

## ORIGINAL ARTICLE

# On edge: the impact of race-related vigilance on obesity status in African-Americans

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## Summary

### Objective

Nearly half of African-Americans are classified as obese. Perceived racism has been associated with obesity, yet the internal experiences of racism have received little attention. African-Americans who face racism may 'ready themselves' to cope through survival strategies, including race-related vigilance. This study explores the association between race-related vigilance and obesity in African-Americans.

### Design and methods

The *Reactions to Race* module of the Behavioral Risk Factor Surveillance Survey (years 2002–2010) was used. Our sample size consisted of 12,214 African-Americans. Race-related vigilance was assessed as 'How often do you think about your race?' and classified as never, <daily, daily and >daily. Obesity was dichotomized as body mass index  $\geq 30$  kg m<sup>-2</sup> vs. <30 kg m<sup>-2</sup> using self-reported weight and height. Multivariable logistic models assessed the association between race-related vigilance and obesity.

### Results

Seventeen percent of respondents reported thinking about their race >daily; 14% daily; 31% <daily and 39% reported never thinking about their race. Compared with those who reported never thinking about their race, the adjusted odds of obesity were 0.91, 95% CI: 0.72–1.15 among those thinking about their race <daily; 1.09, 95% CI: 0.81–1.46 among those thinking about their race daily; and 1.37, 95% CI: 1.07–1.76 among those thinking about their race >daily.

### Conclusions

Frequently thinking about one's race was a risk factor for obesity in African-Americans in this study. Internalized impacts of racism captured through race-related vigilance may be particularly detrimental to African-Americans, driving their risk for obesity.

**Keywords:** African-Americans, health disparity, race consciousness, racism.

## Introduction

Obesity is linked to a number of health outcomes including hypertension, type 2 diabetes and cardiovascular disease (1). More than one-third of US adults are obese (2), however, the distribution of obesity is disproportionate among racial groups. African-Americans have the highest age-adjusted prevalence rate of obesity, with approximately 48% of this population considered obese (3).

Obesity disparities affecting African-Americans have been explored from a number of angles, from adherence

to physical activity and dietary behaviours to factors such as neighbourhood conditions (4), socioeconomic status (5) and food insecurity (4). Such inquiries take into account some of the potential influence of social policies and systems on obesity rates among African-Americans.

The tumultuous history of racism in the USA between African-Americans and Caucasians has led to exploration of the role of experiences of racial discrimination among African-Americans as a contributing factor to health disparities (6–8). Studies focusing on perceived racism and discrimination in African-Americans link racial

discrimination to health and health disparities, but with conflicting findings (9). Some studies report a positive association between discrimination and health (10–12) and others report none at all (13,14). There are studies that also report a U-shaped curve of this association. The classic demonstration of this phenomenon is from the Coronary Artery Risk Development in Young Adults (CARDIA) study, in which young African–American women and men who reported no discriminatory events and those who reported discrimination in three or more domains had higher blood pressure than those reporting discrimination in only one or two domains, particularly among working class respondents (15). In this same study, African–American women who usually accepted and kept quiet about discriminatory treatment were 4.4 times as likely to report hypertension as women who said they took action and talked to others about their experiences (15). Other results from this study found the age-adjusted risk of high blood pressure among African–American women who recounted experiencing zero instances of race-biased and gender-biased treatment to be 2.6 times as great as African–American women who reported these instances (15). Conversely, a national study of a diverse community sample of midlife women ( $n=3,300$ ) revealed that although racial/ethnic differences in blood pressure were evident, high levels of perceived unfair treatment were not associated with elevated blood pressure (16).

Results from studies investigating the association between racial discrimination and obesity further reflect these mixed outcomes, as well as differences by gender. Perceived racial discrimination has been linked to obesity in cross-sectional studies, with findings indicating its association with a lower waist–hip ratio in African–American women (17) and a higher 8-year weight gain in participants of the prospective Black Women’s Health Study (BWHS) (18). In contrast, a similar cross-sectional study of African–American women in the New England region found no association of racial discrimination with weight status (19). Investigators of the Jackson Heart Study examined whether discrimination was independently associated with visceral (VAT) and subcutaneous abdominal fat (SAT) in African–American men and women. The results of their cross-sectional study found that higher reports of everyday discrimination were associated with greater SAT, but not VAT, in men only (20). Longitudinal studies examining this association have been less frequently conducted but present just as scattered results. Investigators of the CARDIA study who examined the association between self-reported experiences of racial/ethnic discrimination and waist circumference and body mass index (BMI) in African–American and Caucasian women and men over 8 years found that an increase

in self-reported experiences of racial discrimination may be associated with increases in waist circumference and (BMI) among African–American women over time (21). No associations were observed among African–American men and Caucasian women and men (21).

A limitation of examining experiences of perceived racial discrimination is that this construct does not fully consider how the external experiences of discrimination by African–Americans are internalized. African–Americans who face discrimination on a routine basis, may ‘ready themselves’ to cope with overt and covert forms of racism through adoption of survival strategies (22,23). Researchers have termed this preparation for and anticipation of discrimination ‘race-related vigilance’ (24,25) and argue that racial vigilance is an important determinant of the poor health of African–Americans (6,9). The ways in which African–Americans acknowledge and cope with race-related vigilance if at all may explain some of the inconsistent findings in studies assessing discrimination. To date, few scientific studies have examined the association of race-related vigilance levels with health outcomes among African–Americans. A recent study found that race-related vigilance was associated with disparities in sleep difficulty between African–Americans and Caucasians (6) and hypertension prevalence and large arterial elasticity among African–Americans (6,24). Each of these conditions is associated with obesity risk (1).

The association between race-related vigilance as a potential explanatory factor for high rates of obesity among African–Americans has yet to be explored. This study investigates the association between race-related vigilance and obesity in African–Americans in a national sample. We hypothesize that race-related vigilance is associated with increased obesity among African–Americans in the USA. Because previous studies examining the association of perceived discrimination with health outcomes have observed gender differences, albeit with conflicting results, we also examined potential gender differences in the association between race-related vigilance and obesity.

## Methods and procedures

### Data source

We combined years 2002–2010 of the Behavioral Risk Factor Surveillance System (BRFSS), a nationwide annual cross-sectional telephone survey (26). The BRFSS, designed and developed by the Centers for Disease Control and Prevention and administered by individual health departments across the USA, is an on-going annual state-based system of health surveys to examine behavioural risk factors and health outcomes in the greater American

populous. Health surveys are administered by telephone to a representative sample of non-institutionalized persons aged  $\geq 18$  years of age.

The Reactions to Race module is a six-question optional module first developed for the BRFSS in 2001 by the CDC Measures of Racism Working Group (27). The questions include assessments of socially assigned race, race-related vigilance, as well as perceptions of differential treatment in health care and work settings, and reports of emotional and physical symptoms as a result of race-based treatment (27). The Reactions to Race module was subjected to several rounds of cognitive and pilot testing before its inception on the 2002 BRFSS (27). We present analyses of pooled data from 17 states (AK, CA, CO, DE, DC, GA, IN, KY, MA, MI, MS, NE, OH, RI, SC, VA, WI and WY) that elected to include the Reactions to Race module in any of the included survey years (2002–2010).

## Sample

There were 14,333 self-identified African–American respondents included in our data set. We excluded women who reported being pregnant at the time of interview ( $n=124$ ). Survey respondents answering ‘Don’t know/not sure’ ( $n=922$ ) and those who declined to answer ( $n=228$ ) the race-related vigilance question were excluded from this analysis. Similarly, individuals with missing data for weight or height were excluded ( $n=672$ ). Respondents categorized as underweight ( $n=173$ ) according to the BMI were also excluded, resulting in a final unweighted analytic sample of 12,214 African–American respondents.

## Measures

Race-related vigilance was inferred from response to the question: ‘How often do you think about your race [Never, Once a year, Once a month, Once a week, Once a day, Once an hour or Constantly]?’ We re-categorized race-related vigilance into four distinct groups based on the frequency distributions: never (Never), <daily (Once a year, once a month and once a week), daily (Once a day) and >daily (Once an hour or constantly).

Body mass index was calculated from self-reported weight and height as  $\text{kg m}^{-2}$ . Obesity status was dichotomized according to BMI status as obese ( $\geq 30 \text{ kg m}^{-2}$ ) or non-obese ( $< 30 \text{ kg m}^{-2}$ ). Potential confounders included age in categories (18–34; 35–49; 50–64; and 65+ years), gender (female and male), education level (<9th grade, 8th–12th grade, high school graduate, attended college/tech, college graduate and higher), employment status (employed, unemployed, homemaker, student, unable to work and retired) and the State where the survey was

conducted. We created an income-to-poverty ratio variable by using the midpoint of the BRFSS household income categories, and dividing these values by the poverty level specific to the household composition (the number of adults and children in each household), per respective survey year. Income-to-poverty ratio was categorized as follows: (household income [HHI] below poverty level; 1–2 times; 2–3 times; 3–4 times; 4–5 times; 5–6 times; or 6 or more times the poverty level).

## Analytic approach

For descriptive analyses, we estimated percentages of all included variables by category of race-related vigilance. We conducted logistic regression models to assess the association between race-related vigilance and obesity status. We ran unadjusted, then multivariable models adjusting for gender, age in years, employment status, education level, income-to-poverty ratio, state and year. We also created a model including an interaction term between gender and race consciousness. Post-stratification weights accounting for the complex sample design were used to adjust for probability of selection and non-response. For those states that asked the ‘Reactions to Race’ module in more than one of the years included in this study, weights were divided by the number of years the state appeared in the data set. We made this provision because we wanted to ensure that each state’s responses were only counted once towards the analysis and that respondents were equally weighted. Stata version 12 (StataCorp LP, TX, USA) was used for all statistical analyses.

## Results

### Sample characteristics

Socio-demographic characteristics of the African–American sample stratified by race-related vigilance classification are presented in Table 1. The majority of the overall sample was composed of women (53%) and individuals younger than 50 years of age (67%). The sample was primarily composed of individuals of high socioeconomic status of whom the majority completed at least a high school education (86%) and had a household income at least two times above the poverty level (56%). With respect to race-related vigilance, 17% of respondents reported thinking about their race more than daily while 14% reported thinking about their race daily. Approximately 31% of respondents reported thinking about their race less than daily and 39% reported never thinking about their race.

**Table 1** Sample characteristics, by race-related vigilance level, African-American BRFSS respondents (2002–2010)  $\geq 18$  years old, weighted frequencies ( $n = 12,214$ )\*

	Race-related vigilance level ( $n = 12,214$ )			
	Never (%) ( $n = 4,716$ )*	<Daily (%) ( $n = 3,747$ )*	Daily (%) ( $n = 1,730$ )*	>Daily (%) ( $n = 2,021$ )*
Race-related vigilance, weighted %	38.6	30.7	14.2	16.6
Age category, years				
18–34	29.9	34.5	35.7	37.2
35–49	28.8	35.5	39.0	37.0
50–64	23.3	22.6	18.1	19.2
65+	18.0	7.4	7.2	6.7
Gender, male	41.2	42.3	54.6	59.5
Education				
<9th grade	5.5	0.7	1.8	2.3
9th–12th grade	13.6	9.8	3.5	12.4
High school graduate	40.7	27.7	25.8	32.1
Attended college	25.9	31.4	34.8	27.8
College graduate and higher	14.2	30.3	34.1	25.3
Employment				
Employed	50.4	62.6	66.3	62.6
Unemployed	10.2	8.7	9.3	12.6
Homemaker	4.6	3.5	1.6	1.9
Student	4.5	9.1	7.8	4.9
Unable to work	17.9	9.2	9.9	7.7
Retired	12.2	6.8	4.8	9.7
Income-to-poverty ratio				
HHI below poverty level	21.9	12.1	11.7	20.1
1–2 times poverty	23.0	19.1	17.6	24.9
2–3 times poverty	13.3	12.3	12.9	13.7
3–4 times poverty	6.3	10.9	8.7	9.8
4–5 times poverty	4.3	7.7	7.1	6.6
5–6 times poverty	3.1	4.7	6.7	4.8
HHI $\geq 6$ times poverty level	2.1	3.0	4.8	3.5

\*Unweighted.

BRFSS, Behavioral Risk Factor Surveillance System; HHI, household income.

### Obesity prevalence and multivariable association of body mass index with race-related vigilance

The overall prevalence of obesity in this sample was 37%. Obesity prevalence was highest in individuals who indicated thinking about their race more than daily (42%), compared with those in the other race-related vigilance categories. Prevalence estimates of obesity within each level of race-related vigilance and the results of the logistic regression models of the association between race-related vigilance level and obesity are detailed in Table 2. Compared with African-Americans who reported never thinking about their race, those that reported thinking about their race less than daily were 0.91 times as likely to have obesity (95% CI: 0.72–1.15), those who reported thinking about their race daily were 1.09 times as likely to have obesity (95% CI: 0.81–1.46) and those who reported thinking about their race more than daily were 1.37 times as likely to have obesity (95% CI: 1.07–1.75), after

adjusting for covariates. Gender-specific results are also reported in Table 2.

### Gender differences in obesity prevalence and multivariable association of body mass index with race-related vigilance

The prevalence of obesity was higher among African-American women (41%) than African-American men (32%). Levels of high race-related vigilance (thinking about one's race >daily) was greater in men (21%) than in women (13%). In analyses stratified by gender, African-American women who reported thinking about their race daily were 1.45 times as likely to be classified as obese (95% CI: 1.02–2.07) than those that reported never thinking about their race, after adjusting for covariates. Although not statistically significant, in African-American men, there was an association

**Table 2** Obesity prevalence and logistic regression models of the association between race-related vigilance and obesity overall and by gender, in African-American BRFSS (2002–2010) respondents,  $\geq 18$  years old, weighted estimates ( $n = 12,214$ )

	% Obese	Overall Unadjusted, OR (95% CI)	Multivariable* OR (95% CI)
Never	37.7	1.00, referent	—
<Daily	33.3	0.82 (0.66–1.03)	0.91 (0.72–1.15)
Daily	35.6	0.91 (0.69–1.20)	1.09 (0.81–1.46)
>Daily	42.3	1.21 (0.96–1.53)	1.37 (1.07–1.75)
<b>Women</b>			
	% Obese	Unadjusted, OR (95% CI)	Multivariable* OR (95% CI)
Never	42.4	1.00, referent	—
<Daily	37.5	0.82 (0.62–1.07)	0.99 (0.76–1.29)
Daily	44.0	1.07 (0.75–1.52)	1.45 (1.02–2.07)
>Daily	44.9	1.10 (0.84–1.45)	1.21 (0.92–1.60)
<b>Men</b>			
	% Obese	Unadjusted, OR (95% CI)	Multivariable* OR (95% CI)
Never	31.1	1.00, referent	—
<Daily	27.7	0.85 (0.58–1.25)	0.87 (0.59–1.29)
Daily	28.6	0.89 (0.57–1.38)	0.86 (0.53–1.39)
>Daily	40.6	1.52 (1.03–2.23)	1.43 (0.96–2.13)

\*Adjusted for age group, gender, employment status, income-to-poverty ratio, year, and state survey was administered. BRFSS, Behavioral Risk Factor Surveillance System; CI, confidence interval; OR, odds ratio. Results weighted to account for sampling design.

between thinking about their race more than daily and obesity (1.43, 95% CI: 0.96–2.13).

## Discussion

While previous studies have examined the association of experiences of racial discrimination with obesity among African-Americans (7,9,28), our study was the first to our knowledge to examine race-related vigilance in association with obesity. In this African-American sample, a high frequency of race-related vigilance (thinking about one's race once an hour or constantly) was associated with obesity. Obesity rates among those who reported never thinking about their race and those who thought about it less frequently (i.e. less than daily or daily) were similar. Our overall findings suggest that the internalized impacts of racism captured through experiencing high levels of race-related vigilance may be one of a myriad of risk factors that place African-Americans at increased risk for obesity.

Consistent with the findings of previously conducted studies on race-related vigilance (6,23), we found that roughly one in five African-American in our sample reported thinking about their race more than daily (once

an hour or constantly). Most previous studies examining the role of discrimination have not considered how individuals interpret, make meaning of and cope with the experience of discrimination and how this may impact their health (29). The extent to which individuals recognize and report experiences of discrimination may also reflect how they interpret and internalize their social reality and the corresponding racial climate in which they exist (30,31). African-Americans are often the targets of negative stereotypes (30,32), are regularly devalued by greater society (30,32) and consequently experience disproportionately negative interpersonal and economic outcomes because of their race (13,33,34). These negative outcomes of stigmatization also extend to and greatly diminish the health of African-Americans living in the USA (6,25,35). Because of the routine and consistent occurrence of racial discrimination experienced by African-Americans, race-related hypervigilance (i.e. constantly anticipating racist encounters) may be an important mechanism vital for effective coping, social adjustment and survival (36,37).

African-Americans can experience both explicit discrimination and implicit microaggressions. Microaggressions refer to the automatic and often unconscious verbal, non-verbal and visual insults that insinuate an heir of inferiority towards a particular group or person, including African-Americans (32). Where historic acts of discrimination were blatant, targeted and aggressive, the nature of modern discrimination is often implicit, evasive and systemic (30,35). In addition, bias and discrimination are not present in every situation. We speculate that this situational uncertainty (6,31) may potentially lead some African-Americans to be more cognizant of the racial climate in society and their resultant place in it. Although we were not able to directly assess microaggressions or internalized racism in this study, self-reported race-related vigilance may reflect the internalization of the effects of racial climate and treatment and represent one's ability to cope with repeated and anticipated experiences of discrimination.

The results of our study suggest that very high levels of race-related vigilance may be a potentially unique mechanism that contributes to high rates of obesity specifically among African-Americans. Recent research has shown that prolonged emotional distress, such as that which may be experienced with repeated encounters and anticipation of racial discrimination, may be the catalyst for a cascade of events leading to weight gain and obesity (38). Psychological stress responses are a common reaction to experiences of racism (39). The chronic feelings of helplessness, frustration and resentment provoked by experiencing racism can lead to physiological immune and neuroendocrine responses (13,24). The acute and



prolonged psychological and emotional overload associated with enduring episodes of racial discrimination may lead to maladaptive behavioural coping strategies that specifically drive obesity (38). Such coping strategies include eating to suppress negative emotions and stress (38,40) in conjunction with physiological coping strategies such as the disruption of energy homeostasis and metabolism (40,41). Previous research studies conducted in African–American women, who have the highest age-adjusted prevalence of obesity in the USA (3), add leverage to this notion. The SisterTalk study conducted with a cohort of African–American women living in the New England region of the USA found in their cross-sectional study that the frequency of eating when depressed or sad and eating to manage stress were both significantly higher among women who reported higher perceived discrimination levels (19).

Gender differences were also observed with African–American women who think about their race on a daily basis, being more likely to be classified as obese. Our findings on gender differences in the prevalence and association of race-related vigilance and obesity are consistent with findings from previous studies that found racism to be a significant driver of the prevalence of obesity in African–American women (18). The lower prevalence of obesity in men is consistent with current national figures (3). In spite of our findings in this study, it is important to note that racism is shown to drive other deleterious effects specific to the health of African–American men (42).

The results of this study should be interpreted within the context of certain limitations. First, as a study of cross-sectional design, we are not able to draw conclusions on causality or the long-term effects of race-related vigilance on obesity. Second, the Reactions to Race module has not yet been adopted nationally in the BRFSS questionnaire. Therefore, the responses we analysed may not be generalizable to the population at-large because of the limited number of states that include the Reactions to Race module in BRFSS years included in this study. We elected to combine years 2002 through 2010 of the BRFSS data sets to ensure an adequate sample size of African–Americans in our analysis. Methodological changes to the BRFSS that occurred in 2011 complicate combining annual waves before and after that point. A future replication study, using several waves of more contemporary data, once available, is warranted. Third, the BRFSS relies on limited self-reported data. Height and weight, collected via self-report, routinely result in underestimates of weight as well as overestimates of height (43), which could subsequently result in the underestimation of BMI in this sample. But, recent studies have shown that the use of self-reported height and weight can be accurate (44). Additional personal characteristics that may contextualize one's risk for obesity (including family

history of obesity and other lifestyle related diseases), and specifics about the setting and duration of race-related encounters, were potential confounders that are not available in the BRFSS. Fourth, given the layered and context specific nature of race-related vigilance, the use of a single self-reported question to assess this in the BRFSS questionnaire should be noted as a limitation. It is plausible that there was some degree of incongruity between our conceptualization of race-related vigilance and how respondents answered. We cannot rule out respondents' potential interpretation of the race consciousness question as an inquiry about racial pride, or self-awareness of racial identity as opposed to race-related vigilance as we have interpreted it. Fifth, respondents may elect to edit their responses depending on their perception of interviewer biases, especially when there is a racial/ethnic mismatch between interviewer and respondent (45). In this setting, such editing is likely to result in under-reporting of racial vigilance. Finally, this study did not take into account the longitudinal impact of time upon race-related vigilance, which may vary with racial climate; future studies should consider this important aspect in classifying the impact of prolonged exposure to race-related vigilance on obesity.

We conducted the first analysis of race-related vigilance and its association with obesity in African–Americans who are disproportionately represented in obesity statistics. The association between these factors suggests that efforts to understand the incidence and prevalence of obesity should extend beyond dietary and physical activity habits to also consider how race-related vigilance in one's daily existence, a commonly experienced stressor among African–Americans, may influence obesity disparities. As such, future research efforts to investigate the cumulative chronological impacts of race-related vigilance as well as considering the integration of race-related vigilance into stress-related and behavioural interventions for obesity are warranted.

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## Conflict of Interest Statement

No conflict of interest was declared.

## Author contributions

L.P. conceived of the study and conducted statistical analyses of data. L.P., W.J. and S.L. were involved in writing the paper and had final approval of the submitted version.

## References

- Field AE, Coakley EH, Must A, et al. Impact of overweight on the risk of developing common chronic diseases during a 10-year period. *Arch Intern Med* 2001; **161**: 1581–1586.
- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011–2012. *JAMA* 2014; **311**: 806–814.
- U.S. Centers for Disease Control and Prevention. Obesity and overweight [Internet]. Available from: <http://www.cdc.gov/obesity/data/facts.html>
- Noormohamed A, Lee SH, Batorsky B, Jackson A, Newman S, Gittelsohn J. Factors influencing ordering practices at Baltimore City carryouts: qualitative research to inform an obesity prevention intervention. *Ecol Food Nutr* 2012; **51**: 481–491.
- Abraham PA, Kazman JB, Zeno SA, Deuster PA. Obesity and African Americans: physiologic and behavioral pathways. *ISRN Obes* 2013; **2013**: 314295.
- Hicken MT, Lee H, Ailshire J, Burgard SA, Williams DR. “Every shut eye, ain’t sleep”: The role of racism-related vigilance in racial/ethnic disparities in sleep difficulty. *Race Soc Probl* 2013; **5**: 100–112.
- Paradies Y. A systematic review of empirical research on self-reported racism and health. *Int J Epidemiol* 2006; **35**: 888–901.
- Pascoe EA, Smart RL. Perceived discrimination and health: a meta-analytic review. *Psychol Bull* 2009; **135**: 531.
- Williams DR, Neighbors HW, Jackson JS. Racial/ethnic discrimination and health: findings from community studies. *Am J Public Health* 2003; **93**: 200–208.
- Taylor TR, Williams CD, Makambi KH, et al. Racial discrimination and breast cancer incidence in US black women: the black women’s health study. *Am J Epidemiol* 2007; **166**: 46–54.
- Williams DR, Yan Y, Jackson JS, Anderson NB. Racial differences in physical and mental health: socio-economic status, stress and discrimination. *J Health Psychol* 1997; **2**: 335–351.
- Schulz A, Israel B, Williams D, Parker E, Becker A, James S. Social inequalities, stressors and self reported health status among African American and white women in the Detroit metropolitan area. *Soc Sci Med* 2000; **51**: 1639–1653.
- Broman CL. The health consequences of racial discrimination: a study of African Americans. *Ethn Dis* 1996; **6**: 148–153.
- Karlsen S, Nazroo JY. Agency and structure: the impact of ethnic identity and racism on the health of ethnic minority people. *Sociol Health Illn* 2002; **24**: 1–20.
- Krieger N, Sidney S. Racial discrimination and blood pressure: the CARDIA study of young black and white adults. *Am J Public Health* 1996; **86**: 1370–1378.
- Brown C, Matthews KA, Bromberger JT, Chang Y. The relation between perceived unfair treatment and blood pressure in a racially/ethnically diverse sample of women. *Am J Epidemiol* 2006; **164**: 257–262.
- Vines AI, Baird DD, Stevens J, Hertz-Picciotto I, Light KC, McNeilly M. Associations of abdominal fat with perceived racism and passive emotional responses to racism in African American women. *Am J Public Health* 2007; **97**: 526–530.
- Cozier YC, Yu J, Coogan PF, Bethea TN, Rosenberg L, Palmer JR. Racism, segregation, and risk of obesity in the black women’s health study. *Am J Epidemiol* 2014; **179**: 875–883.
- Johnson P, Risica PM, Gans KM, Kirtania U, Kumanyika SK. Association of perceived racial discrimination with eating behaviors and obesity among participants of the SisterTalk study. *J Natl Black Nurses Assoc* 2012; **23**: 34–40.
- Hickson DA, Lewis TT, Liu J, et al. The associations of multiple dimensions of discrimination and abdominal fat in African American adults: the Jackson heart study. *Ann Behav Med* 2012; **43**: 4–14.
- Cunningham TJ, Berkman LF, Kawachi I, et al. Changes in waist circumference and body mass index in the US CARDIA cohort: fixed-effects associations with self-reported experiences of racial/ethnic discrimination. *J Biosoc Sci* 2013; **45**: 267–278.
- Williams DR, Mohammed SA. Discrimination and racial disparities in health: evidence and needed research. *J Behav Med* 2009; **32**: 20–47.
- Brewer LC, Carson KA, Williams DR, Allen A, Jones CP, Cooper LA. Association of race consciousness with the patient–physician relationship, medication adherence, and blood pressure in urban primary care patients. *Am J Hypertens* 2013; **26**: 1342–1352.
- Clark R, Benkert RA, Flack JM. Large arterial elasticity varies as a function of gender and racism-related vigilance in black youth. *J Adolesc Health* 2006; **39**: 562–569.
- Clark R, Anderson NB, Clark VR, Williams DR. Racism as a stressor for African Americans: a biopsychosocial model. *Am Psychol* 1999; **54**: 805–816.
- Centers for Disease Control. Behavioral Risk Factor Surveillance System. BRFSS 2002–2010 survey data and documentation. [Internet]. Available from: [www.cdc.gov/brfss/annual\\_data/annual\\_2010.htm](http://www.cdc.gov/brfss/annual_data/annual_2010.htm). English.
- Jones CP, Truman BI, Elam-Evans LD, et al. Using “socially assigned race” to probe white advantages in health status. *Ethn Dis* 2008; **18**: 496–504.
- Pascoe EA, Smart RL. Perceived discrimination and health: a meta-analytic review. *Psychol Bull* 2009; **135**: 531.
- Williams DR, Mohammed SA. Discrimination and racial disparities in health: evidence and needed research. *J Behav Med* 2009; **32**: 20–47.
- Henry PJ, Sears DO. *Symbolic and Modern Racism*. *Encyclopedia of Race and Racism*. Macmillan: Farmington Hills, MI, 2008.
- Sue DW, Capodilupo CM, Torino GC, et al. Racial microaggressions in everyday life: implications for clinical practice. *Am Psychol* 2007; **62**: 271–286.
- Pierce CM, Carew JV, Pierce-Gonzalez D, Wills D. An experiment in racism TV commercials. *Education and Urban Society* 1977; **10**: 61–87.

33. Harrell SP. A multidimensional conceptualization of racism-related stress: Implications for the well-being of people of color. *Am J Orthopsychiatry* 2000; **70**: 42–57.
34. Krieger N. Racial and gender discrimination: risk factors for high blood pressure? *Soc Sci Med* 1990; **30**: 1273–1281.
35. Williams DR, Sternthal M. Understanding racial-ethnic disparities in health: sociological contributions. *J Health Soc Behav* 2010; **51**: S15–S27.
36. Feagin JR. The continuing significance of race–antiblack discrimination in public places. *Am Sociol Rev* 1991; **56**: 101–116.
37. DuBois WEB, Eaton I. *The Philadelphia Negro: A Social Study*. Philadelphia: University of Pennsylvania Press; originally published 1899.
38. Hemmingsson E. A new model of the role of psychological and emotional distress in promoting obesity: conceptual review with implications for treatment and prevention. *Obes Rev* 2014; **15**: 769–779.
39. Clark R, Anderson NB, Clark VR, Williams DR. Racism as a stressor for African Americans. A biopsychosocial model. *Am Psychol* 1999; **54**: 805–816.
40. Dallman MF, Pecoraro NC, la Fleur SE. Chronic stress and comfort foods: self-medication and abdominal obesity. *Brain Behav Immun* 2005; **19**: 275–280.
41. Wallis DJ, Hetherington MM. Emotions and eating. self-reported and experimentally induced changes in food intake under stress. *Appetite* 2009; **52**: 355–362.
42. Chae DH, Nuru-Jeter AM, Adler NE, et al. Discrimination, racial bias, and telomere length in African–American men. *Am J Prev Med* 2014; **46**: 103–111.
43. Taylor AW, Dal Grande E, Gill TK, et al. How valid are self-reported height and weight? A comparison between CATI self-report and clinic measurements using a large cohort study. *Aust N Z J Public Health* 2006; **30**: 238–246.
44. Christian NJ, King WC, Yanovski SZ, Courcoulas AP, Belle SH. Validity of self-reported weights following bariatric surgery. *JAMA* 2013; **310**: 2454–2456.
45. Cotter PR, Cohen J, Coulter PB. Race-of-interviewer effects in telephone interviews. *Public Opin Q* 1982; **46**: 278–284.