



## The Mediating role of perceived discrimination and stress in the associations between neighborhood social environment and TV Viewing among Jackson Heart Study participants

Kosuke Tamura<sup>a,\*</sup>, Stephanie L. Orstad<sup>b</sup>, Ellen K. Cromley<sup>c</sup>, Sam J. Neally<sup>a</sup>, Sophie E. Claudel<sup>a</sup>, Marcus R. Andrews<sup>d</sup>, Joniqua Ceasar<sup>a</sup>, Mario Sims<sup>e</sup>, Tiffany M. Powell-Wiley<sup>a,f</sup>

<sup>a</sup> Social Determinants of Obesity and Cardiovascular Risk Laboratory, Cardiovascular Branch, Division of Intramural Research, National Heart, Lung, and Blood Institute, National Institutes of Health, 10 Center Drive, Bethesda, MD, 20892, USA

<sup>b</sup> Department of Medicine, Division of General Internal Medicine and Clinical Innovation, New York University Grossman School of Medicine, 550 1<sup>st</sup> Avenue, New York, NY, 10016, USA

<sup>c</sup> Institute for Collaboration on Health, Intervention, and Policy (InCHIP), University of Connecticut, 2006 Hillside Road, Unit 1248, Storrs, CT, 06269-1248, USA

<sup>d</sup> Department of Health Behavior and Health Education, School of Public Health, University of Michigan, 1415 Washington Heights, Ann Arbor, MI, 48109, USA

<sup>e</sup> Department of Medicine, University of Mississippi Medical Center, 2500 N State St, Jackson, MS, 39216, USA

<sup>f</sup> Intramural Research Program, National Institute on Minority Health and Health Disparities, National Institutes of Health, 6707 Democracy Boulevard, Bethesda, MD, 20892, USA

### ARTICLE INFO

#### Keywords:

Sedentary time  
Neighborhood social contexts  
Mediation analyses  
Objective built environment  
African americans  
Jackson heart study

### ABSTRACT

**Objectives:** The aim of this study was to test the mediating role of perceived discrimination and stress on associations between perceived neighborhood social environment (PNSE) and TV viewing.

**Methods:** Baseline data were used for 4716 participants (mean age = 55.1 y; 63.4% female) in the Jackson Heart Study (JHS), a large prospective cohort study of African Americans in Jackson, Mississippi. One binary TV viewing outcome was created:  $\geq 4$  h/day versus  $< 4$  h/day. PNSE variables included neighborhood violence, problems (higher value = more violence/problems), and social cohesion (higher value = more cohesion). Mediators included perceived lifetime discrimination, daily discrimination, and chronic stress (higher value = greater discrimination/stress). Multivariable regression was used with bootstrap-generated 95% bias-corrected confidence intervals (BC CIs) to test for mediation adjusting for demographics, health-related and psychosocial factors, and population density.

**Results:** Neighborhood violence, problems, and social cohesion were indirectly associated with TV viewing through lifetime discrimination ( $OR = 1.03$ , 95%BC CI = 1.00, 1.07;  $OR = 1.03$ , 95%BC CI = 0.99, 1.06 [marginal];  $OR = 0.98$ , 95%BC CI = 0.94, 0.99, respectively) and chronic stress ( $OR = 0.95$ , 95%BC CI = 0.90, 0.99;  $OR = 0.96$ , 95%BC CI = 0.92, 0.99;  $OR = 1.05$ , 95%BC CI = 1.01, 1.10, respectively). Daily discrimination was neither directly nor indirectly associated with TV viewing.

**Conclusions:** Each PNSE variable was indirectly associated with TV viewing via lifetime discrimination and perceived stress, but not with daily discrimination among JHS participants. Unexpected directionality of mediating effects of lifetime discrimination and chronic stress should be replicated in future studies. Further research is also needed to pinpoint effective community efforts and physical environmental policies (e.g., installing bright street lights, community policing) to reduce adverse neighborhood conditions and psychosocial factors, and decrease TV viewing and subsequent cardiovascular disease risk.

### 1. Introduction

Sedentary behaviors (SB) are defined as low energy expenditure

behaviors with  $\leq 1.5$  metabolic equivalents (MET) for a task and include activities such as screen activities (e.g., smartphones and television [TV] viewing) (Matthews et al., 2008; Prince, Reed, McFetridge, Tremblay, &

\* Corresponding author. Social Determinants of Obesity and Cardiovascular Risk Laboratory, Cardiovascular Branch, Division of Intramural Research, National Heart, Lung, and Blood Institute, National Institutes of Health, 10 Center Drive, Bethesda, MD, 20892, USA.

E-mail address: [kosuke.tamura@nih.gov](mailto:kosuke.tamura@nih.gov) (K. Tamura).

<https://doi.org/10.1016/j.ssmph.2021.100760>

Received 7 October 2020; Received in revised form 8 February 2021; Accepted 17 February 2021

Available online 20 February 2021

2352-8273/Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Reid, 2017). Engaging in persistent SB has been linked to greater risk of chronic diseases (Katzmarzyk, Church, Craig, & Boucard, 2009; Paterson et al., 2018; Thorp, Owen, Neuhaus, & Dunstan, 2011), such as cardiovascular disease (CVD) (Biswas et al., 2015), cancers (Jochem, Wallmann-Sperlich, & Leitzmann, 2019), and diabetes (Wilmot et al., 2012). TV viewing is one major contributor to overall SB in the U.S. (Imran et al., 2018; Yang et al., 2019), disproportionately impacting African Americans (Bureau of Labor Statistics, 2018). Specifically, the 2017 American Time Use Survey has shown that African Americans (AAs), on average, reported watching TV 3.48 h/day, whereas whites reported 2.71 h/day, Hispanics reported 2.32 h/day, and Asians reported 1.90 h/day (Bureau of Labor Statistics, 2018).

An ecological perspective for health behaviors postulates that a key social determinant of SB is an individual's perception of the physical and societal context in which they reside (Owen et al., 2011). Adverse perceived neighborhood social environments (PNSE; e.g., crime and poverty) are thought to discourage physical activity (PA) (Tamura et al., 2019), and contribute to prolonged SB (Owen, Salmon, Koohsari, Turrell, & Giles-Corti, 2014). A few studies have examined associations between PNSE (e.g., unsafe walking (Van Dyck et al., 2012; Wallmann-Sperlich, Bucksch, Hansen, Schantz, & Froboese, 2013) and social trust/cohesion (Van Holle et al., 2014)) and sitting time among adults, but did not control for race and ethnicity (Van Dyck et al., 2012; Van Holle et al., 2014; Wallmann-Sperlich et al., 2013). To address this limitation, only one study has investigated associations between PNSE and SB (e.g., watching TV) among AAs (Strong, Reitzel, Wetter, & McNeill, 2013). The authors stratified the analyses by sex and demonstrated that among women but not men, more perceived neighborhood problems (e.g., litter) was associated with longer TV viewing, whereas greater social cohesion (e.g., trustworthy neighbors) was associated with less TV viewing (Strong et al., 2013).

To better understand mechanisms of PNSE in relation to TV viewing, there is a need for investigating a potential pathway when examining such associations. Particularly, experiences of discrimination may increase stress, which may affect how well individuals can adhere to healthy lifestyles. These inter-relationships may help explain higher rates of chronic conditions such as CVD among AAs. Therefore, understanding the mediating mechanism of discrimination (e.g., unfair treatment) and chronic stress in the associations between PNSE and TV viewing may inform innovative ways to address the disparities in SB

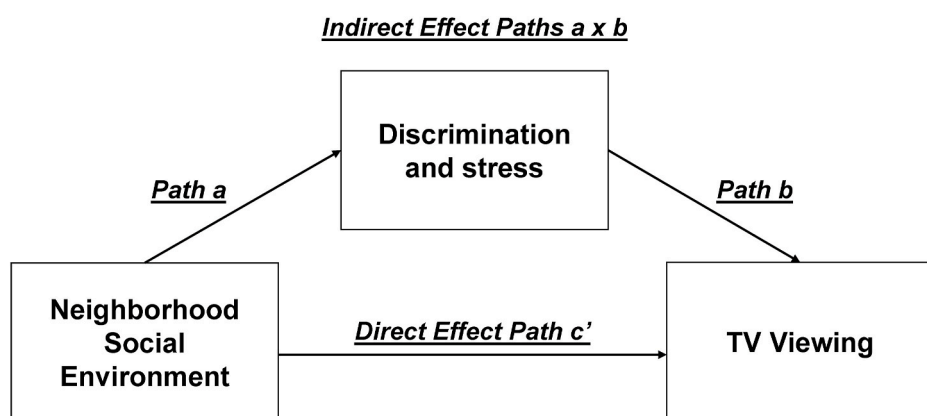
(Matthews, Gallo, & Taylor, 2010).

However, no study to date has tested a mediation role of perceived discrimination and perceived stress on these associations in AAs. Perceived discrimination and stress have been recognized as key factors impacting CVD risk factors, such as hypertension (Sims et al., 2012), disproportionately influencing AAs (Dunlay et al., 2017; Gebreab et al., 2012). A better understanding of PNSE that may contribute to the levels of TV viewing for AAs could help inform the design and implementation of effective environmental intervention strategies for a population at particularly high risk for poor CVD outcomes (Chen et al., 2019). Thus, the primary aim of the present study were to 1) test direct associations between neighborhood social context and TV viewing, and 2) test whether associations of PNSE with TV viewing were mediated through perceived discrimination and chronic stress among AAs (Fig. 1).

## 2. Methods

### 2.1. Jackson Heart Study (JHS) participants

The Jackson Heart Study (JHS) is the largest cohort study designed to examine risk factors for CVD in AAs (Fuqua et al., 2005; Taylor et al., 2005). Briefly, the JHS participants were recruited from Hinds, Madison, and Rankin counties in the Jackson, Mississippi area (i.e., 17% randomly contacted, 22% volunteers, 31% secondary family members, or 30% recruited through the Atherosclerosis Risk in the Community site) (Gebreab et al., 2017). The JHS recruited 5301 African American men and women (aged 21–94 years) at baseline (Exam 1) in 2000–2004 (Campbell Jenkins et al., 2014), followed up in 2005–2008 (Exam 2 response rate = 79.2% of Exam 1 participants) and subsequently followed up in 2009–2013 (Exam 3 response rate = 90.8% of Exam 2 participants) (Forde et al., 2020). The study design and recruitment procedures have been previously described in detail (Fuqua et al., 2005; Taylor et al., 2005). Of 5301 participants, those missing data on TV viewing ( $n = 12$ ), demographic and health-related factors ( $n = 359$ ), lifetime and daily discrimination and perceived stress ( $n = 206$ ), and PNSE ( $n = 8$ ) were excluded, resulting in the final analytic sample of 4716 participants.



**Fig. 1.** Conceptual model of indirect (Paths a x b) and direct (Path c') relationships between neighborhood social environment and TV viewing among Jackson Heart Study participants.

Note: The figure describes the hypotheses: 1) Perceived discrimination mediate the effects of neighborhood social environment factors with TV viewing; and 2) Perceived stress mediate the effects of neighborhood social environment factors with TV viewing. Neighborhood social environment includes neighborhood violence, problems, and social cohesion. Discrimination and stress include lifetime and daily discrimination as well as chronic stress. TV viewing is defined as  $\geq 4$  hours/day.

**Note:** The figure describes the hypotheses: 1) Perceived discrimination mediate the effects of neighborhood social environment factors with TV viewing; and 2) Perceived stress mediate the effects of neighborhood social environment factors with TV viewing. Neighborhood social environment includes neighborhood violence, problems, and social cohesion. Discrimination and stress include lifetime and daily discrimination as well as chronic stress. TV viewing is defined as  $\geq 4$  hours/day

## 2.2. TV viewing outcome

Using the JHS Physical Activity Cohort (JPAC) survey, participants were asked one question on TV viewing: “During the past year, how often did you watch television?” (Diaz et al., 2016) with the following response options: Less than 1 h (h) a week; At least 1 h a week; but less than 7 h a week; At least 1 h a day but less than 2 h a day; At least 2 h a day but less than 4 h a day; and 4 or more hours a day (Diaz et al., 2016; Imran et al., 2018). Based on prior studies among U.S. adults demonstrating a greater association of over 4 h/day of TV viewing and computers, etc. with depression (Madhav, Sherchand, & Sherchan, 2017) and obesity (Hu, Li, Colditz, Willett, & Manson, 2003), one binary TV viewing outcome was created: TV viewing  $\geq 4$  h/day versus  $< 4$  h/day. The item on TV viewing from the JPAC has been validated against accelerometers ( $\rho = 0.22$ ) and provided a good reproducibility (Intraclass Correlation Coefficient = 0.75–0.78) (Garcia et al., 2019; Wareham et al., 2002; Wijndaele et al., 2014).

## 2.3. Perceived neighborhood social environment (PNSE)

The neighborhood survey items were classified into three PNSE constructs using principal component analysis with Promax oblique rotation, consistent with a previous JHS research (Mujahid, DiezRoux, Morenoff, & Raghunathan, 2007). PNSE constructs included 1) neighborhood violence, 2) neighborhood problems, and 3) neighborhood social cohesion (Gebreab et al., 2017). The survey items for neighborhood violence included five items on occurrence of neighborhood fights, gang fights, sexual assault/rape, violent arguments, and robbery with a score between 1 (never) and 4 (often). Neighborhood problems included 6 survey items with respect to neighborhood noise, lack of access to adequate food/or shopping, heavy traffic/speeding cars, lack of access to parks, and trash/litter, with a score between 1 (not really a problem) and 4 (very serious problem). Neighborhood social cohesion consisted of 5 items regarding trust in neighbors, willingness to help neighbors, shared values with neighbors, and extent to which neighbors get along, with a score ranging from 1 (strongly disagree) to 4 (strongly agree). The internal consistencies of the three constructs were relatively high, with Cronbach’s alpha 0.80, 0.76, and 0.77 for neighborhood violence, problems, and social cohesion, respectively (Gebreab et al., 2017). Using unconditional empirical Bayes estimation, participants’ responses were aggregated to the census-tract level (Tamura et al., 2020). Higher neighborhood violence and problems indicated unfavorable neighborhood perceptions, whereas higher neighborhood social cohesion indicated favorable neighborhood perceptions.

## 2.4. Mediators - perceived discrimination and perceived chronic stress

During JHS Exam 1, the JHS Discrimination Instrument (JHSDIS), measuring perceived daily and lifetime discrimination, was administered by trained interviewers and completed by 96% of participants. Lifetime discrimination score was derived from the surveys developed by Krieger (Krieger, 1990) and Sidney (Krieger & Sidney, 1996) with an internal consistency of  $\alpha = 0.78$  (Sims, Wyatt, Gutierrez, Taylor, & Williams, 2009). Participants were asked about the occurrence (yes = 1 or no = 0) of unfair treatment over the lifetime across 9 domains including: at school, getting a job, work, housing, getting services, street/public place, resources or money, medical care, or other. Lifetime discrimination score was counted the occurrence of 9 domains, ranging from 0 to 9.

Daily discrimination score was adapted from the Williams scale (Williams, Yan, Jackson, & Anderson, 1997) with a relatively high internal consistency ( $\alpha = 0.88$ ) (Sims et al., 2009). Participants were asked on frequency on 9 items, such as “You are treated with less courtesy than other people.”, “You receive poorer service than others at restaurants.”, “People act as if they are afraid of you.”, “You are threatened or harassed.” The score for the frequency ranged from 1 (“never”) to 7

(“several times a day”). Daily discrimination score was based on the average of 9 items.

The Global Perceived Stress Scale (GPSS) was adapted from the standardized stress scales (Cohen, Kamarck, & Mermelstein, 1983; Payne et al., 2005). The 8 survey items from the GPSS assessed the severity of perceived stress during the last 12 months with respect to 8 domains, including employment, racism/discrimination, meeting basic needs, caring for others, relationships, related to one’s neighborhood, legal problems, and medical problems. Participants rated stress severity using a four-point scale ranging from “not stressful” to “very stressful” (0–3) with a total range from 0 to 24 (Cronbach’s alpha, 0.72) (Johnson et al., 2016). All three mediators were transformed into the standard deviation (SD) from the mean (i.e., a one-SD unit increase) to ease the interpretation (Brewer et al., 2018; Sims et al., 2016).

## 2.5. Covariates

Demographic characteristics serving as confounders included: age, sex, educational attainment, and annual median household income. Behavioral characteristics included: current smoker and alcohol drinking. Health-related factors included: body mass index (BMI = weight (kg)/height (m<sup>2</sup>)), and prior medical conditions. Total PA is also considered to be a potential confounder and is a summary score based on the JPAC survey items (Smitherman et al., 2009) on active living, sport, and home related PA (Smitherman et al., 2009). We also controlled for walking disabilities in the models (as measured by self-reported walking limitations). An objective population density variable was also controlled as a proxy for walkable neighborhoods (Gebreab et al., 2017).

## 2.6. Statistical analysis

For the first objective, multivariable regression models (Hayes, 2018) were used to examine direct associations between each PNSE and TV viewing (IBM® SPSS v19), controlling for all covariates. Bootstrap resampling ( $k = 5000$ ) with 95% bias-corrected confidence intervals (BC CIs) of the indirect effects was used to test for mediation by each of the three mediators separately (Hayes, 2018). An indication of statistically significant mediation was determined by a BC CI that did not include zero. Unstandardized estimates were reported for associations of each PNSE factor with odds ratios (OR) of TV viewing. Subsequently, ORs were expressed as exponents of unstandardized regression coefficients through standardized mediators (lifetime discrimination, daily discrimination, and chronic stress).

Two distinct sensitivity analyses were performed. First, multilevel modeling (i.e., PROC GLIMMIX in SAS9.4; Cary, NC) was used to control for the two-level nested data structure to examine direct associations between each PNSE and TV viewing in age- and fully-adjusted models. Second, mediation analyses were performed based on TV viewing  $\geq 2$  h/day.

## 3. Results

All independent variables, outcomes, and covariates included in the analyses are presented in Table 1. On average, participants were 55.1 ( $SD \pm 12.8$ ) years. Sixty-three percent of participants were female. Approximately 80% had at least a high school education. Roughly 30% of participants earned at least \$50,000. The mean BMI for participants was 31.8 ( $SD \pm 7.3$ ). About 13% and 45% of participants smoked cigarettes currently and drank alcohol in the past 12 months, respectively. Approximately 36% and 5% of participants had previous medical conditions (e.g., cancers) and walking limitations, respectively. Nearly 40% of participants watched TV  $\geq 4$  h/day in the past year.

Those who reported watching TV  $\geq 4$  h/day were older, more likely to be current smokers and less likely to drink alcohol, with lower educational attainment, higher BMI, lower PA levels, annual median household income  $< \$50,000$  and disability limiting walking, and more

**Table 1**  
Individual characteristics, health-related factors, psychosocial factors, and environmental factors in Jackson Heart Study participants (n = 4716).

	Overall, n (%) n = 4716	TV viewing ≥ 4 h/day, n (%), n = 1766	TV viewing < 4 h/day, n (%), n = 2950	<i>p</i> <sup>d</sup>
<b>Individual characteristics</b>				
Age (years), M (±SD)	55.1 (±12.8)	56.6 (±12.9)	54.2 (±12.7)	<.0001
Female	2990 (63.4)	1123 (63.59)	1867 (63.3)	0.835
Education				<.0001
High school graduate or more	3772 (80.0)	1288 (72.9)	2484 (84.2)	
Less than high school	944 (20.0)	478 (27.1)	466 (15.8)	
Annual median household income				<.0001
≥\$50,000	1390 (29.5)	384 (21.7)	1006 (34.1)	
<\$50,000	2617 (55.5)	1156 (65.5)	1461 (49.5)	
Not reported	709 (15.03)	226 (12.80)	483 (16.37)	
<b>Health-related factors</b>				
Body Mass Index, M (±SD)	31.8 (±7.3)	32.1 (±7.6)	31.6 (±7.1)	0.0196
Total physical activity, M (±SD)	6.5 (±2.0)	5.8 (±1.9)	6.9 (±1.9)	<.0001
Current smoker	601 (12.7)	295 (16.7)	306 (10.4)	<.0001
Drinking alcohol in the past 12 months <sup>a</sup>	2164 (45.9)	778 (44.1)	1386 (47.0)	0.0508
Disable from walking	232 (4.9)	118 (6.7)	114 (3.9)	<.0001
Previous medical conditions	1716 (36.4)	707 (40.0)	1009 (34.2)	<.0001
TV viewing				
≥4 h/day	1766 (37.4)			
<4 h/day	2950 (62.6)			
<b>Psychosocial factors, M (±SD)</b>				
Lifetime discrimination	3.0 (±2.1)	2.7 (±2.1)	3.1 (±2.1)	<.0001
Daily discrimination	2.1 (±1.0)	2.0 (±1.1)	2.1 (±1.0)	0.003
Chronic stress	5.2 (±4.4)	4.6 (±4.4)	5.5 (±4.4)	<.0001
<b>Environmental factors, M (±SD)</b>				
<i>Perceived neighborhood social environment<sup>b</sup></i>				
Violence	1.3 (±0.1)	1.3 (±0.1)	1.3 (±0.1)	<.0001
Problems	1.6 (±0.2)	1.6 (±0.2)	1.6 (±0.2)	<.0001
Social cohesion	3.0 (±0.1)	3.0 (±0.1)	3.0 (±0.1)	<.0001
<i>Objective built environment</i>				
Population density (people/km <sup>2</sup> ) <sup>c</sup>	816.4 (±489.3)	885.4 (±475.3)	775.0 (±493.0)	<.0001

**Note:** <sup>a</sup>Alcohol consumption in the past 12 months. <sup>b</sup>Each perceived social environment variable was based on unconditional empirical Bayes estimation adjusting for age and sex. <sup>c</sup>Population density was measured around 1 mile from participant's residence. <sup>d</sup>P-values were based on t-tests for continuous variables and chi-square tests for categorical variables.

medical conditions (all  $p < .05$ ), compared to those who reported TV < 4 h/day (Table 1). Participants who watched TV ≥ 4 h/day also reported lower perceived lifetime discrimination, daily discrimination, and stress, lower scores in neighborhood violence, problems, and higher social cohesion, and resided in more densely populated areas compared to those watching TV < 4 h/day (all  $p < .05$ ).

Participants reporting higher neighborhood violence tended to be older, female, had less than a high school education and an annual median household income <\$50,000 (all  $p < .01$ ) (Table 2). Participants with higher neighborhood violence had a higher BMI, were less physically active, currently smoked, drank less alcohol, and had previous medical conditions, compared to individuals perceiving lower neighborhood violence (all  $p < .05$ ).

Additionally, participants reporting higher levels of neighborhood

violence had a lower score for lifetime discrimination and daily discrimination (Table 2). Also, areas with higher perceived neighborhood violence had a higher population density than areas with lower neighborhood violence (all  $p < .01$ ). The patterns of associations of socio-demographics, health-related factors, and psychosocial factors with higher neighborhood problems and lower neighborhood social cohesion appeared similar to the associations with higher neighborhood violence.

Less favorable perceptions of neighborhood violence and problems were indirectly and positively related to TV viewing (≥4 h/day) via lifetime discrimination (OR [Paths ab] = 1.031, 95% BC CI = 1.001, 1.074; OR = 1.027, 95% BC CI = 0.999, 1.062 [marginal], respectively) (Table 3). Higher neighborhood violence and problems were associated with lower lifetime discrimination. In turn, higher lifetime discrimination was negatively associated with TV viewing. Neighborhood violence and problems were not directly associated with TV viewing (Path c').

Greater perceived neighborhood social cohesion was indirectly and negatively related to TV viewing via lifetime discrimination (OR [paths ab] = 0.977, 95% BC CI = 0.944, 0.999) (Table 3). Higher neighborhood social cohesion was associated with higher lifetime discrimination. In turn, higher lifetime discrimination was negatively associated with TV viewing. Neighborhood social cohesion was not directly associated with TV viewing (path c').

None of the direct and indirect associations between neighborhood social environment and TV viewing were significantly mediated by daily discrimination (Table 3). However, the directionality of the associations generally support the hypothesized associations. For example, higher neighborhood violence and problems were related to higher daily discrimination. In turn, higher daily discrimination was positively related to TV viewing.

Higher perceived neighborhood violence and problems were indirectly and negatively related to TV viewing via chronic stress (OR [paths ab] = 0.946, 95% BC CI = 0.898, 0.986; OR [paths ab] = 0.961, 95% BC CI = 0.924, 0.989, respectively) (Table 3). Higher neighborhood violence and problems were associated with higher chronic stress. In turn, higher chronic stress was negatively associated with TV viewing. Both neighborhood violence and problems were not directly associated with TV viewing (Path c').

Favorable perceptions of neighborhood social cohesion were indirectly and positively related to TV viewing via chronic stress (OR [paths ab] = 1.046, 95% BC CI = 1.008, 1.101) (Table 3). Higher neighborhood social cohesion was associated with lower chronic stress. In turn, higher chronic stress was negatively associated with TV viewing. Neighborhood social cohesion was not directly associated with TV viewing (Path c').

A sensitivity analysis was performed for direct effects (similar to path c') in the fully-adjusted models (Table 4). All estimates were attenuated relative to age-adjusted models, and none of them were statistically significant, which is similar results compared to those of path c'. Only neighborhood social cohesion was marginally significant ( $p = .06$ ). A sensitivity analysis based on TV viewing ≥ 2 h/day indicated that there were statistically significant associations between each PNSE factor and TV viewing, only through perceived stress, but not lifetime and daily discrimination (Table 5).

#### 4. Discussion

Using a large community-based, cohort of AAs, indirect and direct relationships between each PNSE variable and TV viewing (≥4 h/day) through perceived discrimination and stress were tested. Our findings indicated the complex ways in which perceived discrimination and stress mediated such associations, which is inconsistent with previous studies (Strong et al., 2013; Van Dyck et al., 2012; Van Holle et al., 2014; Wallmann-Sperlich et al., 2013). In our study, greater perceived violence and problems were positively associated with TV viewing, while more social cohesion was negatively associated with TV viewing when lifetime discrimination mediated the relationship. In contrast, our



**Table 2**

Individual characteristics, health-related factors, psychosocial factors, and environmental factors by high/low perceived neighborhood social environment factor (n = 4716).

	Overall (n = 4716)	Neighborhood Violence <sup>a</sup>		<i>P</i> <sup>b</sup>	Neighborhood Problems <sup>a</sup>		<i>P</i> <sup>b</sup>	Neighborhood Social Cohesion <sup>a</sup>		<i>P</i> <sup>b</sup>
	n (%)	High n = 2371	Low n = 2345		High n = 2364	Low n = 2352		High n = 2361	Low n = 2355	
<b>Individual characteristics</b>										
Age (years), M (±SD)	55.1 (±12.8)	57.8 (±12.9)	52.3 (±12.2)	<.0001	57.3 (±12.8)	52.9 (±12.5)	<.0001	54.3 (±12.5)	55.9 (±13.1)	<.0001
Female	2990 (63.4)	1545 (65.2)	1445 (61.6)	<b>0.0116</b>	1539 (65.1)	1451 (61.7)	<b>0.0151</b>	1472 (62.4)	1518 (64.5)	<b>0.1322</b>
Education				<.0001			<.0001			<.0001
High school graduate or more	3772 (79.9)	1713 (72.3)	2059 (87.8)		1713 (72.5)	2059 (87.5)		2005 (84.9)	1767 (75.0)	
Less than high school	944 (20.0)	658 (27.8)	286 (12.2)		651 (27.5)	293 (12.5)		356 (15.1)	588 (25.0)	
Annual median household income				<.0001			<.0001			<.0001
≥\$50,000	1390 (29.5)	441 (18.6)	949 (40.5)		428 (18.1)	962 (40.9)		907 (38.4)	483 (20.5)	
<\$50,000	2617 (55.5)	1592 (67.1)	1025 (43.7)		1587 (67.1)	1030 (43.8)		1103 (46.7)	1514 (64.3)	
Not reported	709 (15.0)	338 (14.3)	371 (15.8)		349 (14.8)	360 (15.3)		351 (14.9)	358 (15.2)	
<b>Health-related factors</b>										
Body Mass Index, M (±SD)	31.8 (±7.3)	32.0 (±7.4)	31.5 (±7.1)	<b>0.0169</b>	31.9 (±7.3)	31.6 (±7.2)	<b>0.2204</b>	31.5 (±7.1)	32.0 (±7.4)	<b>0.0122</b>
Total physical activity, M (±SD)	6.5 (±2.0)	6.2 (±2.0)	6.8 (±2.0)	<.0001	6.3 (±2.0)	6.8 (±2.0)	<.0001	6.7 (±2.0)	6.32 (±2.0)	<.0001
Current smoker	601 (12.7)	351 (14.8)	250 (10.7)	<.0001	346 (14.6)	255 (10.8)	<.0001	260 (11.0)	341 (14.5)	<b>0.0004</b>
Drinking alcohol in the past 12 months <sup>c</sup>	2164 (45.9)	967 (41.2)	1188 (50.7)	<.0001	993 (42.0)	1171 (49.8)	<.0001	1149 (48.7)	1015 (43.1)	<b>0.0001</b>
Disable from walking	232 (4.9)	130 (5.5)	102 (4.4)	0.072	127 (5.5)	103 (4.4)	0.0871	115 (4.9)	117 (5.0)	0.8772
Previous medical conditions	1716 (36.4)	991 (41.8)	725 (30.9)	<.0001	974 (41.2)	742 (31.6)	<.0001	774 (32.8)	942 (40.0)	<.0001
TV viewing				<.0001			<.0001			<.0001
≥4 h/day	1766 (37.5)	1028 (43.4)	738 (31.5)		998 (42.2)	768 (32.7)		816 (34.6)	950 (40.3)	
<4 h/day	2950 (47.5)	1343 (56.6)	1607 (68.5)		1366 (57.8)	1584 (67.4)		1545 (65.4)	1405 (59.7)	
<b>Psychosocial factors, M (±SD)</b>										
Lifetime discrimination	3.0 (±2.1)	2.8 (±2.1)	3.2 (±2.1)	<.0001	2.8 (±2.1)	3.1 (±2.1)	<.0001	3.1 (±2.1)	2.9 (±2.1)	<b>0.0004</b>
Daily discrimination	2.1 (±1.0)	2.0 (±1.0)	2.1 (±1.0)	<b>0.0052</b>	2.1 (±1.1)	2.1 (±1.0)	0.3386	2.1 (±1.0)	2.1 (±1.1)	0.9496
Chronic stress	5.2 (±4.4)	5.2 (±4.6)	5.1 (±4.2)	0.5834	5.2 (±4.6)	5.1 (±4.2)	0.928	5.0 (±4.2)	5.3 (±4.6)	<.0001
<b>Environmental factors, M (±SD)</b>										
<i>Perceived neighborhood social environment<sup>d</sup></i>										
Violence	1.3 (±0.1)	1.4 (±0.1)	1.2 (±0.1)	<.0001	1.4 (±0.1)	1.2 (±0.1)	<.0001	1.2 (±0.1)	1.3 (±0.1)	<.0001
Problems	1.6 (±0.2)	1.7 (±0.1)	1.4 (±0.1)	<.0001	1.7 (±0.1)	1.4 (±0.1)	<.0001	1.5 (±0.1)	1.7 (±0.2)	<.0001
Social cohesion	3.0 (±0.1)	2.9 (±0.1)	3.1 (±0.1)	<.0001	2.9 (±0.1)	3.1 (±0.1)	<.0001	3.1 (±0.1)	2.9 (±0.1)	<.0001
<i>Objective built environment</i>										
Population density (people/km <sup>2</sup> ) <sup>e</sup>	816.4 (±489.3)	1081.6 (±373.3)	548.2 (±444.5)	<.0001	1085.8 (±387.0)	545.6 (±428.2)	<.0001	684.5 (±483.3)	998.7 (±423.1)	<.0001

Note: <sup>a</sup>Based on the median. <sup>b</sup>P-values were based on t-tests for continuous variables and chi-square tests for categorical variables. <sup>c</sup>Alcohol consumption in the past 12 months. <sup>d</sup>Each perceived social environment variable was based on unconditional empirical Bayes estimation adjusting for age and sex. <sup>e</sup>Population density (people/km<sup>2</sup>) was calculated with the total population divided by total land area around 1 mile from participant's residence.

**Table 3**

Indirect and direct associations between neighborhood social environment (IV) and TV viewing ≥4 h/day (DV) via mediators (M) in JHS participants (n = 4716).

	Path a: Effect of IV on M			Path b: Effect of M on DV		Path c': Direct Effect		Paths a x b: Indirect Effect	
	beta	SE	95% CI	OR	95% CI	OR	95% CI	OR	95% BC CI
<b>M: Lifetime Discrimination</b>									
Neighborhood violence	-0.412***	0.116	-0.640, -0.184	0.929*	0.863, 0.999	1.589	0.891, 2.833	1.031	1.001, 1.074‡
Neighborhood problems	-0.364***	0.084	-0.528, -0.199	0.930	0.863, 1.000	1.446	0.950, 2.201	1.027	0.999, 1.062
Neighborhood social cohesion	0.303**	0.113	0.082, 0.525	0.925*	0.859, 0.996	1.200	0.683, 2.109	0.977	0.944, 0.999‡
<b>M: Daily Discrimination</b>									
Neighborhood violence	0.034	0.116	-0.193, 0.261	1.005	0.934, 1.081	1.589	0.891, 2.833	1.000	0.990, 1.010
Neighborhood problems	0.114	0.084	-0.050, 0.278	1.004	0.933, 1.080	1.446	0.950, 2.201	1.001	0.989, 1.012
Neighborhood social cohesion	-0.168	0.113	-0.389, 0.053	1.006	0.935, 1.082	1.200	0.683, 2.109	0.999	0.982, 1.015
<b>M: Perceived Stress</b>									
Neighborhood violence	0.333**	0.118	0.103, 0.563	0.847***	0.787, 0.911	1.589	0.891, 2.833	0.946	0.898, 0.986‡
Neighborhood problems	0.240**	0.085	0.074, 0.407	0.846***	0.786, 0.911	1.446	0.950, 2.201	0.961	0.924, 0.989‡
Neighborhood social cohesion	-0.276*	0.114	-0.501, -0.052	0.849***	0.789, 0.914	1.200	0.683, 2.109	1.046	1.008, 1.101‡

Note: P-values: \**p* < .05; \*\**p* < .01; \*\*\**p* < .001, ‡95% BC CI. IV: Independent variables. DV: Dependent variable. M: Mediators. All models were adjusted for covariates.

findings suggest that greater perceived violence and problems unexpectedly were negatively associated with TV viewing, while higher social cohesion was positively related to TV viewing when chronic stress was a mediator. There were no indirect associations between each PNSE

variable and TV viewing through daily discrimination and no direct associations with TV viewing when accounting for mediators.

Our findings indicated opposing directions of the associations between PNSE and TV viewing when examining lifetime discrimination

**Table 4**  
Sensitivity analysis of associations between perceived neighborhood social environment and TV viewing among the JHS participants (n = 4716).

	Age-adjusted		Fully-adjusted <sup>a</sup>	
	OR	95% C.I.	OR	95% C.I.
Neighborhood Violence	5.778***	3.156, 10.579	1.678	0.881, 3.195
Neighborhood Problems	3.661***	2.430, 5.515	1.557+	0.969, 2.502
Neighborhood Social Cohesion	0.257***	0.125, 0.527	1.062	0.548, 2.057

**Note:** OR: Odds ratios. C.I.: Confidence interval. <sup>a</sup>Fully-adjusted models controlled for all covariates. P-values: +p < .1; \*p < .05; \*\*p < .01; \*\*\*p < .001.

and stress as possible mediators. Specifically, **path a** (Table 3) for both mediators indicated inconsistent directionality of associations. In the case of lifetime discrimination, higher neighborhood violence and problems were associated with lower lifetime discrimination. This finding may relate to the racial composition of the neighborhoods in which participants live (English, Lambert, Evans, & Zonderman, 2014; Hunt, Wise, Jigmeup, Cozier, & Rosenberg, 2007). For instance, one study found that AAs living in neighborhoods with a higher percentage of Whites reported experiencing greater discrimination than those living in neighborhoods with a lower percentage of Whites (English et al., 2014). Another study demonstrated that, for African American women, living in neighborhoods with a greater percentage of AAs was associated with lower lifetime discrimination (i.e., occurrences of discrimination by the police due to race) (Hunt et al., 2007). However, measures of neighborhood racial composition like those used in these two previous studies (English et al., 2014; Hunt et al., 2007) were not available for the present study (Hunt et al., 2007). In future research, researchers should consider investigating how neighborhood racial composition might explain the associations of neighborhood violence and problems with lifetime discrimination to further elucidate this mechanism between neighborhood conditions and discrimination.

In contrast, our finding of associations of higher perceived neighborhood violence and problems with greater chronic stress were to some extent consistent with the previous studies (Giurgescu et al., 2012, 2015). For instance, two studies among African American women indicated that individuals who reported higher perceived physical and social disorder (Giurgescu et al., 2012) and lower neighborhood quality (Giurgescu et al., 2015) had higher perceived stress. Opposing directionality of associations when lifetime discrimination was examined as a mediator, as opposed to stress may be in part due to differences in the derived measures (i.e., lifetime discrimination based on instances of unfair treatment in specific domains [e.g., at work, getting medical care]

**Table 5**  
Sensitivity analysis of indirect and direct associations between neighborhood social environment (IV) and TV viewing ≥2 h/day (DV) via mediators (M) in JHS participants (n = 4716).

	Path a: Effect of IV on M			Path b: Effect of M on DV		Path c': Direct Effect		Paths a x b: Indirect Effect	
	beta	SE	95% CI	OR	95% CI	OR	95% CI	OR	95% BC CI
<b>M: Lifetime Discrimination</b>									
Neighborhood violence	-0.412***	0.116	-0.640, -0.184	1.017	0.941, 1.098	1.103	0.589, 2.064	0.993	0.958, 1.026
Neighborhood problems	-0.364***	0.084	-0.528, -0.199	1.018	0.943, 1.100	1.244	0.795, 1.949	0.993	0.963, 1.022
Neighborhood social cohesion	0.303**	0.113	0.082, 0.525	1.014	0.938, 1.095	1.577	0.859, 2.894	1.004	0.979, 1.031
<b>M: Daily Discrimination</b>									
Neighborhood violence	0.034	0.116	-0.193, 0.261	0.927+	0.858, 1.001	1.103	0.589, 2.064	0.997	0.975, 1.016
Neighborhood problems	0.114	0.084	-0.050, 0.278	0.926+	0.857, 1.000	1.244	0.795, 1.949	0.991	0.972, 1.005
Neighborhood social cohesion	-0.168	0.113	-0.389, 0.053	0.928+	0.858, 1.002	1.577	0.589, 2.894	1.013	0.996, 1.041
<b>M: Perceived Stress</b>									
Neighborhood violence	0.333**	0.118	0.103, 0.563	0.876***	0.812, 0.945	1.103	0.589, 2.064	0.957	0.913, 0.990‡
Neighborhood problems	0.240**	0.085	0.074, 0.407	0.875***	0.811, 0.944	1.244	0.795, 1.949	0.968	0.937, 0.993‡
Neighborhood social cohesion	-0.276*	0.114	-0.501, -0.052	0.878***	0.814, 0.947	1.577	0.859, 2.894	1.037	1.005, 1.082‡

**Note:** P-values: +p < .1; \*p < .05; \*\*p < .01; \*\*\*p < .001, ‡95% BC CI. IV: Independent variables. DV: Dependent variable. M: Mediators. All models were adjusted for covariates.

versus chronic stress based on perceptions within more generalized domains [e.g. racism, and meeting basic needs, etc.]). Therefore, more research is needed to better clarify how perceived discrimination and stress operate differently, depending on certain health behaviors.

Unexpectedly, **path b**, which examined associations of lifetime discrimination and chronic stress with TV viewing, demonstrated that both mediators were negatively associated with TV viewing. This finding is not directly comparable to prior work, but might be somewhat consistent with previous studies from the JHS (Sims et al., 2016, 2017). Two prior JHS studies found an unexpected direction of associations where lifetime discrimination (for women only) (Sims et al., 2016) and chronic stress (Sims et al., 2016) were positively associated with PA. Findings from these studies suggested that someone who is chronically stressed may engage in more PA to cope with psychosocial stressors (e.g., chronic stress, discrimination). Thus, individuals who perceived greater discrimination and chronic stress may engage in more PA to relieve various types of stress, thereby, reducing the time spent in SB, such as TV viewing. Alternatively, those individuals with more stress may have less time for SB leisure time activities such as TV viewing, due to employment, or caretaking activities. However, another study investigating screen time as an outcome stratified by sex and race showed that more experiences of discrimination was related to longer screen time for black men and white women only (Womack et al., 2014). Further research is needed to elucidate the mechanisms by which psychosocial factors link to SB, specifically in AAs, and how TV viewing is seen as a social activity among them (i.e., family time, stress relieving) versus a solitary activity that might promote social isolation and worsen depressive symptoms.

To our knowledge, this study may be the first to test for mediating effects of psychosocial factors on the associations between PNSE and TV viewing among AAs. When considering lifetime discrimination as a mediator (**paths a x b**), our findings were consistent with previous studies (Claudel et al., 2019; Strong et al., 2013; Xiao, Keadle, Berrigan, & Matthews, 2018), which did not test for mediators. For instance, previous studies demonstrated that worsening perceptions of neighborhood features (Claudel et al., 2019; Strong et al., 2013) and neighborhood deprivation (Xiao et al., 2018) are related to prolonged SB. Furthermore, our study demonstrated that higher neighborhood social cohesion was associated with less TV viewing indirectly through lifetime discrimination, which is consistent with previous studies (Claudel et al., 2019; Strong et al., 2013).

Contrary to our expectations, higher neighborhood violence and problems were indirectly and negatively associated with TV viewing while considering chronic stress (e.g., employment) as a mediator (**paths a x b**). Furthermore, higher social cohesion was positively associated with TV viewing when mediated through chronic stress. It might be that individuals living in poor neighborhood conditions may

report greater chronic stress (responding to different domains of chronic stress), whereas those residing in neighborhoods with higher social cohesion may have greater social capital (Sartorius, 2003), allowing individuals to use available resources to manage stress, and thus reduce their stress (Henderson, Child, Moore, Moore, & Kaczynski, 2016). Further interventions might be that health practitioners could circulate information for available community resources to learn skills/tools to cope with stress levels, when individuals perceive greater neighborhood issues. Our findings and those from prior studies cannot be directly compared because previous studies neither tested for mediating roles of lifetime discrimination or chronic stress nor controlled for these psychosocial factors in modeling, which highlights a unique aspect of our work.

We found no direct or indirect associations between PNSE and TV viewing with daily discrimination (e.g., disrespect) as a mediator. A possible explanation for null findings for daily discrimination as a mediator could be that the chronicity of the psychosocial stressor, which may relate to the length of neighborhood residence and neighborhood racial composition, may make the stressor a more likely mediator of the relationship between neighborhood perceptions and SB. Prior work has demonstrated that adverse neighborhood conditions, as measured by neighborhood socioeconomic deprivation, can have differential associations with cardiometabolic health outcomes based on length of neighborhood residence (Powell-Wiley et al., 2015).

The strength of this study is that this study contributes new knowledge to current literature by testing mediating roles of discrimination and stress on the links between each PNSE and TV viewing. This study also utilizes a community-based large cohort for the mediation analyses and uses validated and standardized scales for data collection on PNSE, discrimination, and stress with high internal consistencies (Sims et al., 2009). This study has several limitations to consider. First, the findings from this study might not be generalizable to other African American adults given that the study population is middle-aged living in a single city, and not a nationally representative sample. TV viewing was self-reported, with a pre-defined duration of hours/day or a week (Diaz et al., 2016), which may lead to underestimation of TV viewing (i.e., social desirability bias) (Peiser & Peter, 2000). Additionally, this is a cross-sectional design and causality cannot be made; therefore, it cannot be determined whether experiences of perceived discrimination and stress occurred before or after TV viewing, as in many epidemiologic studies (Johnson et al., 2016). Although individuals were nested within census tracts, mediation analyses did not control for such data structure. Due to non-availability of recent data, this study has been performed, which were limited to the baseline data (2000–2004). Lastly, relevant covariates (e.g., population density as a proxy for neighborhood walkability), have been adjusted in the mediation analyses. However, unmeasured variables (e.g., neighborhood level SES) could confound the associations between each PNSE variable and TV viewing via a mediator. As each PNSE was highly correlated with neighborhood level SES, it was not controlled in the analyses.

## 5. Conclusions

Using a large, community-based sample of AAs, this study examined the mediating role of discrimination and chronic stress in the association of neighborhood social context with TV viewing as an indicator of SB. Greater perceived neighborhood violence and problems are indirectly associated with greater TV viewing through lifetime discrimination. Future interventions may focus on community efforts reducing adverse neighborhood issues and discrimination, which in turn could reduce TV viewing, thereby, reducing CVD risk.

## Ethics approval and consent to participate

The study was approved by the institutional review boards of the University of Mississippi Medical Center, Jackson State University, and

Tougaloo College. All participants provided written informed consent. The National Institutes of Health Office of Human Subjects Research Protections approved our current study.

## Authors' contributions

KT and TPW made substantial contributions to the conceptualization of the work, drafted the work, and revised the work. KT and SO performed all the analysis and interpretation of the data. SJN made all tables and figures. EKC, SJN, SC, MA, JC, SO, and MS made substantial contributions to the interpretation of the data. All authors read and approved the final manuscript.

## Data sharing

The data in the present study came from the Jackson Heart Study (<https://www.jacksonheartstudy.org/>). These data are not publicly available, and its use is restricted.

## Funding

Funding for the Social Determinants of Obesity and Cardiovascular Risk Laboratory is provided through the Division of Intramural Research (DIR) of the NHLBI of the NIH, and through the Intramural Research Program of the NIMHD of the NIH. Kosuke Tamura is supported by the 2019 Lenfant Biomedical Fellowship Award from the NHLBI. This research was made possible through the NIH Medical Research Scholars Program, a public-private partnership supported jointly by the NIH and generous contributions to the Foundation for the NIH from the Doris Duke Charitable Foundation, Genentech, the American Association for Dental Research, the Colgate-Palmolive Company, Elsevier, alumni of student research programs, and other individual supporters via contributions to the Foundation for the National Institutes of Health. The Jackson Heart Study (JHS) is supported and conducted in collaboration with Jackson State University (HHSN268201800013I), Tougaloo College (HHSN268201800014I), the Mississippi State Department of Health (HHSN268201800015I), and the University of Mississippi Medical Center (HHSN268201800010I, HHSN268201800011I and HHSN268201800012I) contracts from the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute on Minority Health and Health Disparities (NIMHD). The views of the present study are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute (NHLBI), the National Institute on Minority Health and Health Disparities (NIMHD), the National Institutes of Health (NIH), or the U.S. Department of Health and Human Services.

## Declaration of competing interest

None.

## Acknowledgements

We thank the Jackson Heart Study participants and research teams at University of Mississippi Medical Center and Jackson State University for their long-term commitment to expanding our knowledge of cardiovascular risk factors toward the eradication of cardiovascular health disparities.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmph.2021.100760>.

## References

- Biswas, A., Oh, P. I., Faulkner, G. E., Bajaj, R. R., Silver, M. A., Mitchell, M. S., et al. (2015). Sedentary time and its association with risk for disease incidence, mortality, and hospitalization in adults: A systematic review and meta-analysis. *Annals of Internal Medicine*, 162(2), 123–132. <https://doi.org/10.7326/M14-1651>
- Brewer, L. C., Redmond, N., Slusser, J. P., Scott, C. G., Chamberlain, A. M., Djouss, L., ... Sims, M. (2018). Stress and Achievement of cardiovascular health metrics: The American heart association life's simple 7 in blacks of the Jackson heart study. *J Am Heart Assoc*, 7(11). <https://doi.org/10.1161/JAHA.118.008855>
- Bureau of Labor Statistics. (2018). In *American time use survey - 2017 results*. (USDL-18-1058). Washington, D.C: Department of Labor Retrieved from. <https://www.bls.gov/news.release/pdf/atus.pdf>.
- Campbell Jenkins, B. W., Sarpong, D. F., Addison, C., White, M. S., Hickson, D. A., White, W., et al. (2014). Joint effects of smoking and sedentary lifestyle on lung function in African Americans: The Jackson heart study cohort. *International Journal of Environmental Research and Public Health*, 11(2), 1500–1519. <https://doi.org/10.3390/ijerph110201500>
- Chen, Y., Freedman, N. D., Albert, P. S., Huxley, R. R., Shiels, M. S., Withrow, D. R., & Berrington de Gonzalez, A. (2019). Association of cardiovascular disease with premature mortality in the United States. *JAMA Cardiol*. <https://doi.org/10.1001/jamacardio.2019.3891>
- Claudel, S. E., Shiroma, E. J., Harris, T. B., Mode, N. A., Ahuja, C., Zonderman, A. B., ... Powell-Wiley, T. M. (2019). Cross-sectional associations of neighborhood perception, physical activity, and sedentary time in community-dwelling, socioeconomically diverse adults. *Front Public Health*, 7, 256. <https://doi.org/10.3389/fpubh.2019.00256>
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396.
- Diaz, K. M., Booth, J. N., 3rd, Seals, S. R., Hooker, S. P., Sims, M., Dubbert, P. M., ... Shimbo, D. (2016). Sedentary behavior and subclinical atherosclerosis in African Americans: Cross-sectional analysis of the Jackson heart study. *International Journal of Behavioral Nutrition and Physical Activity*, 13, 31. <https://doi.org/10.1186/s12966-016-0349-y>
- Dunlay, S. M., Lippmann, S. J., Greiner, M. A., O'Brien, E. C., Chamberlain, A. M., Mentz, R. J., et al. (2017). Perceived discrimination and cardiovascular outcomes in older African Americans: Insights from the Jackson heart study. *Mayo Clinic Proceedings*, 92(5), 699–709. <https://doi.org/10.1016/j.mayocp.2017.01.024>
- English, D., Lambert, S. F., Evans, M. K., & Zonderman, A. B. (2014). Neighborhood racial composition, racial discrimination, and depressive symptoms in African Americans. *American Journal of Community Psychology*, 54(3–4), 219–228. <https://doi.org/10.1007/s10464-014-9666-y>
- Forde, A. T., Sims, M., Muntner, P., Lewis, T., Onwuka, A., Moore, K., et al. (2020). Discrimination and hypertension risk among African Americans in the Jackson heart study. *Hypertension*, 76(3), 715–723. <https://doi.org/10.1161/Hypertensionaha.119.14492>
- Fuqua, S. R., Wyatt, S. B., Andrew, M. E., Sarpong, D. F., Henderson, F. R., Cunningham, M. F., et al. (2005). Recruiting African-American research participation in the Jackson heart study: Methods, response rates, and sample description. *Ethnicity & Disease*, 15(4 Suppl 6), S6–S18, 29.
- Garcia, J. M., Duran, A. T., Schwartz, J. E., Booth, J. N., 3rd, Hooker, S. P., Willey, J. Z., ... Diaz, K. M. (2019). Types of sedentary behavior and risk of cardiovascular events and mortality in blacks: The Jackson Heart Study. *J Am Heart Assoc*, 8(13), Article e010406. <https://doi.org/10.1161/JAHA.118.010406>
- Gebreab, S. Y., Diez-Roux, A. V., Hickson, D. A., Boykin, S., Sims, M., Sarpong, D. F., ... Wyatt, S. B. (2012). The contribution of stress to the social patterning of clinical and subclinical CVD risk factors in African Americans: The Jackson Heart Study. *Social Science & Medicine*, 75(9), 1697–1707. <https://doi.org/10.1016/j.socscimed.2012.06.003>
- Gebreab, S. Y., Hickson, D. A., Sims, M., Wyatt, S. B., Davis, S. K., Correa, A., et al. (2017). Neighborhood social and physical environments and type 2 diabetes mellitus in African Americans: The Jackson Heart Study. *Health & Place*, 43, 128–137. <https://doi.org/10.1016/j.healthplace.2016.12.001>
- Giurgescu, C., Misra, D. P., Sealy-Jefferson, S., Caldwell, C. H., Templin, T. N., Slaughter-Acey, J. C., et al. (2015). The impact of neighborhood quality, perceived stress, and social support on depressive symptoms during pregnancy in African American women. *Social Science & Medicine*, 130, 172–180. <https://doi.org/10.1016/j.socscimed.2015.02.006>
- Giurgescu, C., Zenk, S. N., Dancy, B. L., Park, C. G., Dieber, W., & Block, R. (2012). Relationships among neighborhood environment, racial discrimination, psychological distress, and preterm birth in African American women. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 41(6), E51–E61. <https://doi.org/10.1111/j.1552-6909.2012.01409.x>
- Hayes, A. F. (2018). In *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). New York, NY: The Guilford Press.
- Henderson, H., Child, S., Moore, S., Moore, J. B., & Kaczynski, A. T. (2016). The influence of neighborhood aesthetics, safety, and social cohesion on perceived stress in disadvantaged communities. *American Journal of Community Psychology*, 58(1–2), 80–88. <https://doi.org/10.1002/ajcp.12081>
- Hu, F. B., Li, T. Y., Colditz, G. A., Willett, W. C., & Manson, J. E. (2003). Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *Journal of the American Medical Association*, 289(14), 1785–1791. <https://doi.org/10.1001/jama.289.14.1785>
- Hunt, M. O., Wise, L. R., Jippuep, M. C., Cozier, Y. C., & Rosenberg, L. (2007). Neighborhood racial composition and perceptions of racial discrimination: Evidence from the black women's health study. *Social Psychology Quarterly*, 70(3), 272–289. <https://doi.org/10.1177/019027250707000306>
- Imran, T. F., Ommerborn, M., Clark, C., Correa, A., Dubbert, P., Gaziano, J. M., et al. (2018). Television viewing time, physical activity, and mortality among African Americans. *Preventing Chronic Disease*, 15, E10. <https://doi.org/10.5888/pcd15.170247>
- Jochem, C., Wallmann-Sperlich, B., & Leitzmann, M. F. (2019). The influence of sedentary behavior on cancer risk: Epidemiologic evidence and potential molecular mechanisms. *Curr Nutr Rep*. <https://doi.org/10.1007/s13668-019-0263-4>
- Johnson, D. A., Lisabeth, L., Lewis, T. T., Sims, M., Hickson, D. A., Samdarshi, T., & Diez Roux, A. V. (2016). The contribution of psychosocial stressors to sleep among African Americans in the Jackson heart study. *Sleep*, 39(7), 1411–1419. <https://doi.org/10.5665/sleep.5974>
- Katzmarzyk, P. T., Church, T. S., Craig, C. L., & Bouchard, C. (2009). Sitting time and mortality from all causes, cardiovascular disease, and cancer. *Medicine & Science in Sports & Exercise*, 41(5), 998–1005. <https://doi.org/10.1249/MSS.0b013e3181930355>
- Krieger, N. (1990). Racial and gender discrimination: Risk factors for high blood pressure? *Social Science & Medicine*, 30(12), 1273–1281.
- Krieger, N., & Sidney, S. (1996). Racial discrimination and blood pressure: The CARDIA study of young black and white adults. *American Journal of Public Health*, 86(10), 1370–1378.
- Madhav, K. C., Sherchand, S. P., & Sherchan, S. (2017). Association between screen time and depression among US adults. *Prev Med Rep*, 6, 67–71. <https://doi.org/10.1016/j.pmedr.2017.08.005>
- Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., et al. (2008). Amount of time spent in sedentary behaviors in the United States, 2003–2004. *American Journal of Epidemiology*, 167(7), 875–881. <https://doi.org/10.1093/aje/kwm390>
- Matthews, K. A., Gallo, L. C., & Taylor, S. E. (2010). Are psychosocial factors mediators of socioeconomic status and health connections? A progress report and blueprint for the future. *Biology of Disadvantage: Socioeconomic Status and Health*, 1186, 146–173. <https://doi.org/10.1111/j.1749-6632.2009.05332.x>
- Mujahid, M. S., Diez Roux, A. V., Morenoff, J. D., & Raghunathan, T. (2007). Assessing the measurement properties of neighborhood scales: From psychometrics to ecometrics. *American Journal of Epidemiology*, 165(8), 858–867. <https://doi.org/10.1093/aje/kwm040>
- Owen, N., Salmon, J., Koohsari, M. J., Turrell, G., & Giles-Corti, B. (2014). Sedentary behaviour and health: Mapping environmental and social contexts to underpin chronic disease prevention. *British Journal of Sports Medicine*, 48(3), 174–177. <https://doi.org/10.1136/bjsports-2013-093107>
- Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults' sedentary behavior determinants and interventions. *American Journal of Preventive Medicine*, 41(2), 189–196. <https://doi.org/10.1016/j.amepre.2011.05.013>
- Patterson, R., McNamara, E., Tainio, M., de Sa, T. H., Smith, A. D., Sharp, S. J., ... Wijndaele, K. (2018). Sedentary behaviour and risk of all-cause, cardiovascular and cancer mortality, and incident type 2 diabetes: A systematic review and dose response meta-analysis. *European Journal of Epidemiology*, 33(9), 811–829. <https://doi.org/10.1007/s10654-018-0380-1>
- Payne, T. J., Wyatt, S. B., Mosley, T. H., Dubbert, P. M., Gutierrez-Mohammed, M. L., Calvin, R. L., ... Williams, D. R. (2005). Sociocultural methods in the Jackson Heart Study: Conceptual and descriptive overview. *Ethnicity & Disease*, 15(4 Suppl 6), S6–S38, 48.
- Peiser, W., & Peter, J. (2000). Third-person perception of television-viewing behavior. *Journal of Communication*, 50(1), 25–45. <https://doi.org/10.1093/joc/50.1.25>
- Powell-Wiley, T. M., Cooper-McCann, R., Ayers, C., Berrigan, D., Lian, M., McClurkin, M., et al. (2015). Change in neighborhood socioeconomic status and weight gain: Dallas Heart Study. *American Journal of Preventive Medicine*, 49(1), 72–79. <https://doi.org/10.1016/j.amepre.2015.01.013>
- Prince, S. A., Reed, J. L., McPetridge, C., Tremblay, M. S., & Reid, R. D. (2017). Correlates of sedentary behaviour in adults: A systematic review. *Obesity Reviews*, 18(8), 915–935. <https://doi.org/10.1111/obr.12529>
- Sartorius, N. (2003). Social capital and mental health. *Current Opinion in Psychiatry*, 16, S101–S105. <https://doi.org/10.1097/00001504-200304002-00015>
- Sims, M., Diez-Roux, A. V., Dudley, A., Gebreab, S., Wyatt, S. B., Bruce, M. A., ... Taylor, H. A. (2012). Perceived discrimination and hypertension among African Americans in the Jackson Heart Study. *American Journal of Public Health*, 102, S258–S265. <https://doi.org/10.2105/Ajph.2011.300523>
- Sims, M., Diez-Roux, A. V., Gebreab, S. Y., Brenner, A., Dubbert, P., Wyatt, S., ... Taylor, H. (2016). Perceived discrimination is associated with health behaviours among African-Americans in the Jackson Heart Study. *Journal of Epidemiology & Community Health*, 70(2), 187–194. <https://doi.org/10.1136/jech-2015-206390>
- Sims, M., Lipford, K. J., Patel, N., Ford, C. D., Min, Y. L., & 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>
- Sims, M., Wyatt, S. B., Gutierrez, M. L., Taylor, H. A., & Williams, D. R. (2009). Development and psychometric testing of a multidimensional instrument of perceived discrimination among African Americans in the Jackson Heart Study. *Ethnicity & Disease*, 19(1), 56–64.
- Smitherman, T. A., Dubbert, P. M., Grothe, K. B., Sung, J. H., Kendzor, D. E., Reis, J. P., ... Taylor, H. A., Jr. (2009). Validation of the Jackson Heart Study physical activity survey in African Americans. *Journal of Physical Activity and Health*, 6(Suppl 1), S124–S132.



- Strong, L. L., Reitzel, L. R., Wetter, D. W., & McNeill, L. H. (2013). Associations of perceived neighborhood physical and social environments with physical activity and television viewing in African-American men and women. *American Journal of Health Promotion, 27*(6), 401–409. <https://doi.org/10.4278/ajhp.120306-QUAN-127>
- Tamura, K., Langerman, S. D., Ceasar, J. N., Andrews, M. R., Agrawal, M., & Powell-Wiley, T. M. (2019). Neighborhood social environment and cardiovascular disease risk. *Current Cardiovascular Risk Reports, 13*(4). ARTN 7, 1007/s12170-019-0601-5.
- Tamura, K., Langerman, S. D., Orstad, S. L., Neally, S. J., Andrews, M. R., Ceasar, J. N., ... Powell-Wiley, T. M. (2020). Physical activity-mediated associations between perceived neighborhood social environment and depressive symptoms among Jackson Heart Study participants. *International Journal of Behavioral Nutrition and Physical Activity, 17*(1), 91. <https://doi.org/10.1186/s12966-020-00991-y>
- Taylor, H. A., Jr., Wilson, J. G., Jones, D. W., Sarpong, D. F., Srinivasan, A., Garrison, R. J., & Wyatt, S. B. (2005). Toward resolution of cardiovascular health disparities in African Americans: Design and methods of the Jackson Heart Study. *Ethnicity & Disease, 15*(4 Suppl 6), S6-S4-17.
- Thorp, A. A., Owen, N., Neuhaus, M., & Dunstan, D. W. (2011). Sedentary behaviors and subsequent health outcomes in adults a systematic review of longitudinal studies, 1996-2011. *American Journal of Preventive Medicine, 41*(2), 207–215. <https://doi.org/10.1016/j.amepre.2011.05.004>
- Van Dyck, D., Cerin, E., Conway, T. L., De Bourdeaudhuij, I., Owen, N., Kerr, J., ... Sallis, J. F. (2012). Associations between perceived neighborhood environmental attributes and adults' sedentary behavior: Findings from the USA, Australia and Belgium. *Social Science & Medicine, 74*(9), 1375–1384. <https://doi.org/10.1016/j.socscimed.2012.01.018>
- Van Holle, V., McNaughton, S. A., Teychenne, M., Timperio, A., Van Dyck, D., De Bourdeaudhuij, I., et al. (2014). Social and physical environmental correlates of adults' weekend sitting time and moderating effects of retirement status and physical health. *International Journal of Environmental Research and Public Health, 11*(9), 9790–9810. <https://doi.org/10.3390/ijerph110909790>
- Wallmann-Sperlich, B., Bucksch, J., Hansen, S., Schantz, P., & Froboese, I. (2013). Sitting time in Germany: An analysis of socio-demographic and environmental correlates. *BMC Public Health, 13*, 196. <https://doi.org/10.1186/1471-2458-13-196>
- Wareham, N. J., Jakes, R. W., Rennie, K. L., Mitchell, J., Hennings, S., & Day, N. E. (2002). Validity and repeatability of the EPIC-norfolk physical activity questionnaire. *International Journal of Epidemiology, 31*(1), 168–174. <https://doi.org/10.1093/ije/31.1.168>
- Wijndaele, K., I, D. E. B., Godino, J. G., Lynch, B. M., Griffin, S. J., Westgate, K., et al. (2014). Reliability and validity of a domain-specific last 7-d sedentary time questionnaire. *Medicine & Science in Sports & Exercise, 46*(6), 1248–1260. <https://doi.org/10.1249/MSS.0000000000000214>
- Williams, D. R., Yan, Y., Jackson, J. S., & Anderson, N. B. (1997). Racial differences in physical and mental health: Socio-economic status, stress and discrimination. *Journal of Health Psychology, 2*(3), 335–351. <https://doi.org/10.1177/135910539700200305>
- Wilmot, E. G., Edwardson, C. L., Achana, F. A., Davies, M. J., Gorely, T., Gray, L. J., ... Biddle, S. J. (2012). Sedentary time in adults and the association with diabetes, cardiovascular disease and death: Systematic review and meta-analysis. *Diabetologia, 55*(11), 2895–2905. <https://doi.org/10.1007/s00125-012-2677-z>
- Womack, V. Y., Ning, H., Lewis, C. E., Loucks, E. B., Puterman, E., Reis, J., & Carnethon, M. R. (2014). Relationship between perceived discrimination and sedentary behavior in adults. *American Journal of Health Behavior, 38*(5), 641–649. <https://doi.org/10.5993/AJHB.38.5.1>
- Xiao, Q., Keadle, S. K., Berrigan, D., & Matthews, C. E. (2018). A prospective investigation of neighborhood socioeconomic deprivation and physical activity and sedentary behavior in older adults. *Preventive Medicine, 111*, 14–20. <https://doi.org/10.1016/j.ypmed.2018.02.011>
- Yang, L., Cao, C., Kantor, E. D., Nguyen, L. H., Zheng, X. B., Park, Y., ... Cao, Y. (2019). Trends in sedentary behavior among the US population, 2001-2016. *Jama-Journal of the American Medical Association, 321*(16), 1587–1597. <https://doi.org/10.1001/jama.2019.3636>