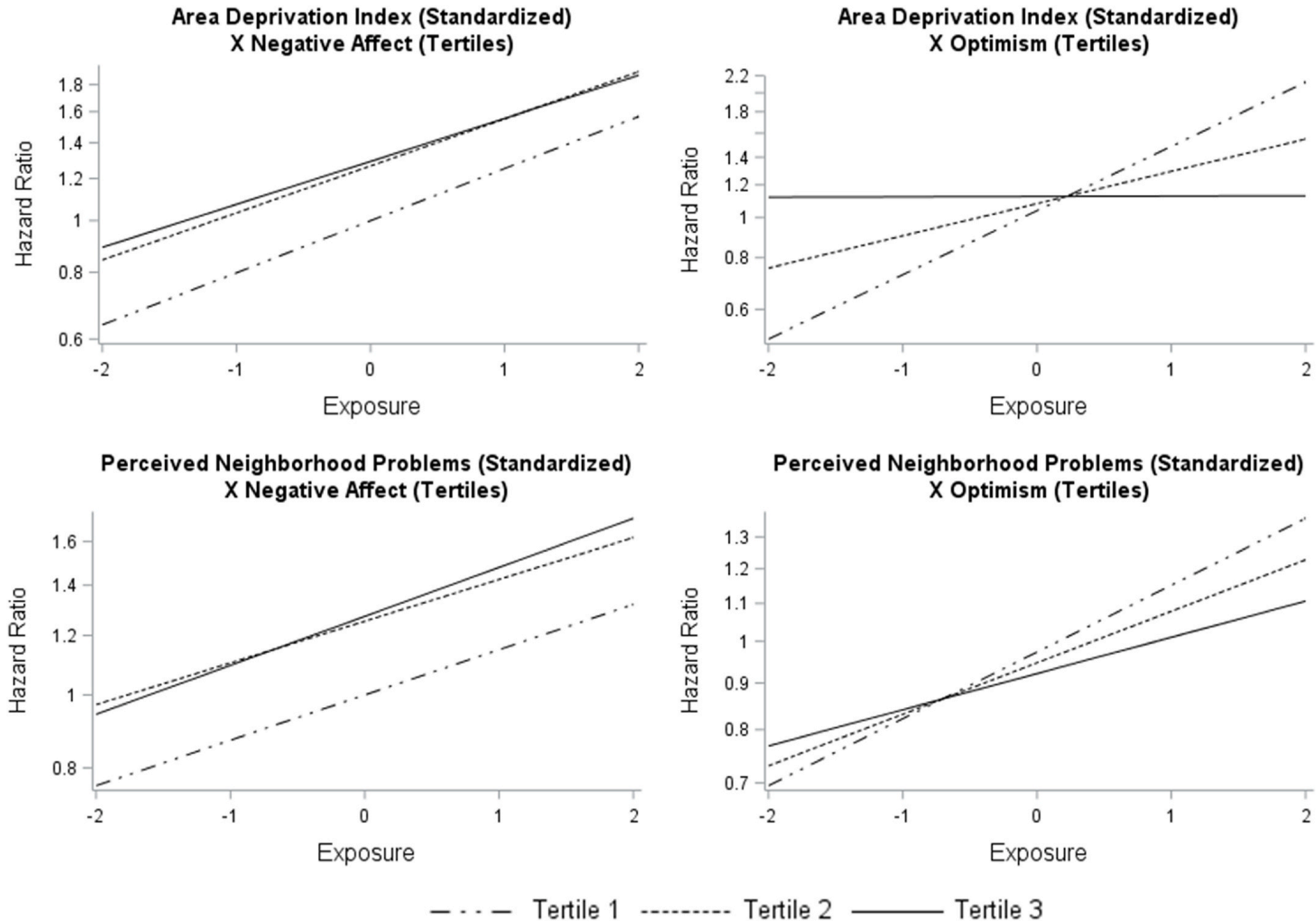

Fig. 2. Visualization of Moderating Role of Psychosocial Risk and Resilience in the Relationship Between Neighborhood Disadvantage and Incident Heart Failure: ARIC-JHS Cohort 2000–2017 (n = 1448)
Parameter estimates were calculated from multivariable, cause-specific, multilevel Cox proportional hazards regression models with robust error variance and a shared frailty term with a gamma distribution. Models were fit to imputed data. Visualization created by utilizing parameter estimates to generate values for a hypothetical male participant who lived above the federal poverty line, never smoked, did not engage in regular physical activity or binge-drinking, did not use hypertension medication, did not have diabetes, and whose age and years of education were equal to the sample mean.

work (Lett et al., 2022; Spence, 2022), the continued highly publicized violent backlash against movements toward racial equity (Rickford, 2016), and the actions of members of oppressed groups that further perpetuate the belief systems that uphold the very structures these efforts are intended to dismantle (Dean, 2013; Yellow Horse et al., 2021).

Despite ongoing barriers, strategies to enact policies to promote equity are integral to removing the fundamental causes of inequitable health outcomes. This goal may be further advanced by identifying narrative elements of social equity dialogue that may be reframed to better capture the utility of simultaneously promoting the development of protective cultural values. While correctly identifying a predominant role of structural inequity in perpetuating unequal health outcomes, some approaches to addressing structural determinants of health may also inadvertently undervalue health-promoting cultural characteristics often unique to racially minoritized and marginalized populations, for example communalism and spirituality (Carter et al., 2020), and give preeminence to those which are celebrated in Eurocentric paradigms—wealth and political power (Baldwin, 1992; Graeber & Wengrow, 2021; Myers et al., 1991). While a consistent body of evidence *has* established wealth and material resources as the strongest predictors of health outcomes in the U.S., this research base has on the whole failed to consider that perhaps the relationship between material advantage and health status is not ineluctable but may itself be a function of Eurocentric social paradigms (Bey, 2022; Huang & Grol-Prokopczyk, 2022; Morrison & Hopkins, 2019). In departure from these frameworks, we do not advocate a simplistic approach that reduces ethnoracial disparities in HF outcomes to a lack of adequate optimism or other individual sources of resilience among Black populations. Instead, we suggest the need, in tandem with a given need to address structural sources of social inequity, for increased recognition of the health benefits associated with sociocultural sources of resilience factors such as optimism that are characteristic of Black communities (Graham, 2015, 2017).

Interventions targeting psychosocial risk or resilience factors may not only enable resilience to the health effects of inequitable social conditions but may also promote a shift of beliefs and values that enables the fortitude and stamina necessary to engage in the long work of dismantling structural racism. An emerging stress and coping framework for health disparities, the Identity-Vitality Pathology model, theorizes that one of the primary mechanisms by which environmental exposures influence optimistic disposition or other psychosocial influences on health is through the elevation of Eurocentric values, particularly those that predicate human worth on their social status (Bey, 2022). Social influences on what to value and in whom are not limited to racial majority populations. Indeed, Cross' work on racial identity (Vandiver et al., 2000), among others, describes the influence of internalized racism on concepts of self-worth, mental health, and several other indicators of well-being related to optimism (Mouzon & McLean, 2017). Black persons adopting Eurocentric values of social hierarchies based on arbitrarily assigned worth are therefore susceptible to the impact of these values on their psychological disposition and health.

Operating within this framework, we therefore suggest interventions which promote fundamental changes in how individuals value themselves and others (e.g. culturally-tailored mind-body programs that uplift Afrocentric values (Woods-Giscombé & Black, 2010) and interventions on unconscious biases as described by Devine et al., 2012) as well as those targeting community-level influences on optimism (e.g. increased community spaces to foster positive social interactions, Vacharkulksemsuk & Fredrickson, 2013) are necessary components of any strategy that will effectively eliminate ethnoracial disparities in health. Our analyses identifying an interactive effect of neighborhood-level and individual level factors in influencing HF risk results support interventions leveraging these approaches. Ultimately, given a persistence in HF disparities even in the context of the large and ever-growing evidence base for the efficacy of structural-level policy interventions, we suggest a need to also consider novel approaches that may be valid and underused strategies for both reducing structural inequities and the ethnoracial disparities in HF they cause. These include—in addition to policies aimed directly at increasing more equitable distribution of social services and material resources—efforts that draw upon culturally-protective factors and directly target disrupting the relationship between deprived neighborhood conditions and health. In this way, the goal of advancing health equity may therefore be additionally served by further research empirically demonstrating a capacity for enabling healthier outcomes even amongst populations exposed to persistent social and material disadvantage.

Authorship statement

Dr. Ganga Bey – conceptualized the study, secured funding, drafted the manuscript, and revised based on co-authors suggestions.

Mr. James Pike – assisted with data procurement, conducted all statistical analyses for the manuscript and produced visualizations and tables, and reviewed manuscript for intellectual content.

Dr. Priya Palta – contributed to the conceptualization and design of the study and provided subject matter expertise through detailed review of the manuscript.

Declaration of competing interest

None.

Data availability

The authors do not have permission to share data.

Abbreviations

ADI Area Deprivation Index
PNP Percieved Neighborhood Problems

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ssmph.2023.101475.

References

Austin, P. C., Wagner, P., & Merlo, J. (2017). The median hazard ratio: A useful measure of variance and general contextual effects in multilevel survival analysis: The median hazard ratio. *Statistics in Medicine, 36*(6), 928–938. https://doi.org/10.1002/sim.7188

Bahrami, H., Kronmal, R., Bluemke, D. A., Olson, J., Shea, S., Liu, K., Burke, G. L., & Lima, J. A. C. (2008). Differences in the incidence of congestive heart failure by ethnicity: The multi-ethnic study of atherosclerosis. *Archives of Internal Medicine, 168*(19), 2138–2145. https://doi.org/10.1001/archinte.168.19.2138

Baldwin, J. (1992). *Nobody knows my name*. Chicago: Vintage.

Barber, S., Hickson, D. A., Wang, X., Sims, M., Nelson, C., & Diez-Roux, A. V. (2016). Neighborhood disadvantage, poor social conditions, and cardiovascular disease incidence among African American adults in the Jackson heart study. *American Journal of Public Health, 106*(12), 2219–2226. https://doi.org/10.2105/AJPH.2016.303471

Barefoot, J. C., Dodge, K. A., Peterson, B. L., Dahlstrom, W. G., & Williams, R. B. (1989). The Cook-Medley hostility scale: Item content and ability to predict survival. *Psychosomatic Medicine, 51*(1), 46–57. https://doi.org/10.1097/00006842-198901000-00005

Baumgartner, J. N., Schneider, T. R., & Capiola, A. (2018). Investigating the relationship between optimism and stress responses: A biopsychosocial perspective. *Personality and Individual Differences, 129*, 114–118. https://doi.org/10.1016/j.paid.2018.03.021

Bey, G. S. (2022). The identity vitality-pathology model: A novel theoretical framework proposing "identity state" as a modulator of the pathways from structural to health inequity. *Social Science & Medicine, 314*, Article 115495.

Bey, G., Pike, J., Palta, P., Zannas, A., Xiao, Q., Love, S. A., & Heiss, G. (2022). Biological Age Mediates the Effects of Perceived Neighborhood Problems on Heart Failure Risk Among Black Persons. *Journal of racial and ethnic health disparities*. Advance online publication. https://doi.org/10.1007/s40615-022-01476-3

Boehm, J. K., Chen, Y., Koga, H., Mathur, M. B., Vie, L. L., & Kubzansky, L. D. (2018). Is optimism associated with healthier cardiovascular-related behavior? *Circulation Research, 122*(8), 1119–1134. https://doi.org/10.1161/CIRCRESAHA.117.310828

Boehm, J. K., & Kubzansky, L. D. (2012). The heart's content: The association between positive psychological well-being and cardiovascular health. *Psychological Bulletin, 138*(4), 655–691. https://doi.org/10.1037/a0027448

Brosschot, J. F., Verkuil, B., & Thayer, J. F. (2018). Generalized unsafety theory of stress: Unsafe environments and conditions, and the default stress response. *International Journal of Environmental Research and Public Health, 15*(3), E464. https://doi.org/10.3390/ijerph15030464

Brown, A. F., Ma, G. X., Miranda, J., Eng, E., Castille, D., Brockie, T., Jones, P., Airhihenbuwa, C. O., Farhat, T., Zhu, L., & Trinh-Shevrin, C. (2019). Structural interventions to reduce and eliminate health disparities. *American Journal of Public Health, 109*(S1), S72–S78. https://doi.org/10.2105/AJPH.2018.304844

Bunn, C. (2023). Hamstrung by 'golden handcuffs': Diversity roles disappear 3 years after George Floyd's murder inspired them. *NBC News*. February 27, 2023 https://www.nbcnews.com/news/nbcblk/diversity-roles-disappear-three-years-george-floyd-protests-inspired-rcna72026.

van Buuren, S. (2007). Multiple imputation of discrete and continuous data by fully conditional specification. *Statistical Methods in Medical Research, 16*(3), 219–242. https://doi.org/10.1177/0962280206074463

Carter, R. T., Kirkinis, K., & Johnson, V. E. (2020). Relationships between trauma symptoms and race-based traumatic stress. *Traumatology, 26*(1), 11.

Chang, P. P., Wruck, L. M., Shahar, E., Rossi, J. S., Loehr, L. R., Russell, S. D., Agarwal, S. K., Konety, S. H., Rodriguez, C. J., & Rosamond, W. D. (2018). Trends in hospitalizations and survival of acute decompensated heart failure in four US communities (2005-2014): The atherosclerosis risk in communities (ARIC) study community surveillance. *Circulation, 138*(1), 12–24. https://doi.org/10.1161/CIRCULATIONAHA.117.027551

Chen, J., Christ, N. M., Shih, C. H., Xie, H., Grider, S. R., Lewis, C., … Wang, X. (2021). Dispositional optimism mediates relations between childhood maltreatment and PTSD symptom severity among trauma-exposed adults. *Child Abuse & Neglect, 115*, Article 105023.

Churchwell, K., Elkind, M. S. V., Benjamin, R. M., Carson, A. P., Chang, E. K., Lawrence, W., Mills, A., Odom, T. M., Rodriguez, C. J., Rodriguez, F., Sanchez, E., Sharrief, A. Z., Sims, M., Williams, O., & null, null (2020). Call to action: Structural racism as a fundamental driver of health disparities: A presidential advisory from the American heart association. *Circulation, 142*(24), e454–e468. https://doi.org/10.1161/CIR.0000000000000936

David, D., Montgomery, G. H., & Bovbjerg, D. H. (2006). Relations between coping responses and optimism-pessimism in predicting anticipatory psychological distress in surgical breast cancer patients. *Personality and Individual Differences, 40*(2), 203–213. https://doi.org/10.1016/j.paid.2005.05.018

Dean, J. J. (2013). Heterosexual masculinities, anti-homophobias, and shifts in hegemonic masculinity: The identity practices of black and white heterosexual men. *The Sociological Quarterly, 54*(4), 534–560.

Devine, P. G., Forscher, P. S., Austin, A. J., & Cox, W. T. (2012). Long-term reduction in implicit race bias: A prejudice habit-breaking intervention. *Journal of Experimental Social Psychology, 48*(6), 1267–1278.

Diez Roux, A. V. (2016). Neighborhoods and health: What do we know? What should we do? *American Journal of Public Health, 106*(3), 430–431. https://doi.org/10.2105/AJPH.2016.303064

Diez-Roux, A. V., Nieto, F. J., Muntaner, C., Tyroler, H. A., Comstock, G. W., Shahar, E., Cooper, L. S., Watson, R. L., & Szklo, M. (1997). Neighborhood environments and coronary heart disease: A multilevel analysis. *American Journal of Epidemiology, 146*(1), 48–63. https://doi.org/10.1093/oxfordjournals.aje.a009191

Egede, L. E., Walker, R. J., Campbell, J. A., Linde, S., Hawks, L. C., & Burgess, K. M. (2023). Modern day consequences of historic redlining: Finding a path forward. *Journal of General Internal Medicine, 38*(6), 1534–1537. https://doi.org/10.1007/s11606-023-08051-4

Elo, I. T., Mykyta, L., Margolis, R., & Culhane, J. F. (2009). Perceptions of neighborhood disorder: The role of individual and neighborhood characteristics. *Social Science Quarterly, 90*(5), 1298–1320. https://doi.org/10.1111/j.1540-6237.2009.00657.x

Felix, A. S., Lehman, A., Nolan, T. S., Sealy-Jefferson, S., Breathett, K., Hood, D. B., Addison, D., Anderson, C. M., Cené, C. W., Warren, B. J., Jackson, R. D., & Williams, K. P. (2019). Stress, resilience, and cardiovascular disease risk among black women: Results from the women's health initiative. *Circulation: Cardiovascular Quality and Outcomes, 12*(4). https://doi.org/10.1161/CIRCOUTCOMES.118.005284

Gary, T. L., Safford, M. M., Gerzoff, R. B., Ettner, S. L., Karter, A. J., Beckles, G. L., & Brown, A. F. (2008). Perception of neighborhood problems, health behaviors, and diabetes outcomes among adults with diabetes in managed care: The translating research into action for diabetes (TRIAD) study. *Diabetes Care, 31*(2), 273–278. https://doi.org/10.2337/dc07-1111

Gebreab, S. Y., Riestra, P., Gaye, A., Khan, R. J., Xu, R., Davis, A. R., Quarells, R. C., Davis, S. K., & Gibbons, G. H. (2016). Perceived neighborhood problems are associated with shorter telomere length in African American women. *Psychoneuroendocrinology, 69*, 90–97. https://doi.org/10.1016/j.psyneuen.2016.03.018

Gómez, C. A., Kleinman, D. V., Pronk, N., Wrenn Gordon, G. L., Ochiai, E., Blakey, C., Johnson, A., & Brewer, K. H. (2021). Addressing health equity and social determinants of health through healthy people 2030. *Journal of Public Health Management and Practice, 27*(Supplement 6), S249. https://doi.org/10.1097/PHH.0000000000001297

Gonzales, M. (2023). Why are DEI roles disappearing? *SHRM*. March 15, 2023 https://www.shrm.org/resourcesandtools/hr-topics/behavioral-competencies/global-and-cultural-effectiveness/pages/why-are-dei-roles-disappearing-.aspx.

Graeber, D., & Wengrow, D. (2021). *The dawn of everything: A new history of humanity*. UK: Penguin.

Graham, C. (2015). The surprising optimism of Black Americans. *Social Mobility Memos*. https://www.brookings.edu/blog/social-mobility-memos/2015/09/25/the-surprising-optimism-of-black-americans/.

Graham, C. (2017). In *Happiness for all? Unequal Hopes and Lives in Pursuit of the American Dream*. Princeton University Press.

von Hippel, P. T. (2020). How many imputations do you need? A two-stage calculation using a quadratic rule. *Sociological Methods & Research, 49*(3), 699–718. https://doi.org/10.1177/0049124117747303

Howe, C. J., Bailey, Z. D., Raifman, J. R., & Jackson, J. W. (2022). Recommendations for using causal diagrams to study racial health disparities. *American Journal of Epidemiology*. , Article kwac140. https://doi.org/10.1093/aje/kwac140

Huang, R., & Grol-Prokopczyk, H. (2022). Health and health behaviors in China: Anomalies in the SES-health gradient? *SSM - population health, 17*, Article 101069. https://doi.org/10.1016/j.ssmph.2022.101069

Keita, A. D., Casazza, K., Thomas, O., & Fernandez, J. R. (2011). Neighborhood perceptions affect dietary behaviors and diet quality. *Journal of Nutrition Education and Behavior, 43*(4), 244–250. https://doi.org/10.1016/j.jneb.2009.07.004

Kim, E. S., Smith, J., & Kubzansky, L. D. (2014). Prospective study of the association between dispositional optimism and incident heart failure. *Circulation: Heart Failure, 7*(3), 394–400. https://doi.org/10.1161/CIRCHEARTFAILURE.113.000644

Kind, A. J. H., & Buckingham, W. R. (2018). Making neighborhood-disadvantage metrics accessible—the neighborhood atlas. *New England Journal of Medicine, 378*(26), 2456–2458. https://doi.org/10.1056/NEJMp1802313

Krieger, N. (2001). Theories for social epidemiology in the 21st century: An ecosocial perspective. *International Journal of Epidemiology, 30*(4), 668–677. https://doi.org/10.1093/ije/30.4.668

Kubzansky, L. D., Huffman, J. C., Boehm, J. K., Hernandez, R., Kim, E. S., Koga, H. K., Feig, E. H., Lloyd-Jones, Donald M., Seligman, M. E. P., & Labarthe, D. R. (2018). Positive psychological well-being and cardiovascular disease. *Journal of the American College of Cardiology, 72*(12), 1382–1396. https://doi.org/10.1016/j.jacc.2018.07.042

Lett, E., Adekunle, D., McMurray, P., Asabor, E. N., Irie, W., Simon, M. A., … McLemore, M. R. (2022). Health equity tourism: Ravaging the justice landscape. *Journal of Medical Systems, 46*(3), 17.

Lewsey, S. C., & Breathett, K. (2021). Racial and ethnic disparities in heart failure: current state and future directions. *Current opinion in cardiology, 36*(3), 320–328.

Lu, A. T., Quach, A., Wilson, J. G., Reiner, A. P., Aviv, A., Raj, K., Hou, L., Baccarelli, A. A., Li, Y., Stewart, J. D., Whitsel, E. A., Assimes, T. L., Ferrucci, L., & Horvath, S. (2019). DNA methylation GrimAge strongly predicts lifespan and healthspan. *Aging, 11*(2), 303–327. https://doi.org/10.18632/aging.101684

Malouff, J. M., & Schutte, N. S. (2017). Can psychological interventions increase optimism? A meta-analysis. *The Journal of Positive Psychology, 12*(6), 594–604. https://doi.org/10.1080/17439760.2016.1221122

McEwen, B. S. (2000). Allostasis and allostatic load: Implications for neuropsychopharmacology. *Neuropsychopharmacology, 22*(2). https://doi.org/10.1016/S0893-133X(99)00129-3. Article 2.

Mersky, J. P., Choi, C., Lee, C. P., & Janczewski, C. E. (2021). Disparities in adverse childhood experiences by race/ethnicity, gender, and economic status: Intersectional analysis of a nationally representative sample. *Child Abuse & Neglect, 117*, Article 105066.

Messer, L. C., Oakes, J. M., & Mason, S. (2010). Effects of socioeconomic and racial residential segregation on preterm birth: A cautionary tale of structural confounding. *American Journal of Epidemiology, 171*(6), 664–673. https://doi.org/10.1093/aje/kwp435

Morrison, K. S., & Hopkins, R. (2019). Cultural identity, africultural coping strategies, and depression as predictors of suicidal ideations and attempts among African American female college students. *Journal of Black Psychology, 45*(1), 3–25. https://doi.org/10.1177/0095798418813511

Mouzon, D. M., & McLean, J. S. (2017). Internalized racism and mental health among African-Americans, US-born caribbean blacks, and foreign-born caribbean blacks. *Ethnicity and Health, 22*(1), 36–48.

Myers, L. J., Speight, S. L., Highlen, P. S., Cox, C. I., Reynolds, A. L., Adams, E. M., & Hanley, C. P. (1991). Identity development and worldview: Toward an optimal conceptualization. *Journal of Counseling and Development, 70*(1), 54–63. https://doi.org/10.1002/j.1556-6676.1991.tb01561.x

Nabi, H., Kivimaki, M., Vogli, R. D., Marmot, M. G., & Singh-Manoux, A. (2008). Positive and negative affect and risk of coronary heart disease: Whitehall II prospective cohort study. *BMJ, 337*(jun30 1). https://doi.org/10.1136/bmj.a118. a118–a118.

Nayak, A., Hicks, A. J., & Morris, A. A. (2020). Understanding the complexity of heart failure risk and treatment in black patients. *Circulation: Heart Failure, 13*(8), Article e007264.

Nguyen, C. D., Carlin, J. B., & Lee, K. J. (2017). Model checking in multiple imputation: An overview and case study. *Emerging Themes in Epidemiology, 14*, 8. https://doi.org/10.1186/s12982-017-0062-6

Phelan, J. C., Link, B. G., & Tehranifar, P. (2010). Social conditions as fundamental causes of health inequalities: Theory, evidence, and policy implications. *Journal of Health and Social Behavior, 51*(1_suppl), S28–S40. https://doi.org/10.1177/0022146510383498

Reny, T. T., & Newman, B. J. (2021). The opinion-mobilizing effect of social protest against police violence: Evidence from the 2020 George Floyd protests. *American Political Science Review, 115*(4), 1499–1507.

Rickford, R. (2016). Black lives matter: Toward a modern practice of mass struggle. In *New labor forum* (Vol. 25, pp. 34–42). Sage CA: Los Angeles, CA: SAGE Publications. No. 1.

Robins, J. M., & Rotnitzky, A. (1992). Recovery of information and adjustment for dependent censoring using surrogate markers. In N. P. Jewell, K. Dietz, & V. T. Farewell (Eds.), *AIDS epidemiology: Methodological issues* (pp. 297–331). https://doi.org/10.1007/978-1-4757-1229-2_14. Birkhäuser.

Robins, J. M., Rotnitzky, A., & Zhao, L. P. (1995). Analysis of semiparametric regression models for repeated outcomes in the presence of missing data. *Journal of the American Statistical Association, 90*(429), 106–121. https://doi.org/10.2307/2291134

Rosamond, W. D., Chang, P. P., Baggett, C., Johnson, A., Bertoni, A. G., Shahar, E., Deswal, A., Heiss, G., & Chambless, L. E. (2012). Classification of heart failure in the atherosclerosis risk in communities (ARIC) study: A comparison of diagnostic criteria. *Circulation. Heart failure, 5*(2), 152–159. https://doi.org/10.1161/CIRCHEARTFAILURE.111.963199

Ross, C. E., & Mirowsky, J. (1999). Disorder and decay: The concept and measurement of perceived neighborhood disorder. *Urban Affairs Review, 34*(3), 412–432. https://doi.org/10.1177/107808749903400304

Rozanski, A., Bavishi, C., Kubzansky, L. D., & Cohen, R. (2019). Association of optimism with cardiovascular events and all-cause mortality: A systematic review and meta-analysis. *JAMA Network Open, 2*(9), Article e1912200. https://doi.org/10.1001/jamanetworkopen.2019.12200

Rubin, D. B. (1987). Multiple imputation for nonresponse in surveys. In *Multiple imputation for nonresponse in surveys* (pp. i–xxix). John Wiley & Sons, Ltd. https://doi.org/10.1002/9780470316696.fmatter.

Sampson, R. J. (2013). The place of context: A theory and strategy for criminology's hard problems. *Criminology, 51*(1), 1–31. https://doi.org/10.1111/1745-9125.12002

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the life orientation test. *Journal of Personality and Social Psychology, 67*(6), 1063–1078. https://doi.org/10.1037//0022-3514.67.6.1063

Seligman, M. E. P. (2006). *Learned optimism: How to change your mind and your life*. Knopf Doubleday Publishing Group.

Sims, M., Glover, L. M., Norwood, A. F., Jordan, C., Min, Y.-I., Brewer, L. C., & Kubzansky, L. D. (2019). Optimism and cardiovascular health among African Americans in the Jackson heart study. *Preventive Medicine, 129*, Article 105826. https://doi.org/10.1016/j.ypmed.2019.105826

Sims, M., Lipford, K. J., Patel, N., Ford, C. D., Min, Y.-I., & Wyatt, S. B. (2017). Psychosocial factors and behaviors in African Americans: The Jackson heart study. *American Journal of Preventive Medicine, 52*(1S1), S48–S55. https://doi.org/10.1016/j.amepre.2016.09.020

Sohl, S. J., Moyer, A., Lukin, K., & Knapp-Oliver, S. K. (2011). Why are optimists optimistic? *Individual Differences Research : ID, 9*(1), 1–11.

Spence, M. (2022). DEI leaders struggle to cope with burnout: What you can do to help. *Inclusion Learning Lab*. https://inclusionlearninglab.com/dei-leaders-struggle-to-cope-with-burnout-what-you-can-do-to-help/.

Spielberger, C. D., Krasner, S. S., & Solomon, E. P. (1988). The experience, expression, and control of anger. In M. P. Janisse (Ed.), *Individual differences, stress, and health psychology* (pp. 89–108). Springer. https://doi.org/10.1007/978-1-4612-3824-9_5.

Sternthal, M. J., Slopen, N., & Williams, D. R. (2011). Racial disparities in health: How much does stress really matter? *Du Bois Review: Social Science Research on Race, 8*(1), 95–113. https://doi.org/10.1017/S1742058X11000087

Strutton, D., & Lumpkin, J. (1992). Relationship between optimism and coping strategies in the work environment. *Psychological Reports, 71*(3 Pt 2), 1179–1186. https://doi.org/10.2466/pr0.1992.71.3f.1179

Taylor, H. A., Wilson, J. G., Jones, D., Sarpong, D., Srinivasan, A., Garrison, R., Nelson, C., & Wyatt, S. (2005). Toward resolution of cardiovascular health disparities in African Americans: Design and methods of the Jackson Heart Study. *Ethnicity & Disease, 15*(4 Suppl 6). https://pubmed.ncbi.nlm.nih.gov/16320381/.

Vacharkulksemsuk, T., & Fredrickson, B. L. (2013). Looking back and glimpsing forward: The broaden-and-build theory of positive emotions as applied to organizations. In *Advances in positive organizational psychology* (Vol. 1, pp. 45–60). Emerald Group Publishing Limited.

Vandiver, B. J., Cross, W. E., Jr., Fhagen-Smith, P. E., Worrell, F. C., Swim, J., & Caldwell, L. (2000). Cross racial identity scale. *Cultural Diversity and Ethnic Minority Psychology*.

Wang, X., Auchincloss, A. H., Barber, S., Mayne, S. L., Griswold, M. E., Sims, M., & Diez Roux, A. V. (2017). Neighborhood social environment as risk factors to health behavior among African Americans: The Jackson Heart Study. *Health & Place, 45*, 199–207. https://doi.org/10.1016/j.healthplace.2017.04.002

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063.

Wellen, K. E., & Hotamisligil, G. S. (2005). Inflammation, stress, and diabetes. *The Journal of Clinical Investigation, 115*(5), 1111–1119. https://doi.org/10.1172/JCI25102

Williams, D. R., Lawrence, J. A., & Davis, B. A. (2019). Racism and health: Evidence and needed research. *Annual Review of Public Health, 40*(1), 105–125. https://doi.org/10.1146/annurev-publhealth-040218-043750

Woods-Giscombé, C. L., & Black, A. R. (2010). Mind-body interventions to reduce risk for health disparities related to stress and strength among African American women: The potential of mindfulness-based stress reduction, loving-kindness, and the NTU therapeutic framework. *Complementary Health Practice Review, 15*(3), 115–131.

Wright, J. D., Folsom, A. R., Coresh, J., Sharrett, A. R., Couper, D., Wagenknecht, L. E., Mosley, T. H., Ballantyne, C. M., Boerwinkle, E. A., Rosamond, W. D., & Heiss, G. (2021). The ARIC (atherosclerosis risk in communities) study: JACC focus seminar 3/8. *Journal of the American College of Cardiology, 77*(23), 2939–2959. https://doi.org/10.1016/j.jacc.2021.04.035

Yellow Horse, A. J., Kuo, K., Seaton, E. K., & Vargas, E. D. (2021). Asian Americans' indifference to black lives matter: The role of nativity, belonging and acknowledgment of anti-black racism. *Social Sciences, 10*(5), 168.

Ziaeian, B., Kominski, G. F., Ong, M. K., Mays, V. M., Brook, R. H., & Fonarow, G. C. (2017). National differences in trends for heart failure hospitalizations by sex and race/ethnicity. *Circulation: Cardiovascular quality and outcomes, 10*, Article e003552.